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Reviewed Article:

Scraping Seal Skins with Mineral Additives

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Neolithic scrapers from the Vlaardingen Culture (3400-2500 BC) display a variety of hide-working traces, amongst which traces interpreted as being the result of contact with dry hide. It has been suggested that, potentially, some of these implements were used to scrape fatty hides with mineral additives. Therefore, a series of experiments were set up to better understand the use-wear traces resulting from scraping fatty hides with mineral additives.

For these experiments two skins of common seals (*Phoca vitulina*) were scraped using either sand or clay. The use-wear traces on the scrapers were well developed and easy to distinguish. The 'dry hide' scrapers from the Vlaardingen Culture site Hekelingen III were reanalysed. It was suggested that the use-wear traces on these scrapers might be related to the scraping of fatty hides with additives. We concluded that the wear-traces on these scrapers did not match the experimentally observed traces. They most closely resemble traces resulting from the softening of dry hides. In one instance the traces resembled those of previously conducted dehairing experiments. Although the traces from these experiments could not be matched to those found on Vlaardingen Culture scrapers, the traces resembled those found on a retouched blade from the Middle Neolithic site of Schipluiden (3600-3400 BC). We concluded that the traces resulting from scraping fatty hides with mineral additives are distinctive enough to be recognised archaeologically. Nevertheless, the experiments should be extended to terrestrial animals with fatty hides, to fully understand the variation in traces resulting from the scraping of fatty hides with mineral additives.



The experiments aimed to allow us to better distinguish between different hide-working processes at archaeological sites.

An Experimental Study to Better Understand the Variation in Use-wear Traces Observed on Flint Scrapers from the Late Neolithic Vlaardingen Culture (3400-2500 BC)

Introduction

Use-wear traces on flint scrapers from the Late Neolithic and the Bronze Age in the Netherlands have frequently been interpreted as being the result of scraping hides with mineral additives (Garcia-Diaz, 2017, p. 72; Houkes *et al.*, 2017, p. 187; Van Gijn, 1990, p. 140; Van Gijn and Niekus, 2001, p. 311). It is thought that minerals were added to absorb the fat during the scraping of hides from fur bearing animals. These animals have a fatty layer underneath their skins, and this layer is difficult to clean without the use of these additives (Van Gijn, 2010, p. 79).

These traces are occasionally found but are still poorly understood. It has therefore been suggested that more experiments are needed to better understand these traces (Van Gijn and Niekus, 2001, p. 311). This paper presents a series of experiments where we scraped sealskins, using sand or clay to remove the fat. It will also present the analysis of the scrapers from Hekelingen III. It was suggested that some of these might have been used to scrape fatty hides with mineral additives. This study is part of the research project *Putting Life into Late Neolithic Houses: Investigating domestic craft and subsistence activities through experiments and material analysis*. The project aims to provide a detailed analysis of domestic life in the Late Neolithic Vlaardingen Culture (3400-2500 BC). In the project scientists collaborate closely with volunteers of the archaeological open-air museum of Masamuda in Vlaardingen (The Netherlands). The experiments presented here were carried out by the volunteers of Masamuda during a workshop.

Vlaardingen Culture

This study aimed to gain insight into the variability in hide-working traces on flint scrapers from the Neolithic Vlaardingen Culture (3400-2500 BC). However, the results are also applicable to the study of other periods and regions. Sites from the Vlaardingen Culture are mainly located in the wetland areas of the western Netherlands. These sites are characterised by a wide diversity in terms of subsistence strategies and their location within the landscape. It is thought that the sites in the coastal dune area are generally permanently inhabited while those on the levees consist of temporary camps (Raemaekers, 2003, p. 744).

The site Hekelingen III, located in the western Netherlands (See Figure 1), is thought to represent such a temporary camp, notably focussed on fishing and hunting (Raemaekers, 2003, p. 744; Van Gijn, 1990). Ethnographically, it is documented that in temporary hunting camps hides are only cleaned and dried to be processed elsewhere (Binford, 1978, p. 494). For Hekelingen III it was suggested that the 'dry hide' scrapers could have been used to scrape fresh hides of fur bearing animals with additives (Van Gijn, 1990, p. 129). If this is indeed the case the assemblage only yields traces related to the initial stages of hide-working (cleaning of the fresh hides). It could be argued that the dried hides are then subsequently taken elsewhere (to a permanent settlement) for further processing, which would involve the softening of the hides (Van Gijn, 1990, p. 129). The presence of specific types of hide-working traces, and therefore hide-working processes, can thus provide an indication of the duration of occupation on settlements. On temporary hunting camps we would expect only traces of scraping fresh hides, or if fur bearing animals were hunted (as in Hekelingen III), we could expect traces of scraping hides with additives (Prummel, 1987, pp. 200-2; Van Gijn, 1990, p. 129).

