Things and Patterns – from Pyramiden to Patagonia

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Re-visiting Middagskarheia 1

Fragments of Middle Mesolithic Life on Vega, Central Norway

Birgitte Skar, Helena Knutsson, Kjel Knutsson

ABSTRACT

The Middle Mesolithic Middagskarheia 1 site was excavated by Hein Bjerck in 1987. The activity is confined to inside a hut on a skerry in the strait between the Boreal main island Vega and a smaller island, in Hein's reports called the Kjul island. The necessary condition for human activity on this skerry is the presence of a bay creating a protected harbor where it was possible to land a boat. The site is well organized, including a hut-ground with a sunken floor, a marked wall-mound and a central fireplace. The lithic artifact inventory is, however, unexpectedly limited. The analysis reveals that there is no debris from the production of blanks or morphological tools on the site. The factors which collectively sparked an interest in re-analyzing this particular location and assemblage more closely were: The Middle Mesolithic period does not have many surviving traces in Central Norway; the clear prerequisite of marine technology for access; the well-organized site with a hut; the limited assemblage; and the peculiar fact that there seems to be no primary lithic production on the site. By using a *chaîne opératoire* approach including use-wear analysis, the aim is to get closer to understanding the activities that took place on this site, its role in the settlement system of different site-types on Vega and not least to contextualize this Central Norwegian Middle Mesolithic material with other Norwegian assemblages analyzed using *chaîne opératoire* analysis.

Introduction and motivation

The Middle Mesolithic Middagskarheia 1 site was excavated by Hein Bjerck in 1987, as part of a three-year research project funded by the Norwegian Research Council, called "Research-based cultural heritage management on Vega" (Bjerck 1989a). The project was primarily based on surveys to delineate the very rich Stone Age heritage values in the Vega landscape to help the municipality strike a balance between development and conservation. The project created a phenomenal local engagement and enthusiasm, greatly stimulated by the opportunity given to the public to participate in the excavations, and Hein's great ability to communicate landscape history and translate archaeological finds into narratives of the past.

The project investigations framed the isolated island of Vega with its rapid post-glacial shoreline uplift as a favorable laboratory for understanding Mesolithic settlement patterns focusing particularly on the Boreal and Atlantic periods. Through this project Hein introduced a completely new perspective on Stone Age maritime landscapes and the importance of the enigmatic boat as a core condition for the Mesolithic way of life, thus disentangling the grammar of Mesolithic landscape perception and use. At this time, it was the structures and repeated patterns of localization in proximity to safe harbors, and the associated potential resource use, that interested him most. The project resulted in a methodological approach for working with coastal Mesolithic settlements (i.e., refs Bjerck 1989a, Bjerck 1989b, Breivik 2016, Fretheim 2017) that has influenced a whole generation of Norwegian archaeologists. While celebrating and keeping this important approach to Mesolithic landscape analysis as an integral part of our knowledge pool and practice, Mesolithic studies of Central Norway can now be said to call for more bottom-up approaches that serve to understand the finer details of the very comprehensive archaeological material held in museum storerooms. Archaeology is no longer based on material culture studies alone. New methodologies from the life sciences and environmental studies have been

introduced like aDNA and eDNA. Without aDNA studies of some of the few human remains from this period in central Scandinavia (Günther et al. 2018, Kashuba et al. 2019, Kashuba 2024) we would clearly not have had the firm conviction of a second migration entering Norway during the Early Postglacial. When combined with lithic technological studies (Sørensen et al. 2013, Damlien 2016, Manninen et al. 2021, Skar 2022), they demonstrated the introduction of a new and specialized narrow blade technology and a range of other innovations during the Middle Mesolithic. aDNA has contributed to our understanding of the complexity of admixture of populations and direction of mobility as drivers for development of new knowledge systems during the Middle Mesolithic. In the future it is likely that eDNA will contribute to reconstructing more diverse datasets from Mesolithic sites including foods and organic raw materials. This methodology holds significant potential for doing paleoenvironmental reconstructions and addressing key archaeological questions concerning the origins, lifestyles, and environments of past human populations (Özdogan et al. 2024).

The present study, however, is based on the well-known *chaîne opératoire* methodology, which has been acknowledged and practiced with varying intensity in the analysis of struck lithics for the past 40 years in Norway (Skar and Coulson 1986, Damlien 2016) and used as a methodological concept in Europe for much longer (Leroi-Gourhan 1964, 1993:232, Schlanger 1994:144¸ Arntz and Lewis 2020). Apart from one of the authors' study of the Middle Mesolithic site of Foldsjøen 4A (Skar 1989), there are few examples from Central Norway. While time-consuming, the methodology is potentially very rewarding for addressing the deeper aspects of Mesolithic know-how and ways of life at the site level. The present example is an analysis of a small site that was already at the time of investigation considered by Hein to be a little peculiar (Bjerck 1989b: 6-20).

The setting—A Middle Mesolithic oceanic landscape and a settlement system

The postglacial marine limit on Vega was 99 m asl and the continual isostatic uplift of the landscape in this outermost part of the Helgeland coast has left rich early postglacial settlements. The focus of Hein's investigations was from the Middle Mesolithic during the Boreal chronozone to the Late Mesolithic during the Atlantic chronozone (Bjerck 2008a, Table: III.I). The Middle Mesolithic landscape was confined by the 60 m asl shoreline and consisted of one larger island (approx. 24 km^2), here called Vega. Among several smaller independent sites, the northern end of the main island also comprised the extended Åsgarden settlement areas (Fig. 1). Towards the east a smaller island (approx. 6 km^2), in Hein's reports called Kjul, included several smaller sites plus the two larger Hestvika settlements facing southwest. All islands except the very steep Søla (approx. 1.5 km^2) to the west of Vega have provided Mesolithic sites. Søla is very weather-exposed and steep and does not provide a safe harbor. To this day, however, the island is not fully archaeologically investigated. The 60-meter contour line around the Vega landscape is estimated to be a relevant coastline for marine settlement for 300–600 years of the Middle Mesolithic. Altogether ten sites that had been test-excavated and surveyed were found at this shore level. Hein's interpretation was that the localities form a settlement system with sites falling quite neatly into a system of a tripartite hierarchical order. Åsgarden 1 at the northern point of the main island, which alone counts about 20 pit house grounds (Bjerck 1989, Bjerck 1989b, Bjerck 2008a), was considered to be a long-term residential base. While the two Hestvika sites that are also large are seen as field camps addressing less exposed marine resource areas at the southern end of Kjul. Seven smaller sites are interpreted to be boat stations or stops, including Middagskarheia 1 (Fig. 1).

The site

At the time of its occupation, the Middagskarheia 1 site was located on the northern and larger of a group of three skerries in a strait between the two occupied islands of Vega and Kjul. The strait, which must have been nearly two kilometers wide, has been called the Vika-Floa strait. In these waters one must expect a rapid current around the skerries and an abundance of fish, so marine mammals would likely have been present. The protected bay on the southern end of the Middagskarheia skerry would have been of importance for the choice of landing on this outpost. In practice, the Middagskarheia bay has one main access route from the SW, where two small skerries on either side of the bay would have made it possible to land a boat, for example paddling up against a north–south current. These skerries would likely also have slowed down the landing of a boat if it arrived with a following current from the south-west (Fig. 1 top). No matter how one interprets the character of the activity on the Middagskarheia skerry, there is no doubt that it was primarily possible to land a boat in fine

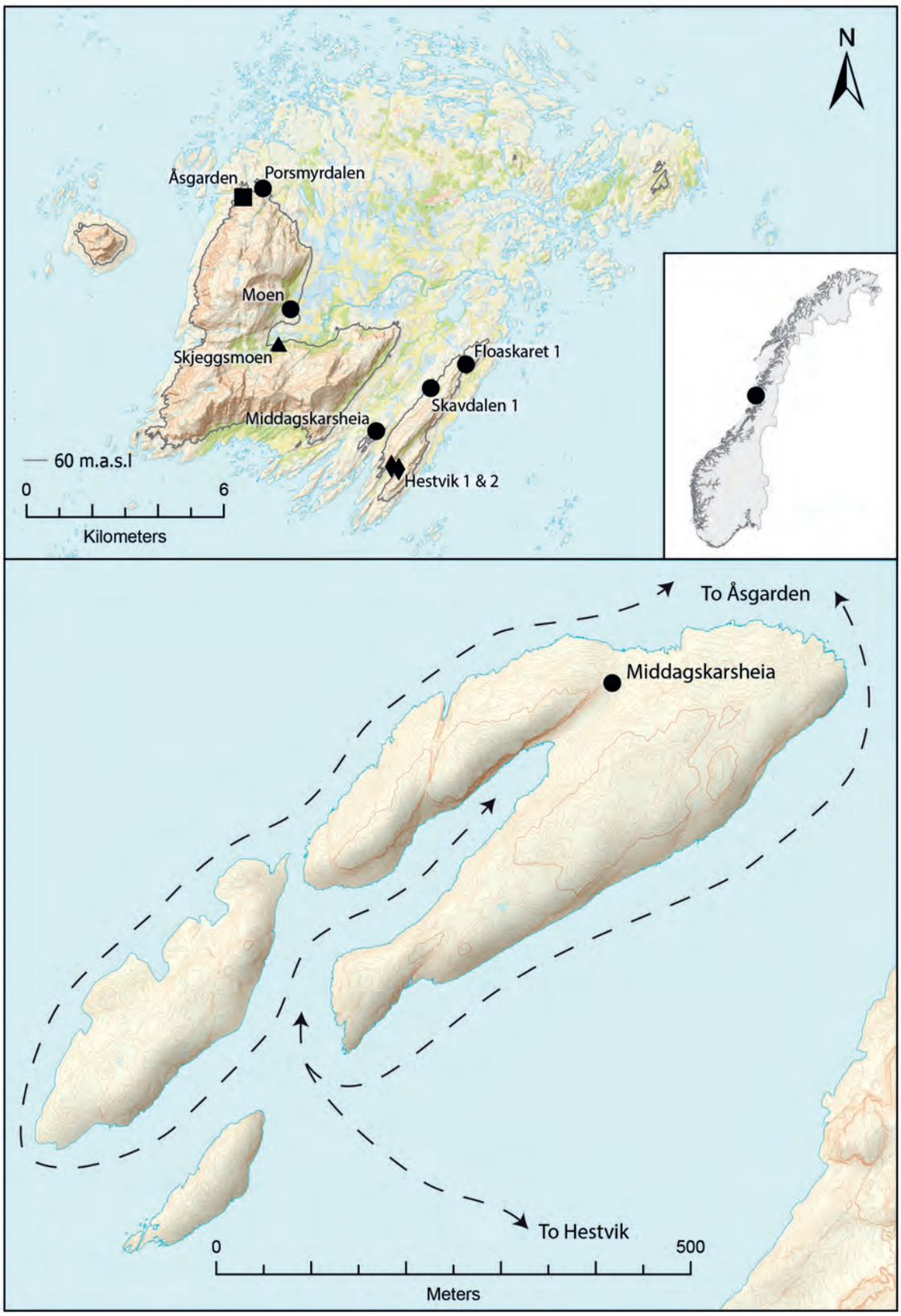

Figure 1. (top) The Vega area in the Boreal period. The 60 m contour line representing the shoreline over a period of 2-300 years. Square: Åsgarden 1 suggested residential base; rhombus: field camps; circle: boat stations; and triangle: stops. Illustration: Kristoffer Rantala