Previous Studies

Experiments with scraping hides with additives are scarce. The published experiments relate to experiments where hides were scraped with ochre to dye the hides. Here isolated spots of well-developed smooth and matt polish, or a wide band of highly linked bright and matt polish, occasionally with striations, were observed on the working edges of the tools (Rots, 2002, p. 69; Van Gijn, 1990, p. 29). In other studies, the archaeological traces are characterised as a band of rough polish with small spots of bright reflective polish (Houkes *et al.*, 2017, pp. 187-9). Recent experiments, however, indicate that these isolated spots of polish also occur during dehairing of hides (Petrogiannaki, 2022, p. 49).

To better understand these traces, a new set of experiments was set up. The aim was to use mineral additives which would be widely available. We chose to use sand and clay as additives. Sealskins were chosen because sealskins are notoriously fatty, therefore we expected that additives would help well with absorbing the fat during scraping. However,

these experiments should be extended to terrestrial fur bearing animals such as fox or marten.

Methods and Materials

The skins were donated to the project by *Zeehonden Centrum Pieterburen* and they belonged to two young common seals (*Phoca vitulina*), who died of natural causes. Common seals have not been found on Vlaardingen Culture settlements, but grey seals (*Halichoerus grypus*) are known from multiple sites, including Hekelingen III (Brinkkemper *et al.*, 2010, p. 34; Prummel, 1987, p. 200). Both species have a similar fatty layer under their skin, and it is assumed that the exact species in this case will not affect the development of the wear traces. The experiments were conducted by volunteers from the archaeological open-air museum Masamuda (See Figure 2). The volunteers are not experienced hide-workers; for most, this was the first time they had conducted hide-working experiments. The sand used in the experiments was obtained from river deposits near Heveadorp (in the eastern Netherlands). The clay was locally sourced in Vlaardingen from prehistoric river clay deposits. The sand and clay were not sieved or otherwise processed before use.

The seals were already skinned with metal tools, but before the actual scraping could take place the thick layer of blubber (fat) under the skin had to be removed first (See Figure 3). For these experiments we used five unmodified flakes, made of fine-grained Scandinavian flint. After the blubber was removed incisions were made along the edge of the skins with another flint flake. Then, the skins were stretched on a wooden frame, where they were tied with a rope. The frames were laid on the ground and sprinkled with either sand or clay. Next the skins were scraped, and more additives were applied when needed (See Figure 4). The skins were scraped while they were still fresh. For these experiments four scrapers were used (See Figure 5). The scrapers were inserted in wooden hafts with leather bindings.

For all tools the duration of use was noted as well as the activity in which they were used. After use the experiments were cleaned using detergent, water, and alcohol. The archaeological tools were cleaned in a similar manner. If grease was not properly removed after initial cleaning the experimental tools were soaked in a 10% HCL solution for approximately 20 minutes (the time was varied depending on the need). They were then rinsed with water and subsequently soaked in a 10% KOH solution to neutralize the acid. After this the tools were rinsed and dried. The use-wear traces on the experimental and archaeological scrapers were studied and photographed using a Leica DM6000 metallographic microscope. The experimental tools, hafts and frames were made by Diederik Pomstra (an experienced flint knapper and prehistoric craftsman, see table 1 for a list of the experimental tools).

EXP number	Tooltype	Tool use	Length (mm)	Width (mm)	Thickness (mm)
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2252	Flake	Blubber cutting	54	47	17
2253	Scraper	Scraping hide with sand	38	42	8
2254	Scraper	Scraping hide with clay	34	35	9
2256	Flake	Blubber cutting	59	42	14
2257	Flake	Blubber cutting	57	41	14
2258	Flake	Blubber cutting	46	39	12
2259	Scraper	Scraping hide with sand	44	40	9
2261	Scraper	Cutting holes in skin	56	37	9
2262	Scraper	Scraping hide with clay	43	28	7

TABLE 1. EXPERIMENTAL TOOLS, TYPOLOGY, USE, AND DIMENSIONS.

Use-wear Traces on the Unmodified Flakes

Despite the long duration of use (more than two hours per experiment), the use-wear traces resulting from removing the blubber, by cutting with the aforementioned flakes, were limited. Blubber is a very soft material, therefore creating little friction between the tool and the contact material. The use-wear traces on the experimental flakes can be characterised as a vague band of rough and greasy polish along the edge (See Figure 6 and Table 2).

Occasionally, some diagonal directionality was noted which hinted at a cutting motion. In general, the polish looked like the polish that is attributed to cutting soft animal materials. This hide-working stage does not create characteristic use-wear traces. Archaeologically, the traces would either be classified as meat cutting polish, fresh hide cutting polish, or the traces would simply be missed because this very weakly developed polish can easily be overlooked or be confused with post depositional surface modifications.

Microscopic handling traces were not found on the unmodified flakes. However, it was noted that, due to the interaction with the grease, the chalk cortex on the flakes largely dissolved during the cutting of the blubber (See Figure 6). Archaeologically, this will be difficult to take into account because many processes can be responsible for the dissolution or weathering of chalk cortex on flint artefacts.

Experiment number	Duration of use	Polish	Directionality
2252	152 minutes	Band of rough and greasy polish	No clear directionality
2256	142 minutes	Thin band of rough & greasy polish gradually fading, meat/fresh hide like	Diagonal directionality
2257	142 minutes	Thin band of rough & greasy polish gradually fading, meat/fresh hide like	Diagonal directionality

2258	152 minutes	Weakly developed rough & greasy	No clear directionality
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TABLE 2. BLUBBER CUTTING EXPERIMENTAL FLAKES, DURATION, POLISH, AND DIRECTIONALITY DESCRIPTIONS.

Another flake was used to cut holes in the hides, after the blubber was removed (EXP 2261). The experimental tool was used only for twenty minutes. Only a weakly developed band of rough and greasy polish could be observed. It is unlikely that such traces would be identified correctly on archaeological artefacts. Presumably such tools would be classified as ‘possibly used’ tools or meat cutting tools.

Use-wear traces on the scrapers

Two scrapers were used on a seal skin with sand as an additive, the other two experiments were used to scrape the skins with clay (See Table 3). All four scrapers displayed a wide zone with macroscopically visible gloss along the edge. This macroscopic gloss was previously also identified on an experiment by Van Gijn in which a fresh deerskin was scraped with ochre (Van Gijn, 1994, pp. 181-183).

The edges of all scrapers were heavily rounded (See Figure 7). The polish could be characterised as either a smooth and matt or a rough and matt highly linked band of polish, often as a combination of both, where the rough and matt (more hide-like polish) was observed directly on the edge (See Table 3 and Figure 7C). Experiment 2253 also displayed zones with clear perpendicular striations (See Figure 7B).

Experiment number	Duration of use	Additives	Polish	Directionality
2253	58 minutes	Sand	Spread of smooth & matt polish with a more rough & matt polish along the edge combined with heavy rounding. Also with parallel striations.	Transverse directionality
2259	58 minutes	Sand	Spread of rough & matt polish gradually fading. Heavy edge rounding.	Transverse directionality
2254	48 minutes	Clay	Spread of smooth & matt polish. More rough & matt near the edge. Heavy edge rounding.	Transverse directionality
2262	48 minutes	Clay	Spread of smooth & matt polish with heavy edge rounding. Polish more rough & matt and cratered near the edge.	Transverse directionality

TABLE 3. RESULTS OF THE EXPERIMENTS WITH SCRAPING HIDES WITH ADDITIVES.

A clear distinction between the scrapers used to scrape hide with clay and those used to scrape hide with sand could not be made. Both are characterised as a highly linked band of

smooth and matt and/or a highly linked band of rough and matt polish with heavy edge rounding, transverse directionality and occasionally by the presence of striations. It seems that the rougher polish, which is mostly observed directly on the edge, is caused by direct contact with the hide. The smoother polish is likely caused by contact with the additives. As a group these traces can be clearly distinguished from other hide-working processes such as fresh hide scraping, softening of hides, and dehairing. The extreme rounding in combination with a highly linked, extremely invasive, band of polish which is also visible macroscopically is not observed on other types of hide-working experiments (Keeley and Newcomer, 1977, pp. 39-42; Petrogiannaki, 2022, pp. 48-50; Van Gijn, 1990, pp. 28-30).