Figure 1. (bottom) The Middagskarheia skerries. Dotted lines indicate possible paddle routes. Illustration: Kristoffer Rantala

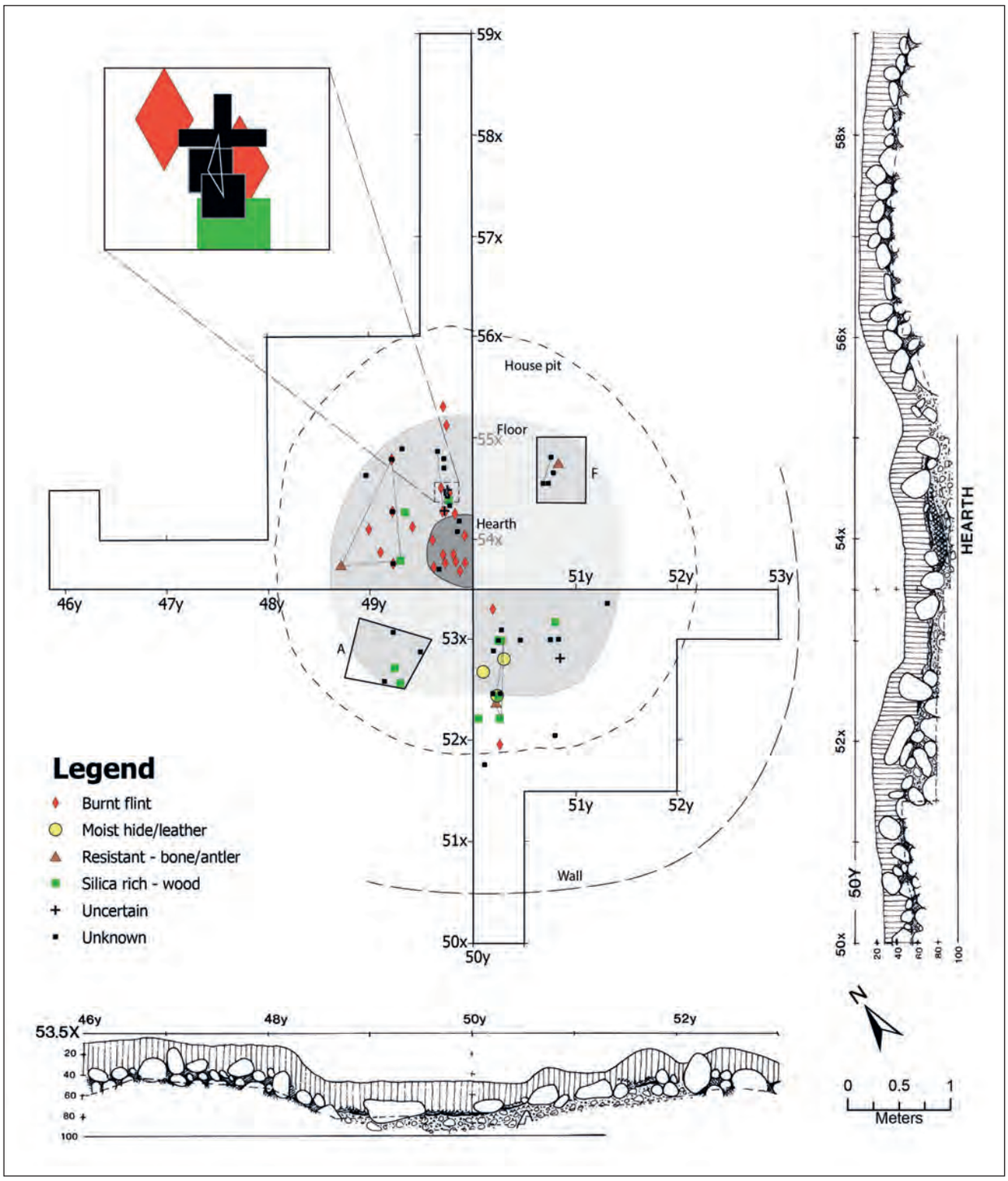

Figure 2. Middagskarheia 1, house foundation in plan and section. The contact materials for all artifacts are based on use-wear analysis. Refits are shown as lines, where the outer dotted line represents the outer circumference of the wall mounds, the inner light grey shaded area represents the hut floor, and the darker grey shaded area illustrates the fireplace. Illustration: Kristoffer Rantala, based on Bjerck 1989

weather. Heavy swells from the open sea towards the north would likely break along the north–northeastern shoreline and south-westerly winds would also have made it challenging for a paddler. These skerries are literally on the edge of the Atlantic Ocean, and with the sea level 60 meters higher during the Middle Mesolithic, they would have been completely unprotected. There would have been no freshwater

at Middagskarheia, but as mentioned by Hein, rainwater could have made up for this deficiency. The Middagskarheia skerry is a harsh location, but once in between the small skerries and on land, the landscape formation called Heia and low knolls lend some protection from northerly and north–westerly winds to the site.

The Middagskarheia 1 site consists of a semicircular hut ground located amongst low knolls at the far northern end of the bay. The sunken floor had been dug down c. 80 cm into the coarse ground consisting of many boulders, to establish a gravel floor. The external dimensions of the hut site were c. 5 m x 4 m, while the internal floor space measured c. 2.8 m x 2.7 m. The structure was surrounded by an up to 1.5 meter-wide wall mound, being most clearly marked towards the south (Fig. 2). The entrance to the hut has not been established through excavation, but the presence of some artifacts towards the southwest in the wall mound could indicate that this was the original location of the passage in and out of the hut—like a door dump (Fretheim 2023:11)—thus indicating a partial clearing or toss zone in relation to an area with traffic. There are otherwise no indications of clearing at the site. At the center of the floor there was a distinct hearth marked by numerous burnt flint flakes and a clear charcoal concentration. The entire artifact material from the site consists of 110 artifacts of which 44 were burnt flints. The hut with the sunken floor is typical of its chronological period during MM1–MM2 (Fretheim 2023:5). There is, however, an apparent discrepancy between the effort put into building the hut, which is visible in the terrain today, with its distinct fireplace indicating intensive use, and the very limited lithic artifact material.

Two diagonally opposite quadrants of the structure have been excavated. Prior to excavation two quite large test pits had been dug, which were positioned in the two quadrants of the floor that have not been systematically excavated. This means that we have material from all four quadrants of the original hut available for analysis. If one includes the two large test pits A and F that are located inside the structure, 13.4 m^2 of the site has been excavated, constituting approx. 6.1 m^2 of the floor space. Test pitting around the site documented in field reports, and ditches that were laid out in four directions along the X and Y axes of the excavation grid, illustrate that the site was clearly delineated (Bjerck 1985, 1987). A sufficient area of the structure is covered by systematic excavation that also included wet sieving. Even if the site is not completely excavated, the assemblage is considered to be suitable for a *chaîne opératoire* approach.

Methods and scope of analysis

One of the motivations for running a detailed analysis of the Middagskarheia 1 assemblage is to contextualize the site's presumed connection to the much larger complex of Åsgarden on Vega, and to the numerous sites from the Middle Mesolithic investigated in Norway during the past c. 10 years.

In the following paragraphs, we describe the methodology and summarize the results of the analysis for each approach applied.

Radiocarbon dating

From the perspective of shoreline dating and technology, the assemblage of the Middagskarheia 1 site falls within the Middle Mesolithic chronozone 1–2 (Bjerck 2008 b). Conventional radiocarbon analyses from 1987 date Middagskarheia 1 to 8,520 +/- 120 BP. Based on this dataset, Hein's assumption (Bjerck 1989 b) that the site overlaps in time and could be associated with Åsgarden 1 hut 2 seemed very reasonable. Åsgarden 1 hut 2 was at the time conventionally dated to 8,330 +/- 90 BP. A recalibration of the old date T-7789 for Middagskarheia 1 and a new date Tra-24131 on a twig of betula show that the old date and the new date partially overlap within the range 7,950–7,350 cal BC, the newest date (TRa-24131) being 7,950–7,600 cal BC. Judging from the two dated charcoal concentrations, Åsgarden had a break in occupation, with the recalibrated date (T-7790) dating the activity to 7,550–7,050 cal BC, and an older phase which is dated on salix to (TRa-24132) 8,450–8,300 cal BC. It must, however, also be mentioned that the samples for dating Åsgarden are related to two different charcoal concentrations, thus representing two separate remains of fireplaces from different occupation periods. The two phases at Åsgarden thus belong to the Early Mesolithic phase EM 3 and MM 2 respectively, while Midddagskarheia is dated to the earliest phase of the Middle Mesolithic, MM 1 (based on Bjerck 2008a: table III.I).