Scrapers from Hekelingen III

The scrapers from Hekelingen III were originally studied by Van Gijn (1990). The scrapers which were interpreted as 'dry hide' scrapers were analysed again (1990, p. 140). For the other scrapers, the results of the original study by Van Gijn (1990) will be included here. In total, 98 scrapers and three scraper/borer combination tools were analysed. Of these 52 scrapers and all scraper/borer combination tools yielded use-wear traces (See Table 4). The borers were used to drill shell, bone and wood. Interestingly, seven scrapes also yielded used zones related to cutting, sawing or carving bone. These were not typologically classified as combination tools, but they were clearly used as such. The majority (N=34) of used zones were related to transverse motions, as expected.

	Scraping	Shaving	Cutting / sawing	Carving	Drilling	Indet	Total
Animal medium hard material	-	-	-	-	-	1	1
Animal soft material	1	-	-	-	-	-	1
Bone	3	-	5	2	1	-	11
Bone or antler	1	-	-	-	-	-	1
Dehairing	1	-	-	-	-	-	1
Dry hide	12	-	-	-	-	-	12
Fresh hide	3	-	-	-	-	-	3
Hide indet	7	-	-	-	-	2	9
Shell	-	-	-	-	1	-	1
Soft material	-	-	-	-	1	2	3
Wood	2	1	-	-	-	-	3
Indet	3	-	-	-	-	5	8
Total	33	1	5	2	3	10	54

TABLE 4. RESULTS OF THE USE-WEAR ANALYSIS ON THE SCRAPERS AND SCRAPER/BORERS FROM HEKELINGEN III, BASED ON VAN GIJN AND THE RE-ANALYSIS OF THE SCRAPERS ORIGINALLY CLASSIFIED AS DRY HIDE SCRAPERS, WHICH WERE THOUGHT TO BE USED FOR SCRAPING FATTY HIDES WITH ADDITIVES (AFTER: VAN GIJN, 1990).

The dry hide scraping traces on the scrapers from Hekelingen III did not resemble the traces from the experiments with seal skins. They lacked the smooth and matt polish spots as they were observed on the published ochre scraping experiments (Rots, 2002, p. 69; Van Gijn, 1990, p. 29). Most of these scrapers were thus interpreted as 'dry hide' scrapers (See Figure 8A and Table 4). The traces most closely resemble those from scraping dry or drying hides (Van Gijn, 1990, p. 29: see figure 13c).

Interestingly, in one instance small, isolated spots of polish could be observed (See Figure 8B). These traces were consistent with those observed on experimental scrapers used for dehairing dry hides (Petrogiannaki, 2022, pp. 48-50). This scraper was thus interpreted as having been used to dehair animal hides (See Figure 8b and 9).

Furthermore, it should be noted that hafting traces were observed on seven scrapers in the assemblage. In two instances these were related to hafting in a wooden haft. In one case the hafting traces were found on a scraper which was made on a flake made from a recycled flint axe. These hafting traces seemed to be related to the previous use-life of the scraper. They were thus related to the use of the flint axe, which was held in a wooden haft. In five cases the hafting traces were interpreted as traces resulting from hafting in a hard material.

Discussion and conclusion

The experiments aimed to allow us to better distinguish between different hide-working processes at archaeological sites. The use-wear traces on the flint scrapers were well developed after approximately fifty minutes. A macroscopically visible band of gloss developed, which microscopically could be characterised as a highly linked, invasive wide band of smooth and matt, or rough and matt, polish with a clear transverse directionality. These observations were used to reanalyse the 'dry hide' scrapers from the Late Neolithic site Hekelingen III. The aim was to test the suggestion that the dry hide scraping traces might have resulted from scraping fatty hides with additives. It could be concluded that the traces on these scrapers did not resemble those from this activity. They were akin to traces resulting from scraping dry or drying hides. It is likely that these scrapers were used to soften dry hides. In one case the traces were interpreted as traces of dehairing hides. Interestingly, the use-wear traces on a flint tool from the Middle Neolithic site of Schipluiden, located in the western Netherlands, did yield traces which were very similar to those observed on the scrapers used to scrape the seal skins with additives. The polish on this tool was distributed as a highly linked wide band along the edge of the tool (Van Gijn *et al.*, 2006, pp. 156-7). The polish could be characterised as a band of smooth and matt polish along the edge with a clearly visible transverse directionality. On the original use-wear form it is mentioned that the band of polish was visible with the naked eye. The microscopic traces are comparable to those from the sealskin scraping experiments (See Figure 10). This site also yielded bones of fur bearing animals, including bones of common seals (*Phoca vitulina*). It seems plausible that this tool was indeed used to scrape fatty hides with clay or sand.