The two phases of occupation at Åsgarden correspond well with technological observations (Skar in prep.), with most of the material displaying older technological traits. Meanwhile, the dates for Middagskarheia are contemporary with the peak of prepared-platform pressure blade technology (eastern blade technology) in central and western Scandina-

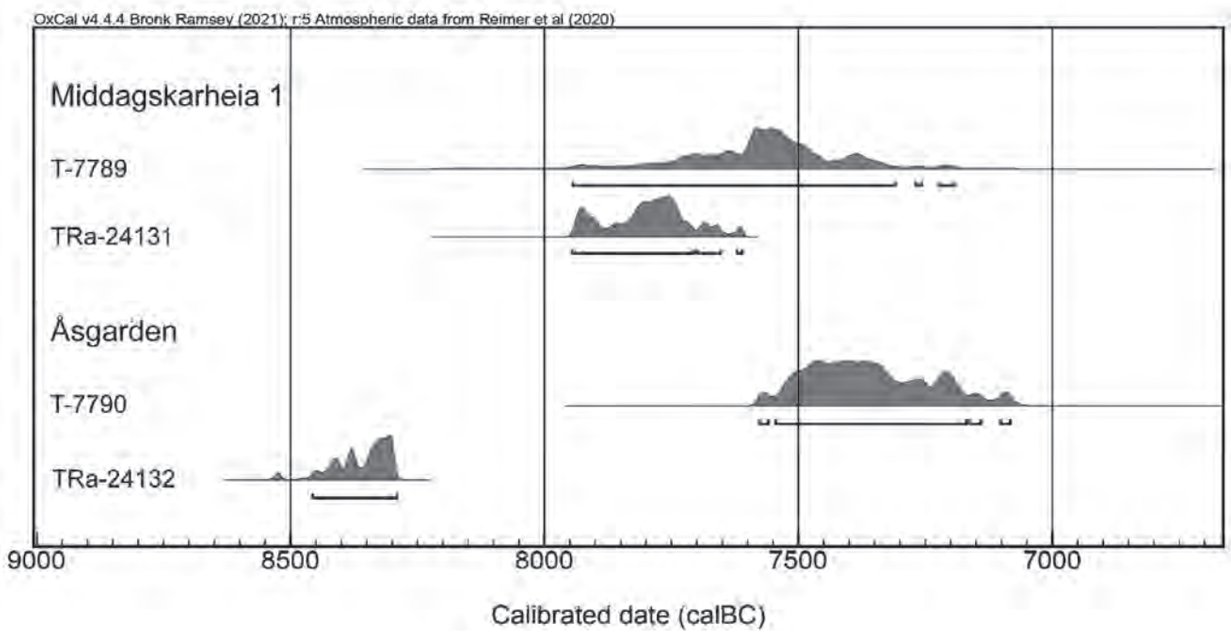

Figure 3. Re-calibrated older conventional radiocarbon dates and new AMS dates from Middagskarheia 1 and Åsgarden 1 hut 2. Illustration: Magnar Mojaren Gran

via (Damlien et al. 2018) as well as the latest peak of eastern blade technology in Northern Norway and the Kola Peninsula according to Manninen et al. (2021). The pressure blade technology has been demonstrated (e.g., Damlien 2016) to be distinct for the Middle Mesolithic period in the abovementioned geographical areas. From the present set of dates for Middagskarheia and Åsgarden, we can establish that there is a gap in occupation between the sites likely precluding contemporary use in a local settlement system.

Lithic analysis

A *chaîne opératoire* framework is geared towards studying composite assemblages using multiple analytical scales simultaneously (Dobres 1995:342). When it can be reconstructed, the operational chain of the lithic production stages reveals a conceptual knowledge of what the desired end product is, as well as the practical and procedural know-how of how to achieve the goal (Pelegrin 1990, Schlanger 1994:148). In favorable situations where long operational chains are preserved and can be established by refitting, the method also offers a procedure for targeting technological and temporal aspects of clusters and activities at a site and interpreting spatial arrangements (Skar and Coulson 1986, Skar and Coulson 1989).

An intra-site distribution analysis and examination by Minimum Analytical Nodule Analysis (MANA) (Larson and Kornfeld 1997) can also provide important information about activities on a site. The present assemblage from Middagskarheia 1 is very limited, but a *chaîne opératoire* approach still allows us to reveal fragments of a conceptual *schéma opératoire* (Pelegrin 1990)—enough to be able to recognize distinct traces of technology. The MANA approach in combination with refitting confirms the site's integrity. The present study also applies high-power micro-wear analysis (HPA), which adds a crucial ingredient to the focus on functional as opposed to morphological types when trying to understand the assemblage.

Table I. The phases of the *chaîne opératoire* or the operational chain in struck lithic production as employed in this analysis (based on Eriksen 2000:81) (for detailed data see Suppl. Table I).

Table I. The phases of chaîne opératoire or the operational chain in struck lithic production as employed in this analysis (based on Eriksen 2000:81) (for detailed data see Suppl. Table I).

CO 1	Acquisition of raw material	Testing / selection
CO 2	Preparation	Opening and initial shaping of core, cresting, platform prep., etc./selection
CO 3	Complete production sequence	Production of blanks, blades and flakes to finished core / selection
CO 4	Modification	Shaping into or integration into tools / selection
CO 5	Use	Hafting, use, resharpening, re-use, transformation / continual selection
CO 6	Discard	Discarding selection
CO 7	Deposition	Deposition of preforms ready for production left at site as a cache

The assemblage

The floor of the Middagskarheia 1 structure was excavated in quarter square meters and as one layer; the soil was water-sieved and a few of the artifacts were collected in the sieve. The provenance of these artifacts therefore refers to quarter square meters, while most of the artifacts were found in situ and given x, y, and z coordinates.

The entire Middagskarheia material consists of 66 artifacts (not including burnt flint (44)). Artifacts of flint make up 75% (50) of the material, quartz and rock crystal artifacts make up 18% (13), and 4.5% (3) are very small non-knappable flint beach pebbles. In addition, one oval palm-sized stone with ochre pigments and charcoal was found. 62% of the flint assemblage was identified as blanks and informal tools, the clear majority being intentionally sectioned or complete blades. One double-ended scraper and a troncature on a flake stand out as the only morphological tools.

Most of the material was found close to the hearth. The burnt flakes were found in and just outside the hearth (Fig. 2). The hearth would have been at least 0.50 m^2 and thus normal for this type of centrally placed hearth with the given floor area.

MANA, dynamical technological analysis, and refitting.

MANA

The lithic debris from Middagskarheia has been analyzed using the MANA method (Larson and Kornfeld 1997, Manninen and Knutsson 2014, Damlien 2016:115). The objective was to quantify the number of nodules that were worked on the site and document the stages of reduction present, as well as identify the distribution of debris considered to originate from the same nodule. As flint is the dominant raw material, the classification has been done in accordance with Eigeland (2015) and Damlien (2016). The artifacts are visually examined, and non-altered flint (non-burnt and non-patinated) is separated into types based on texture, inclusions, and other visual variations such as color, homogeneity, transparency, and granularity (Inizian et al. 1999:21, Soressi and Geneste 2011:338). Generally, this sorting of flint is only relevant for intra-site analysis and is not geared towards establishing links between sites.

The assemblage of 50 flint artifacts at Middagskarheia 1 contains as many as 16 different flint raw materials. The high number of flint raw materials is in line with analysis of other Mesolithic Vega sites (e.g., Wathne 2017, Holen 2020) and my own work from Åsgarden (in prep.). The individual beach nodules are often of the size of a child's fist, so very short sequences of flakes or blades are produced from each nodule. Using a *chaîne opératoire* approach based on refitting is thus challenging.

With respect to the quality of the majority of the local beach flint, a coarse untransparent and chalky flint often dominates at Early and Middle Mesolithic sites on Vega. It is noteworthy that at Middagskarheia 1, we have a selection of very high quality fine-grained and often slightly transparent raw materials. We have only one example of the coarse material—a larger, retouched flake—referred to by Hein as a flange knife (personal communication). The raw material and signs of post-depositional degradation unfortunately made this artifact unsuited for microwear analysis, so the use of the flake remains unsolved. The otherwise very fine raw materials are seemingly a result of a deliberate choice of blanks and artifacts brought into the site—in most cases blades and bladelets. This indicates that the trip to the skerry and the activities on the site were well prepared, likely with particular tasks in mind.

Dynamic technological analysis and refitting

The material is found in two concentrations that can be interpreted as activity areas on either side of, and partly overlapping, a fireplace (Fig. 2). The confined excavation area limits our possibilities of getting a complete overview as the rest of this central area has not been excavated. The fireplace was represented by burnt flint and large amounts of charcoal in the center of the floor. Complete or snapped blades, bladelets and flakes are the dominant artifacts on the site. These are found in the two systematically excavated areas and in the two large test pits A and F. There are no cores or core fragments associated with blade production on the site. However, in the activity area NW of the fireplace, two large flakes of identical flint material stand out due to their large size in comparison to all other struck material. One is a large core rejuvenation flake from an irregular flake core, representing the only core fragment found on the site; the other, a large broken flake.

26% (13) of the Middagskarheia 1 artifacts refit. The refits are related to four of the raw material groups and represent bladelets in very short sequences, intentional breaks and unintentional breaks. Even though the number of raw material groups is very high and the number of refits low, the analysis serves to link the material in the two excavated quadrants of the floor and the two test pits. While refits link activity within each of the excavated quadrants of the floor, raw material groups link the entire site together.

The analysis of the various refits and raw material groups demonstrates that the majority of lithic material on Middagskarheia 1 falls into *chaîne opératoire* (CO) 6, which includes worn out functional tools, and a few examples of CO 7 that may have been left as a cache for a future visit (Suppl. Table I). Particularly the use-wear analysis that follows allows the history of the tools to be traced. There are no indications of testing and discarding of raw materials, except perhaps regarding the 11 small splinters of quartzite. The early stages of the *chaîne opératoire* covering preparation, core and platform rejuvenation, trimming and basic production of blanks and tools are missing. The artifacts seem to have been brought in as preselected blades and flakes and in two cases as morphological tools: a double-ended scraper and a flake with concave distal troncature. It is not evident that the informal tools on the site represent complete toolkits. The activity and the choice of introduced artifacts and blanks are very specialized. The collective flake material of flint that was not chosen for microwear analysis was prior to this analysis judged by the authors to have been discarded during the Mesolithic due to the character of its edges, which placed it in CO 6. A large core rejuvenation flake from an irregular flint core of the R4 raw material may have been "placed" (CO 7) as a good quality raw material for a later visit. A concentration of five snapped bladelets in the southern wall of the hut, which could easily represent a composite tool made of organic material, where only the already used insets of fragments of bladelets were preserved, may have been "placed" (Binford 1978, Clark 2017).

The very small unmodified flint nodules have either been selected on the beach as raw materials, something their very small size argues against, or they may have been selected for another purpose, for example to play with. It has been suggested by Hein (Bjerck 1989 b) that the core fragment (33) of raw material R4 together with two flakes (32 and 37) are from the same very characteristic nodule as flake 193 from the residential site Åsgarden (T20755) situated further north on the main island of Vega. The "cauliflower-like" cortex with small fossils, as well as the matrix of the flint, indicate that these flakes could belong to the same nodule. However, much as we have tried, the flakes do not refit.

Attribute analysis

The attribute analysis of the blade assemblage at Middagskarheia aimed at facilitating comparison with other contemporary Mesolithic assemblages in Central and Southern Norway (Damlien et al. 2018, Holen 2020) has been carried out according to Damlien (2016) based on Sørensen (2013).

17 of the blades comprising fragments or whole blades with a bulbar end that has been measured for attribute analysis. 11 of these are blades (> 8 mm wide) while 6 are bladelets (< 8 mm wide or less). The blades are regular to very regular, but still the blade curvature is dominated by type 2-3 and thus a tendency to have distal to even curvature (Damlien 2016:127). The predominant interior platform angle is 90 degrees, and the bulb formation is diffuse. A few demonstrate almost no bulb and a few have a pronounced bulb. Diffuse lip formation is predominant while a few have a pronounced lip. Approximately half of the platforms show more than two facets, a few have two facets and approximately 40% have plain platforms.

Table II. Summarized attribute statistics for blades and **blade fragments** at Middagskarheia 1. Classification according to Damlien (2016), except for * Sørensen (2013). (For detailed data see Suppl. Table II)

Attributes	T 20759 Middagskarheia	
	MAN	Total
Interior platform angle	< 90	29.40%
	Ca. 90	65%
	> 90	5.80%
Regularity	Irregular	0
	Regular	58.80%
	Very regular	41.10%
Lip formation	None	0
	Diffuse	76.40%
	Pronounced	23.50%
Bulb formation	None	11.70%
	Diffuse	70.50%
	Pronounced	17.60%
	Double	0.00%
Bulbar scar	None	76.40%
	Yes	23.50%
Conus formation	None	94.10%
	Ring crack on butt	0.00%
	Ventral fissures	17.60%
	Detached bulb	0
Butt preparation*	Plain	41.10%
	Two facets	11.76%
	More than two facets	47.00%

The blade material has in general been produced by indirect soft technique, but there are 3 examples indicating potentially a harder technique demonstrating ventral fissures and bulbar scars (Suppl. Table II). Indirect soft technique gives attributes that resemble pressure technique but are distinguished by a smaller proportion of the assemblage having an interior platform angle of more than 90 degrees. In this assemblage only one blade has an interior platform angle of more than 90 degrees. The faceted platforms and associated attributes related to bulb formation as well as the curvature of blades are strongly indicative of indirect soft technique but clearly in a Middle Mesolithic format. From a *chaîne opératoire* and MANA perspective it is important to note that we have two short series of refitted narrow blades comprising just two to three bladelets, with one of them clearly demonstrating heavy platform preparation between the two blade detachments, which supports the distinct technology and *schéma opératoire* (Pelegrin 1990). Our results are also in line with previous analyses of this assemblage (Holen 2020:16).

Microwear analysis

The microwear analysis had two main objectives. The first was to identify the functional profile of the Middagskarheia flint assemblage, and the second to generate hypotheses on the overall use of the site. Two microscopic techniques were used to achieve these goals. A stereoscopic microscope (Nikon SMZ800) with magnifications between 1x and 65x was used to observe and document the presence of macro modifications on the edges (e.g., impact fractures, microchipping, etc.). A Nikon metallographic microscope (Nikon Epiphot) with magnifications between 50x and 400x was then used to identify and document surface modifications such as abrasion, striation, rounding, etc. Both microscopes were provided with a DS-U2 digital camera and a Nikon NIS-Elements 3.2 image analysis software program that was used to analyze the images. To enhance the depth of field during photographic documentation, image stacking was used (Stoneslab.se).

The interpretations of type of use and contact materials are based on a reference collection of several hundred experimental flint tools, used for different tasks and on different materials in the archives of Stoneslab (Stoneslab.se).

Prior to analysis, all artifacts are normally soaked in a weak acid solution (HCL 3%) for 24 hours to remove mineral deposits on the surface of the tools. In this project the acid bath was left out, as this somewhat harsher treatment can negatively affect the surface. Thus, after the primary soaking, each artifact was instead put in a petri dish with distilled water in an ultrasonic cleaning bath for 10 minutes. To remove organic materials and grease from handling, the artifacts were then gently cleaned in tap water using an ordinary detergent. Finally, the artifacts were treated in distilled water in the ultrasonic cleaning bath. During microscopic analysis the artifacts were occasionally cleaned with acetone to remove grease from handling.

Out of a total of 50 recovered flint artifacts from the site, microwear analysis was performed on 28. These were mostly blades and blade fragments, a flake, a morphological troncature and a scraper. Twenty-one (21)

of these pieces showed identifiable traces of wear interpreted as resulting from use. The presence of post-depositional processes is a well-known issue and may have acted to transform, destroy, and remove use-wear traces (Plisson and Mauger 1988, Levi Sala 1996). We are aware of this, and the observed microscopic alteration of the artifact surfaces should go beyond surface modification and microdamage to be defined as use-wear. The observed wear was thus evaluated and interpreted based on distribution, directionality and consistency.

The toolkit, an initial hypothesis

An informal functional and technological analysis was carried out to organize the material before analysis. This resulted in an initial hypothesis for the functional profile and overall use of the site, and an organization into a hypothetical "toolkit" based on previous analyses of Middle Mesolithic assemblages (Knutsson and Knutsson 2019) (Suppl. Fig. 1).

A large flake (32) with a distal break that forms two, strong right-angled edges, may have been used as a *scraper plane*, well known in ethnographic sources (White 1968, Plate II).

One double-edged "*scraper*" (74) can be given several interpretations. Many of these types of artifacts have been microscopically analyzed over the years. Traces of use as a hide scraper dominate, evidencing the whole tanning process from fat scraping, removal of the subcutaneous layer, thin-scraping, and scraping hides with tanning agents such as bark and ochre. Scrapers used on harder materials such as wood have also been identified (Knutsson and Knutsson 2019).

Several use-wear analyses of Middle Mesolithic sites in Sweden and Norway (Knutsson, H. and Knutsson, K. 2012, Eigeland et al. 2016) have identified a cognitive type named "*corner knife*". On several macroblades with a distal break, characteristic traces of use have been identified, indicating that the blades were systematically used to cut deep into a softer type of raw material giving rise to friction, as evidenced by many striations. Twelve blades potentially fitting this category have been found in the material from Middagskarheia (AM2; AM6; FM13; 41; 40; 26; 46; 65; 75;18; 6; and 23). One example from this group is an irregular medial fragment of a primary blade (23), that has one lateral side covered in cortex, while the opposite, lateral edge has a regular retouch. This piece can best be understood as a fragment of a longer piece, possibly a corner knife with the proximal end missing.

Five medial fragments of narrow blades (2; 8,43; 68; 73; 51; and 34), and a proximal and a distal part of a narrow blade (70; 72), some of which have a lateral retouch, may fall under the category "insets" or preforms to insets. Since Middagskarheia is a Middle Mesolithic site, pieces of narrow, broken blades and blade fragments may represent insets for slotted bone points or knives, known from sites in Norway (e.g., Bergsvik and David 2014). These are either remnants from retooling (Keeley 1982:800 ff) and/or from the production of new insets. Previous wear analyses of insets in bone points and narrow blades found on Mesolithic sites in Scandinavia have shown that these small edges have been used both as edges in knives used for cutting skin and organic materials and as projectiles (Knutsson, H. and Knutsson, K. 2019, Knutsson et al. 2024).

In the assemblage, three whole bladelets (4; 7; and 69) can be understood as unused blanks to produce "insets".

Two distal fragments of bladelets (9 and 72) may represent remnants from tool production on the site. Number 9 can be fitted to the proximal fragment 46 (see corner knives above) thus forming an almost complete blade. This blade can be fitted to the proximal fragment 65 (also classified above as a possible corner knife).

The second distal fragment 72 and the proximal fragment 70 can be conjoined with a whole blade. This mended blade can be refitted to the intact blade 4. While the first set of bladelets demonstrate platform preparation, the second one does not.

These hypothetical suggestions of the use of lithics in a *chaîne opératoire* were tested by microwear analysis (Suppl. Fig. 1)

Results of the use-wear analysis

Although the material is slightly weathered, use-wear can be identified on most blades and blade fragments from Middagskarheia, which show rather weakly but systematically developed wear traces agreeing with experimental tools in Stoneslab's reference collection. Below, our observations are described, and micrographs are presented to support our interpretations (see also Suppl. Fig. 2)

Wear is mostly and most consistently found on only one of the two sharp lateral edges, often demonstrating systematically oriented striations and the overall picture is one of one of use. This contextualizes the actual wear surfaces into aspects of a cultural system, a materialization of an applied "folk knowledge".