For the Vlaardingen Culture it can be concluded that these traces have, so far, not been found. Based on these experiments, however, it is likely that they could now be recognised (if they are present) as the traces resulting from this process are distinctive and easy to recognise.

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🔖 **Keywords** [experiment](#)
[stone](#)
[use wear analysis](#)
[skin or leather](#)

🔖 **Country** [the Netherlands](#)

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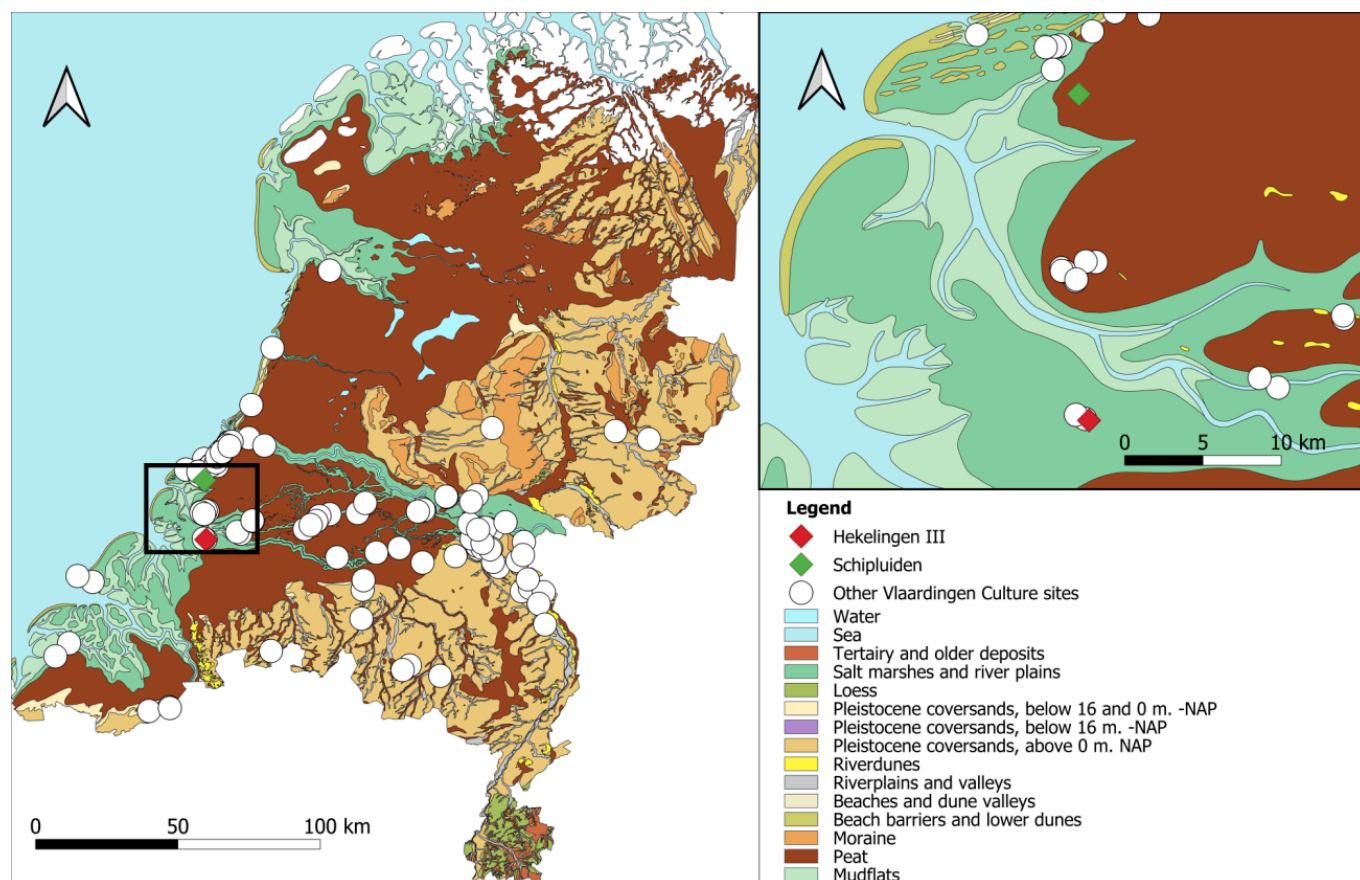


FIG 1. LOCATION OF HEKELINGEN III AND SCHIPLUIDEN PLOTTED ON THE PALAEOGRAPHIC MAP OF THE NETHERLANDS CIRCA 2750 BC WITH OTHER VLAARDINGEN CULTURE SITES ILLUSTRATED IN WHITE. ON THE MAP SCHIPLUIDEN APPEARS TO BE PLOTTED IN THE PEATLANDS, PRESUMABLY BECAUSE THE PALAEOGRAPHIC ENVIRONMENT PLOTTED ON THE MAP IS OF A LATER DATE THAN THE SITE ITSELF (AFTER: VOS ET AL., 2020).