The large flake with a distal break (32) forming two sturdy, obtuse edges, shows traces indicating use as a

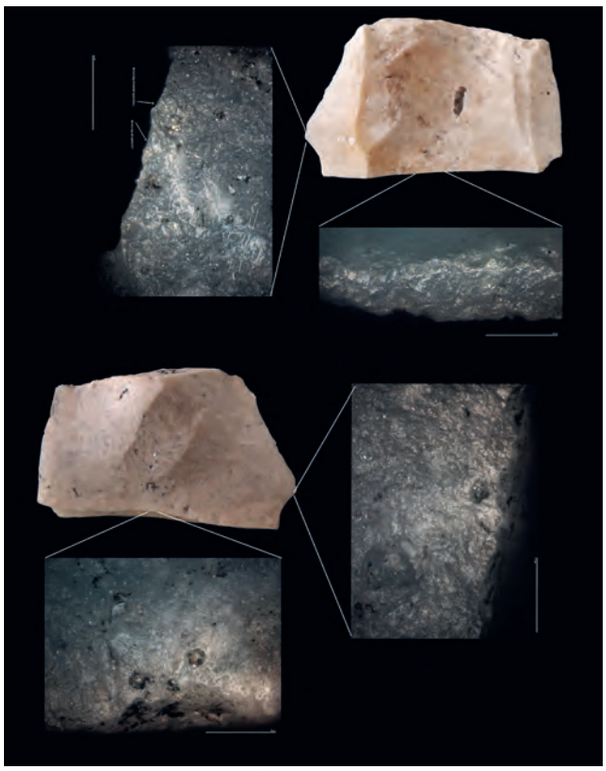

Figure 4. Light and domed polish on higher areas of the microtopography of the obtuse edge of the big flake no. 32 can be interpreted as caused by contact with wood. The use-wear has linear features oriented at right angles to the edge.

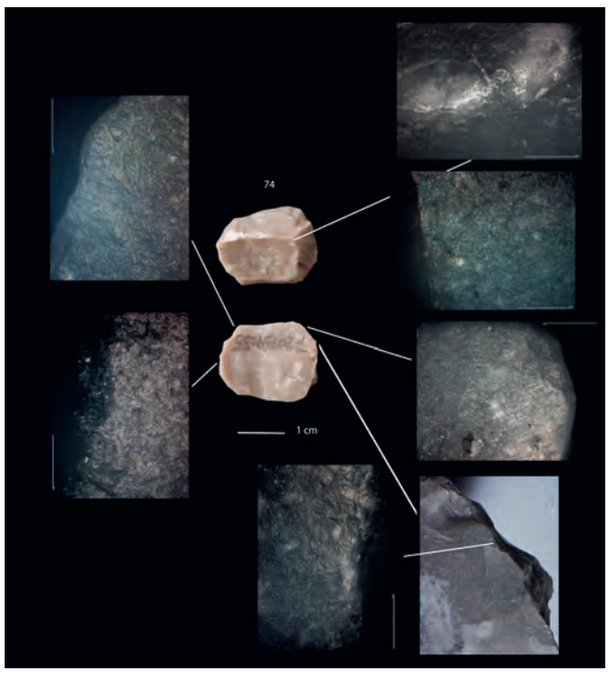

Figure 5. Striations in a polished area on one of the retouched edges of scraper no. 74 indicate a scraping movement and a silica-rich contact material, most likely wood. The lateral edges show profound surface changes, edge-rounding, white, smooth polish and striations.

heavy scraper plane and for whittling, probably on wood (Fig. 4).

The formal scraper (74) shows wear on both retouched edges, most likely from use as a scraper (Fig. 5). The wear indicates use on a silica-rich raw material, possibly related to scraping fresh wood. Visible striations oriented perpendicular to the edge are also observed on both lateral edges. These can be interpreted as the result of hafting or, more likely in this case, from a previous use when the scraper was still a whole blade used as a spokeshave. The latter are known from Middle Mesolithic sites (Knutsson, H. and Knutsson, K. 2019). The result is in line with the initial hypothesis but adds primary use as a spokeshave in another part of the life cycle.

Three complete narrow blades (4; 7; and 69) have worn surfaces. Two of these blades (4 and 69) have minor patches of wear nearest to the distal tip, and 4 has a short, obtuse edge caused by a small distal snap. On this obtuse edge, there are patches of a white, domed polish with a few striations at 90 degrees to the edge. 69 has a small burin-like edge caused by an impact break at the tip. Along a very short stretch of this edge there

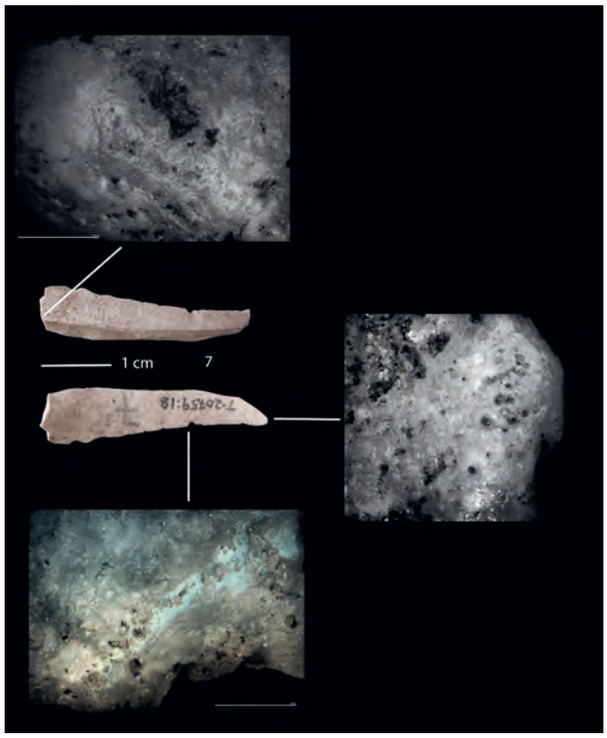

Figure 6. On one of the lateral edges of blade no. 7, several small half-moon fractures are seen. The outermost edge rim is rounded and closest to the edge there are patches of a bright polish.

is a smooth, white polish with a few striations at 90 degrees to the short obtuse edge. This minute wear at the tip of these small blades can with some hesitation be explained as the result of short-term use to make grooves in a raw material containing an abrasive like silica. The wear, including the impact break developed as the blade detached from the core, could also derive from when it hit the ground (Keeley 1980:26).

The narrow blade (no. 7) (Fig. 6) has more extensive and developed wear.

On one of the lateral edges there are several small half-moon fractures (sensu Keeley, 1980:25), the outermost edge rim is rounded and closest to the edge there are patches of a bright polish. On the distal edge there is a heavily worn surface with a bright, smooth polish, seemingly caused by contact with an abrasive material. Striations on the platform edge can be explained by technical preparation of the platform before releasing the blade. This blade can be interpreted as a tool; the contact material is soft and may be related to hide work.

Twelve (12) large proximal parts of blades were assumed to be "corner knives" (AM2; AM6; FM13; 41; 40; 26; 46; 65; 75; 18; 6; and 23). Blades nos. 41, 46 and 23 show no or faint wear and have been interpreted as unused. 75 and 26 had a faint polish on the intersection between one lateral edge and the right-angle break surface at the distal end. Although faint, the traces are consistent with use as a groover. Blade AM2 has developed wear on one of the lateral edges, indicating multiple use as a spokeshave and knife on a moist, silica-rich material. Blade AM 6 has one concave retouched lateral edge with no use-wear, while on the opposite unretouched edge there are wear traces indicating use as a spokeshave. Wear is also found on the obtuse edge caused by the distal snap. The wear indicates the contact material to be wood. Blade FM 13, morphologically a concave truncature on a flake, shows wear on one lateral edge and has been used for cutting or scraping (Fig. 7). Wear is also found on an obtuse, burin-like edge at the tip of the blade. The contact material was a moist, resistant material causing high friction, possibly antler/bone.

One lateral edge on no. 65 has a fine retouch along one of the lateral edges. On the opposite edge, there are several half-moon breakages (sensu Keeley 1980:25). Both edges have microscopic wear indicating use for cutting/sawing a resistant material. On the obtuse, distal edge, there is wear from planing/scraping a resistant material, both indicative of work on bone. At the intersection between a burin-like, obtuse edge and the

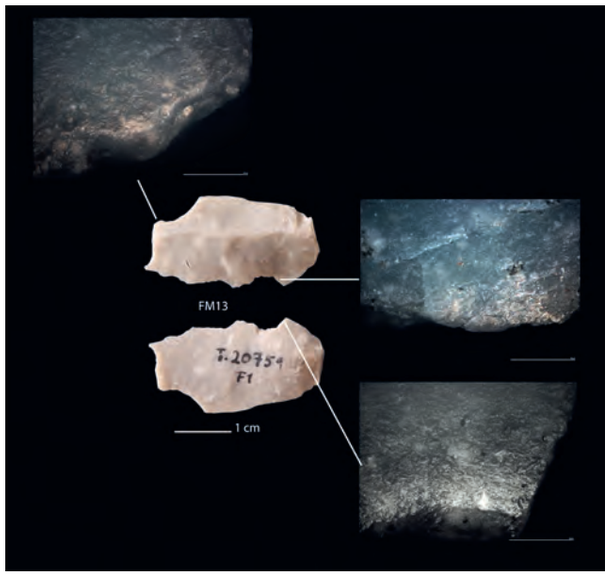

Figure 7. Blade no. 13 has wear on one lateral edge and on an obtuse, burin-like edge on the tip of the blade. The blade was used for cutting or scraping. The contact material was a moist, resistant material causing high friction, possibly antler/bone.

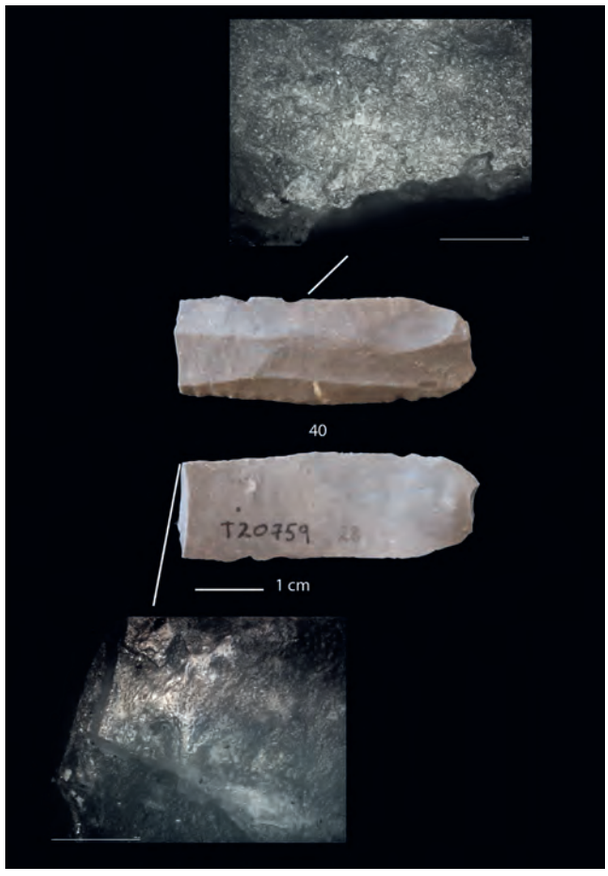

Figure 8. At the intersection between a burin-like, obtuse edge and the lateral thin edge on blade no. 40, there is distinct wear in the form of a bright, smeary polish caused by contact with a material rich in silica. The blade was probably used as a spokeshave and "groover."