FIG 2. VOLUNTEERS FROM MASAMUDA WITH THE TWO FRAMED SEALSKINS AFTER THE EXPERIMENTS. PHOTO BY LASSE VAN DEN DIKKENBERG



FIG 3. REMOVING THE BLUBBER WITH FLAKES. PHOTO BY LASSE VAN DEN DIKKENBERG



FIG 4. SCRAPING THE SEALSKIN WITH SAND. PHOTO BY LASSE VAN DEN DIKKENBERG



2253



2254



2259



2262



5 cm



FIG 5. FOUR EXPERIMENTAL SCRAPERS USED TO SCRAPE SEAL SKINS WITH SAND (ON THE LEFT) AND CLAY (ON THE RIGHT). IMAGE BY LASSE VAN DEN DIKKENBERG

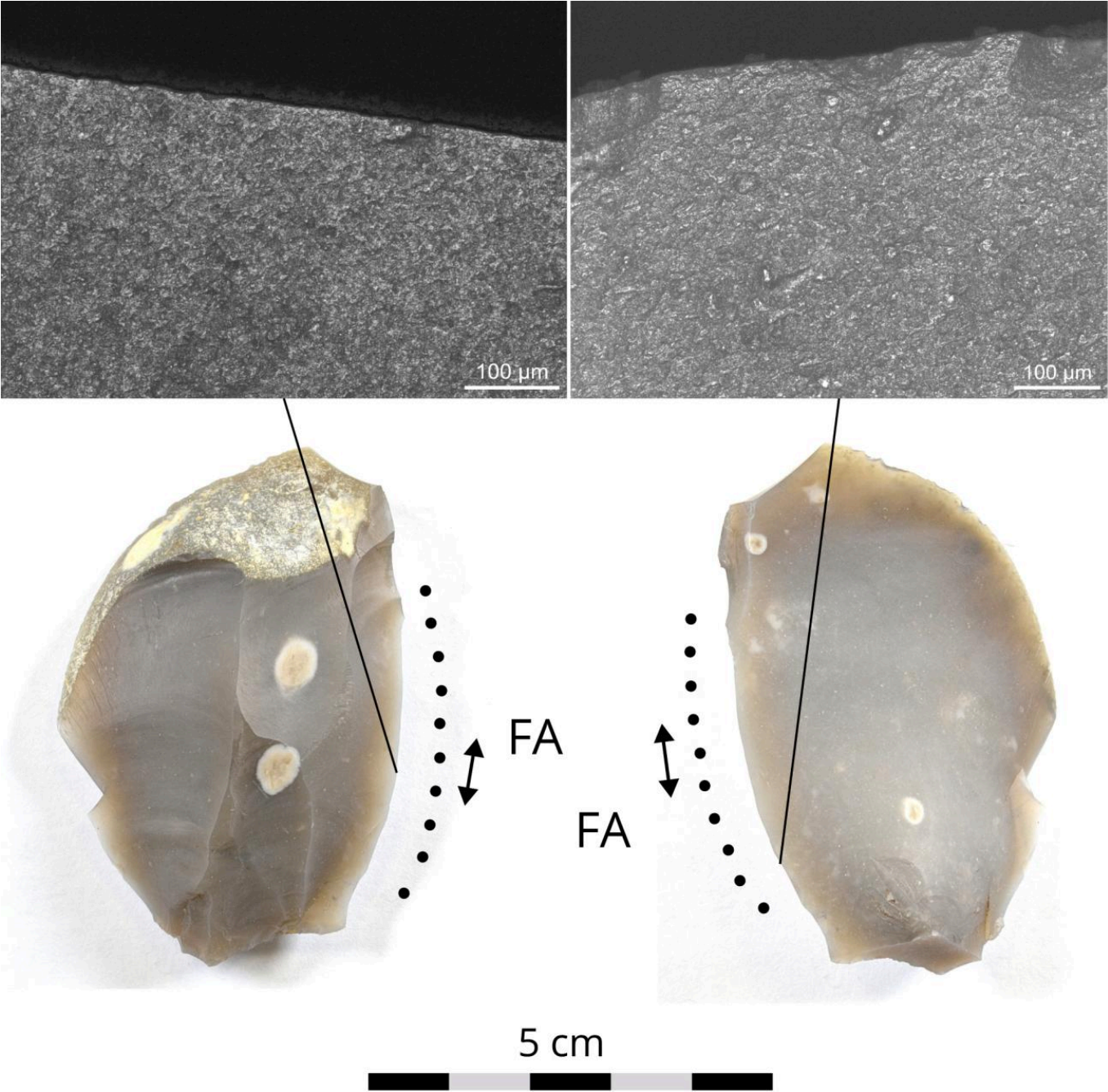


FIG 6. EXPERIMENT 2256 FLAKE USED TO CUT BLUBBER (FAT) WITH MICROSCOPE PHOTOS OF THE USE-WEAR. IMAGE BY LASSE VAN DEN DIKKENBERG