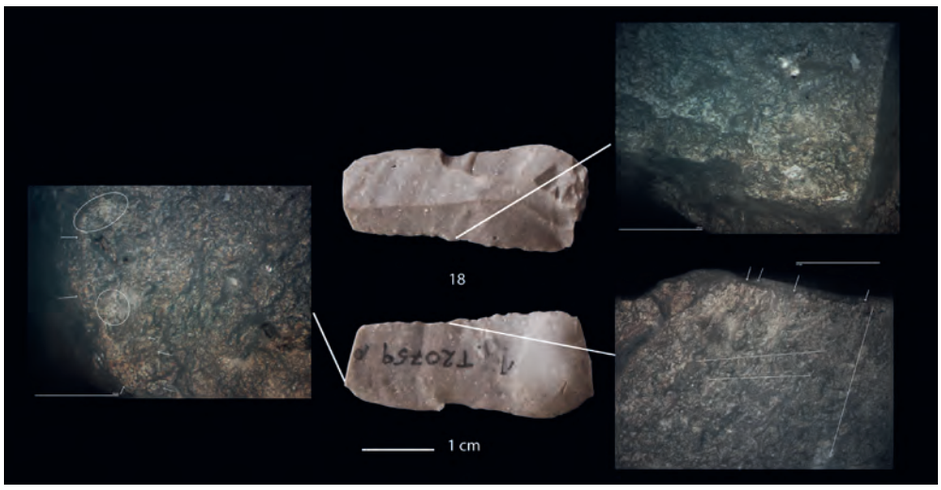

Figure 9. On blade no. 18 one of the retouched lateral edges has wear with striations indicating use for cutting or whittling on a material rich in silica. At the intersection between a distal break and one of the side edges, the wear indicates use as a "groover."

lateral thin edge on no. 40, there is distinct wear in the form of a bright, smeary polish caused by contact with a material rich in silica. The blade was probably used as a spokeshave and "groover" (Fig. 8).

On blade no. 18 one of the retouched lateral edges has wear with striations indicating use for cutting or whittling on a material rich in silica. At the intersection between a distal break and one of the side edges, the wear indicates use as a "groover" (Fig. 9).

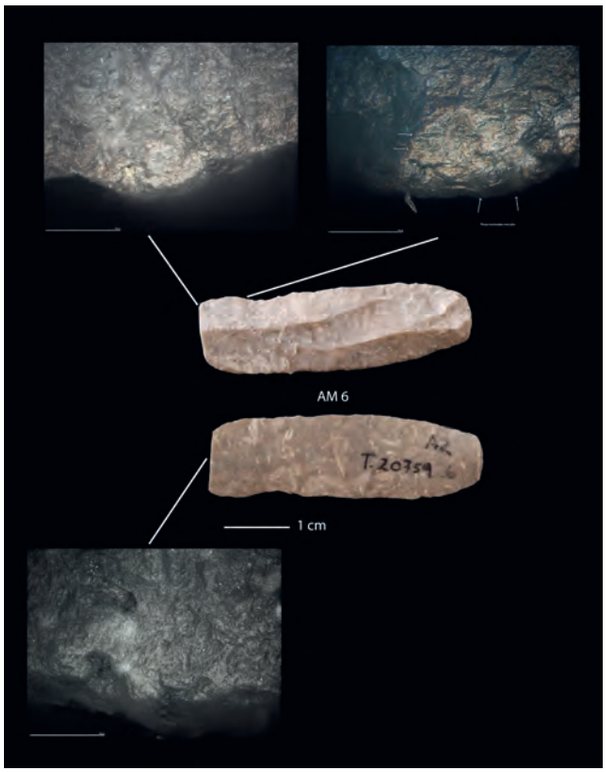

Figure 10. Both lateral edges of blade no. AM 6 were used for cutting and scraping a silica-rich material. Patches of polish and striations perpendicular to the edge between the platform and ventral side indicate planing and scraping.

On blade no. FM 6 there are traces of use on both lateral edges for cutting and scraping a silica-rich raw material. On the edge between the platform and the ventral side there are patches of polish and striations perpendicular to the edge, which indicates use as a scraper plane and for scraping (Fig. 10).

Two distal fragments (72 and 9) both have observable use-wear. The sturdy edge caused by the break on 72 has a bright polish with striations perpendicular to the edge indicating that it was used for scraping/planing on a silica-rich material like wood (Fig. 10). No. 9 demonstrates similar wear.

On bladelet no. 70, wear was identified along one of the lateral edges and on the edge formed by the distal break. Striations indicate use for scraping and cutting/sawing a resistant contact material, which was likely bone/antler.

The wear analysis has thus disproved the initial "corner knife" hypothesis for the Middagskarheia assemblage. The wear on the blades with a distal break did not correspond to previously observed traces on Middle Mesolithic assemblages. Many of the blades from Middagskarheia have wear that can be interpreted as systematic use for planing, whittling and grooving a silica-rich material, probably wood, but bone and hide are also represented as contact materials. The wear is situated mainly on one and occasionally both lateral edges. Normally there is no retouch, but sometimes they have an obtuse edge from a distal snap intersecting with the lateral edges used for a grooving activity.

The investigation of five medial parts of narrow blades (2; 8; 43; 73; and 76) shows that four of these (2; 43; 76; and 73) have no or faint traces of surface

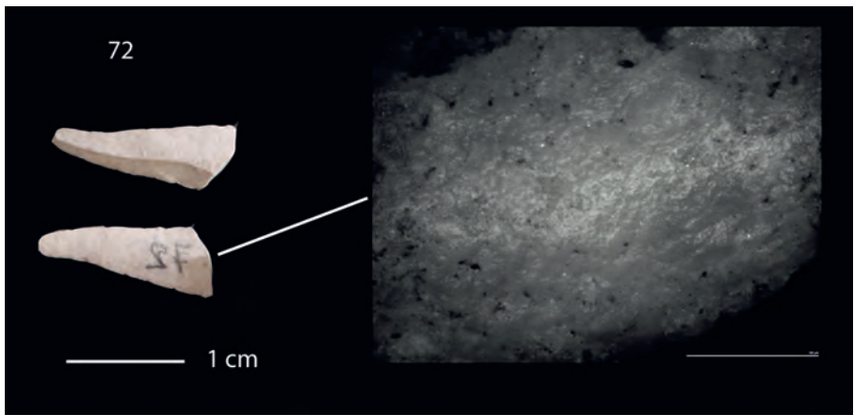

Figure 11. Distal fragment no. 72 has bright polish with striations perpendicular to the edge, indicating use for scraping/planing a silica-rich material.

alteration that can have been caused by use. While number 8 has small patches of wear on both lateral edges, the edge with the most developed wear has striations oriented perpendicular to the edge. The two obtuse edges have patches of greasy wear as well. The piece is interpreted as having been used for scraping/cutting on a soft material like leather or moist hide. The small size indicates it was inset into a handle as part of a hafted tool. Likewise, no. 68 is a distal fragment of a narrow blade, where a bright, greasy polish with striations perpendicular to it has been identified on the obtuse edge created by the break surface. The corner formed by the intersection between the lateral edge and the distal break is rounded and shows striations perpendicular to the obtuse edge. This small blade fragment can thus be interpreted as having been casually used as a scraper plane and/or to cut or groove soft materials like leather or moist hide (Fig. 12).

The hypothesis suggested that this group of narrow blades were either remnants from a retooling process or consisted of used and discarded "insets". Both suggestions proved to be correct. Four fragments were unused and thus interpreted as preforms. One piece may have been a discarded inset from a used knife, and another piece casually used to scrape or groove.

The narrow blade no. 69 has previously been seen as belonging together with the fragments of other narrow blades nos. 68, 70 and 72. They were found together in the southern wall of the hut. It has been suggested by Hein that these belonged to a composite tool that could have been "placed" for later use (Bjerck 1989:11). The microwear analysis, however, does not support that explanation. The edges of the implements have been used on entirely different contact materials: No. 68 as a scraper on hide, no. 69 as a groover on wood, no. 70 as a scraper and knife on bone and no. 72 as a scraper and planer on wood. These implements are located in the door dump in the potential entrance to the hut.

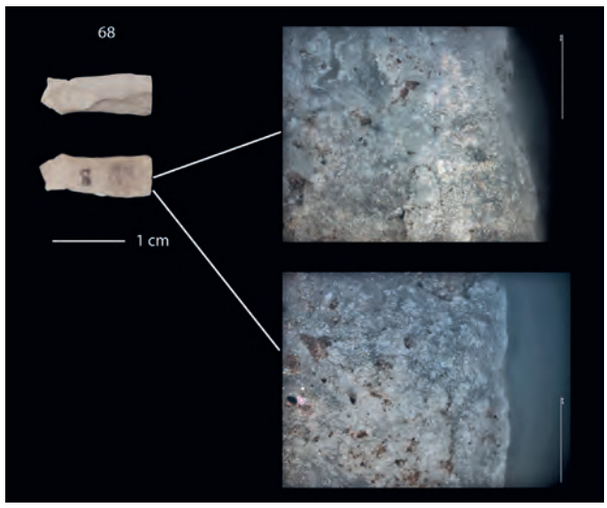

Figure 12. On the obtuse edge created by the break surface on a distal fragment of narrow blade no. 68, a bright, greasy polish with striations perpendicular to it was identified. The corner formed by the intersection between the lateral edge and the distal break is rounded and shows striations perpendicular to the obtuse edge, which is interpreted as casual use as a scraper plane and/or to cut or groove soft materials like leather or moist hide.

Two very short medial parts of blades (51 and 34) were grouped together, hypothetically interpreted as remnants of insets. No. 51 is slightly burned and possibly used, but the surface has been altered by the heat and interpretation is not possible. On no. 34 one of the lateral edges shows a bright polish with striations perpendicular and at an angle to the edge. The blunt edge of the distal break shows only faint traces of wear. The short piece can be interpreted as a small part of a broken blade, with one lateral edge used as a spokeshave and for cutting/whittling an unknown contact material.

Table III. Results of microwear analysis: contact material versus artifact function. Numbers refer to find numbers in the catalogue. (Based on Suppl. Fig. 2)

Contact material/ Artifact function	Silica-rich/Wood	Hide/Leather	Bone/Antler	Material unknown
Scraper	32, 72, 9, 6, 74	8,7,68	FM13, 70, 65	
Spokeshave	AM2, AM6, 74			34
Plane	32, 72		65	
Knife	32, AM2 18, 6, 51	8,68	FM13, 70, 65	34
Saw			65	
Groover	69, 4, 40	68		26
Faint traces	7, 69, 4			
Hafting	74			
Production and storage wear				7, 69, 4
Unused				76, 41, 73, 75

Discussion

The Middagskarheia material has been analyzed using a technological *chaîne opératoire* approach including use-wear analysis to achieve a deeper understanding of the activities performed, and of the organization of the site. One of the objectives was to carry out an analysis including MANA, refitting and attribute analysis to compare the assemblage technologically with other Norwegian assemblages where those approaches have been used in recent years. The analysis demonstrates that the assemblage conforms to a Middle Mesolithic *schéma opératoire* as seen in many other sites from this period (e.g., Eigeland et al. 2016). From a MANA perspective, the presence of 16 different flint types and the very limited collected material (110), with several types represented with just a few artifacts from the same nodule, show that all the materials were produced elsewhere and brought into the site as ready-made tools. Use-wear analysis further reveals (Table III) that many of these artifacts, mainly snapped blades, were used for a variety of functions such as scraping, cutting, whittling and grooving, while the contact material on which the individual artifact was used is more consistent. Furthermore, it can be noted that there are no examples in this assemblage of the same implement being used to work on different contact materials. It is likely that it was a toolkit for planned repairs of necessary gear used on a hunting trip or related to gathering or fishing, knowing that there would be limited need for primary production of blanks.

If the fact that tools of different flint types were brought to the site gave very limited prospects for refitting studies, it did mean, as shown, that the MANA results clearly suggested the lithic assemblage was brought to the site as a toolkit. However, the few refits of short series of bladelets with demonstrated platform preparation, paired with additional attribute analysis, confirmed that the technique used was an indirect soft hammer approach. Even though this material does not demonstrate conical core pressure blade technology—a signature for the period—the analysis supports the view that the material was produced by a distinct technology following a Middle Mesolithic *chaîne opératoire* (Eigeland et al. 2016, Pelegrin 1990), intended for manufacturing flat regular blades on conical cores, which amongst other things is well suited to making insets for composite tools. The deliberate and systematic snapping of blades serves to underpin this conclusion.

With respect to relating the site to the settlement system on Vega, it can be mentioned that the core fragment at Middagskarheia has remains of a particular cauliflower-like cortex which Hein compared to material with a similar cortex and matrix from Åsgarden 1 house ground 2 and interpreted to be from the same core. It is difficult to evaluate this, as the flake from Åsgarden does not refit with the material from Middagskarheia. There is, however, a possibility that material from the older part of the Åsgarden assemblage was picked up by the visitors to Middagskarheia, as it represented mate-

rial of a good size and of prime quality for further use. Thus, the large core fragment of this material may have been "placed" as a good raw material for a later visit. However, the placing of a composite tool represented by bladelets (68; 69; 70; and 72) in the wall could not be substantiated by the microwear analysis.

The radiocarbon dates for Middagskarheia place the site chronologically at the peak of prepared-platform pressure blade technology (eastern blade technology) in central and western Scandinavia (Damlien et al. 2018) as well as the latest peak of eastern blade technology in Northern Norway and the Kola Peninsula (Manninen et al. 2021). Use of the indirect soft hammer technique is an integral part of the *chaîne opératoire* of this period's blade production. The short sequences of refits belong to artifacts from four raw material groups without giving any indication that they were produced on the site. The MANA examination of the assemblage confirms the integrity of the site, since refitted artifacts and non-refitted artifacts of the same raw material bind together the different areas of the hut ground, providing evidence of closely associated activity areas around the fireplace inside the hut.

The distribution of the used artifacts (Fig. 2) does give some indications as to designated work areas even though the volume of material is small. Wood-working is the dominant activity, dispersed around the northern, western, and southern parts of the hut, antler/bone work—although documented in fewer artifacts—occurred in the northern, southern and eastern parts, while leather work is confined to the southern part of the hut. With the few artifacts present and several tools likely being composite, these work processes may represent individuals in the hut working on particular tasks and retooling personal tools. Work on silica-rich materials like wood dominates, and as there would have been very little forest growing on this barren island, the wood-working could have been dedicated to the repair of items brought in or already there as part of a defined toolkit. The production or repair of utensils made of withy or other organic material leaving similar use-wear traces is another possibility. The ochre stone found on the site may have served to make paint, for example for painting wooden implements—or as suggested by Hein for people to paint each other to ensure a good catch. The wear traces on the scraper indicating use on a silica-rich material could also agree with an interpretation as a tool for scraping hides with ochre as a tanning agent.

Antler/bone and hide/leather work is represented in fewer artifacts but may simply have been part of the retooling and refixing of handles, or for making smaller implements from organic material. In combination with woodwork, this could also indicate smaller repairs on parts of larger objects—like fish-traps, boat ribs, paddles, the hut itself, etc. The hut floor would not have allowed work on very large items.

The results of the analysis give a clear indication of how little of the actual material from Stone Age sites we find. A massive amount of organic material must have been present at many sites and in many cases would have dominated the hunter-gatherer-fisher equipment. The excavation of numerous submerged sites in Scandinavia (e.g., Miettinen et al. 2008, Hansson et al. 2019, Andersen 2013a; b:115–221) has demonstrated that plant materials and wood are completely dominant for many utensils. We must expect this material to have also been important in the outer islands of Norway, even though forest vegetation would have been sparce (e.g., driftwood). Species identification of firewood from the fireplace at Middagskarheia 1 documents the presence of both Betula and Salix of a certain size, which are species that facilitate potential production of mastic and withy bast, for instance. Antlers would need to be brought from the mainland as ungulates were only introduced to Vega in recent historic times. Bone from marine mammals and birds may, however, have substituted and supplemented antler in some work functions.

The floor area of the hut is approximately 6 m^2, which is relatively small for a family unit. The spatial organization of the material does not support the kind of differentiation of activities that would suggest a family unit (Grøn 2011, 2018, Manninen and Knutsson 2014), although use-wear analysis indicates some distinction between work areas. The hut would have suited a small task group of three to four hunter-gatherer-fishers. Considerable effort must have been put into constructing the hut, which in places has wall mounds that are close to a meter wide and has a depth of 80 cm. Burnt flint stretches to the north of the fireplace. Although flint splinters in a fire and spreads, the distribution pattern could indicate some trampling and spreading at a time when there was no fire, meaning that the fire could have been lit several times. There are also a couple of indeterminable pieces of flint in the fireplace with retouch. These may have fallen into the fire during retooling, as mastic resins could have been softened over the fire to detach the cutting edge from a handle. These pieces cannot be analyzed by microwear analysis. The presence of a small door dump and traffic in this area suggest where the open-

ing of the hut would have been. If Middagskarheia 1 was a site for killing time while waiting for prey it remains a mystery that no lithic material seems to have been struck on this site. The lithic *chaîne opératoire* pertaining to Middagskarheia would have been carried out on another site with the purpose of meeting the needs on this site. The hut structure itself is solid and indicates a social organization encouraging repetitive use in a defined resource area. The small inventory from a large number of different flint materials may represent a few recurring visits for the same purpose, for example checking fish or bird traps.

We have suggested that Åsgarden site 1 hut 2 is most likely not the place where this group had a more stable residence, but Åsgarden comprises approximately 20 huts, and there could easily have been other huts on Åsgarden where the people from Middagskarheia dwelled more regularly. However, the distance to Åsgarden is 12 km (app 6.9 nmi) across exposed waters. In a vessel from the Mesolithic this would presumably have taken a full day. Meanwhile, the distance to Hestvika, which has a couple of large sites, is less than 1.5 nmi across more sheltered waters. Thus, Hestvika may also have been the site of more stable settlement. Our suggestions do not necessarily question the tripartite (or probably even more) settlement system suggested by Hein. Rather, a site like Middagskarheia implies that we should have a focus on thorough analysis of the smaller sites that can serve to disclose the versatile livelihood of Mesolithic hunter-gatherer-fishers.

Conclusion

The Middle Mesolithic Middagskarheia 1 site excavated by Hein in 1987 was at the time of specialized occupation located on the northernmost and largest of a group of three skerries in a strait between the two occupied islands of Vega and Kjul. It consists of a semicircular hut ground with a sunken floor located amongst low knolls. 110 flint artifacts were found on the hut floor, of which 44 were burnt by a hearth. Very little other material was present.

The radiocarbon dates for Middagskarheia are contemporary with the peak of prepared-platform pressure blade technology (eastern blade technology) in central and western Scandinavia. The material does not demonstrate conical core pressure blade technology, but the technological analysis supports the view that the material was produced by a distinct technology following a Middle Mesolithic schéma opératoire.

The analysis showed that these artifacts and blanks, mainly consisting of snapped blades, were produced elsewhere and brought into the site as readymade tools. It is likely that it was a toolkit for planned repairs to necessary gear and/or foraging. The use-wear analysis showed that these artifacts had a variety of functions such as scraping, cutting, whittling and grooving, primarily on a silica-rich material such as wood and/or withy, while hide and bone/antler work was also performed. This opens for a wider scope of potential activities related to gathering or for example fishing/trapping, in other words foraging rather than hunting.