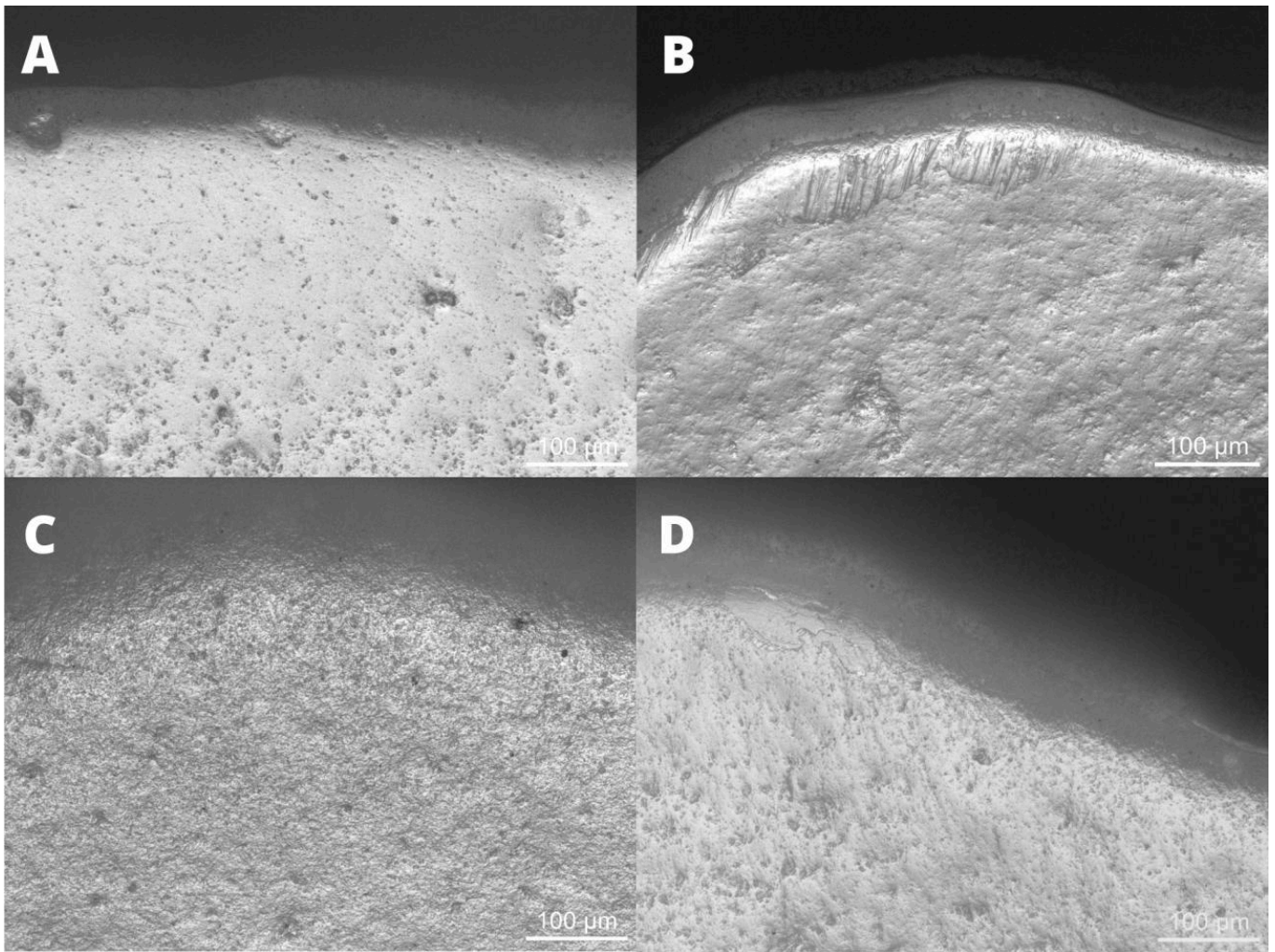


FIG 7. A) HIGHLY LINKED BAND OF SMOOTH AND MATT POLISH, MORE ROUGH AND MATT NEAR THE EDGE OF SCRAPER 2262 USED TO SCRAPE HIDE WITH CLAY; B) HIGHLY LINKED BAND OF SMOOTH AND MATT POLISH WITH PERPENDICULAR STRIATIONS ON SCRAPER 2253 USED TO SCRAPE HIDE WITH SAND; C) HIGHLY LINKED BAND OF ROUGH AND MATT POLISH SCRAPER 2259 USED TO SCRAPE HIDE WITH SAND; D) HIGHLY LINKED BAND OF SMOOTH AND MATT POLISH, MORE ROUGH NEAR THE EDGE WITH CLEAR TRANSVERSE DIRECTIONALITY ON SCRAPER 2254 USED TO SCRAPE HIDE WITH CLAY. IMAGE BY LASSE VAN DEN DIKKENBERG