The short sequences of refitted artifacts from four raw material groups and the MANA examination of the assemblage indicates designated work areas. The character and the spatial organization of the material does not, however, support an interpretation as gendered toolkits and a strict differentiation of activities suggesting a family unit as seen in some contemporary contexts such as in Denmark (Grøn 2011, 2018). The hut would be more suited to a small task group of no more than three or four hunter-gatherer-fishers on a foraging trip working on organic materials while simultaneously renewing the edges of composite tools. The solid hut implies plans for recurring visits and a need for shelter during the activities undertaken on the skerry. Whether limited revisits took place cannot be firmly established.

Hein's lifelong effort to investigate Mesolithic settlement systems has led to a very important understanding of how archipelagoes provide unique living conditions for mobile marine hunters in both the northern and southern hemispheres, and how closely dependent settlement systems have been to landscape and resource qualities. The work of Hein and his apprentices (Breivik and Fretheim) constitutes a lasting knowledge base and a gateway to beginning to understand the Mesolithic way of life in Norway and beyond. Both lithic *chaîne opératoire* and biomolecular analyses support the transfer of knowledge of new technologies in culturally dynamic situations and the gradual establishment of networks between groups in different landscape types, while life in general became increasingly less mobile and more settled throughout the period. These are important aspects for future Stone Age studies. To this end we will need to re-evaluate our approaches to surveying and excavating, as well as which paths to follow regarding a wide range of analytical methodologies in the field and in later research. The present study is an example of the potential of microwear analysis in the framework of a *chaîne opératoire* approach. Hein made

a choice to meticulously document Middagskarheia 1 in 1987, and although he did not fully excavate the site, the documentation and reflections he set out in several articles are of vital importance to a study like the present one.

See Supplementary Tables and Figures in last chapter of this book. High resolution figures published on https://www.ntnu.no/museum/vitark

Suppl. Figure 1. Hypothesis based on initial study of the lithic assemblage.

Suppl. Figure 2. The results of the entire assemblage subjected to use-wear analysis.

Suppl. Table I. Entire assemblage from Middagskarheia 1. Find number, provenance, nomenclature from catalogue, CO = *chaîne opératoire* stage, MAN = minimum analytical nodule / raw material, functional type and contact material, refits and technology type.

Suppl. Table II. Extended attribute analysis of blades and blade fragments with intact bulbar end.

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Supplementary Tables and Figures

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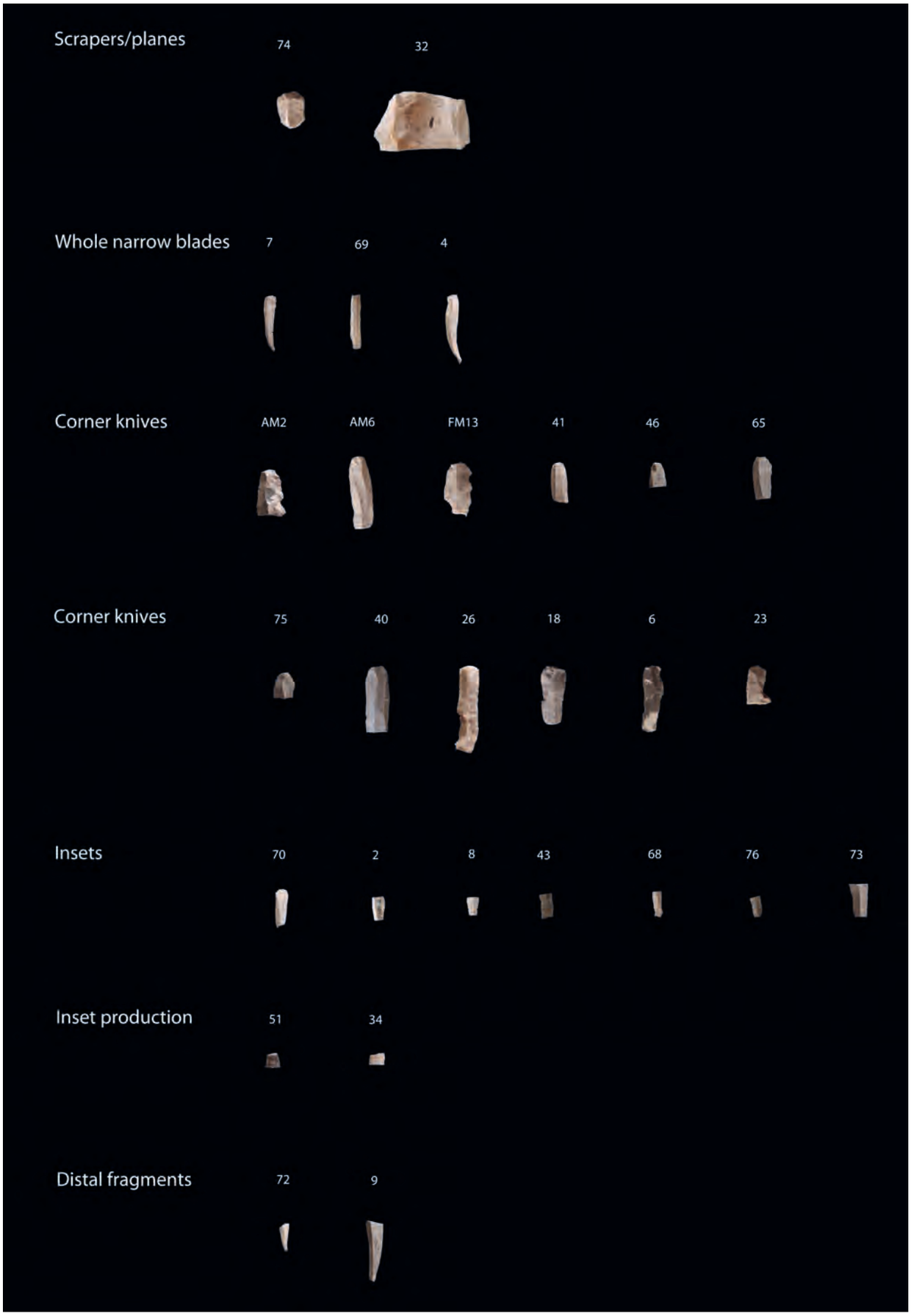
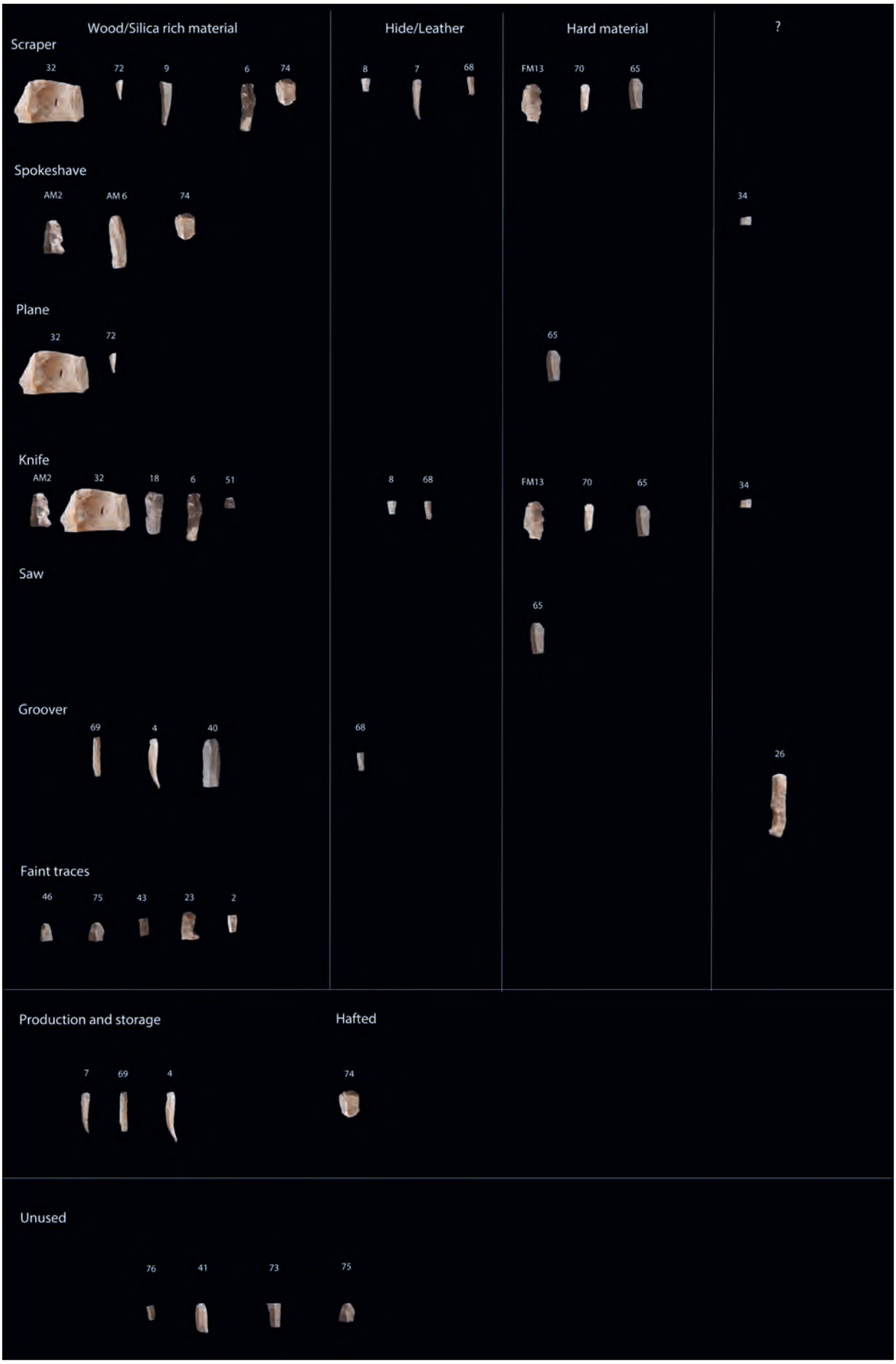


Supplementary Figure 1. Hypothesis based on initial study of the lithic assemblage. *



Supplementary Figure 2. The results of the entire use wear analysed assemblage.*