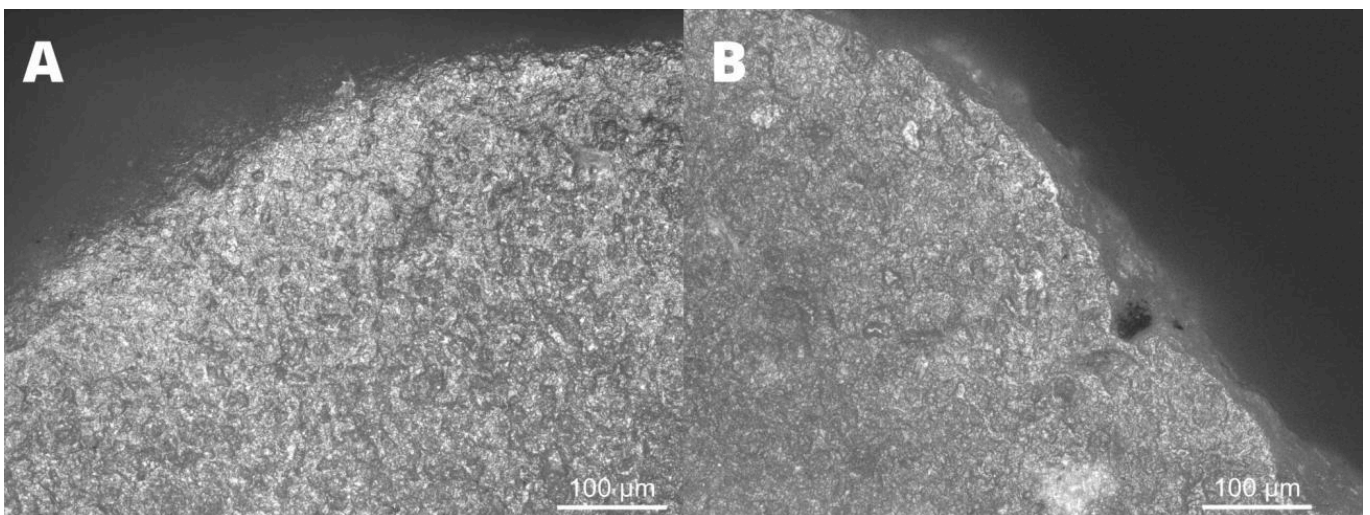


FIG 8. A) HEAVY ROUNDING AND A BAND ROUGH AND MATT POLISH ON SCRAPER 1003 (UNIT A1), RESEMBLING TYPICAL DRY HIDE SCRAPING TRACES; B) BAND OF ROUGH AND MATT POLISH WITH EDGE ROUNDING AND SMALL ISOLATED SPOTS OF SMOOTH AND MATT POLISH INTERPRETED AS TRACES OF DEHAIRING HIDE ON SCRAPER 2036 (UNIT A1G). IMAGE BY LASSE VAN DEN DIKKENBERG



FIG 9. SCRAPER 236 FROM HEKELINGEN III USED FOR DEHAIRING HIDES (COLLECTION RMO LEIDEN). IMAGE BY LASSE VAN DEN DIKKENBERG

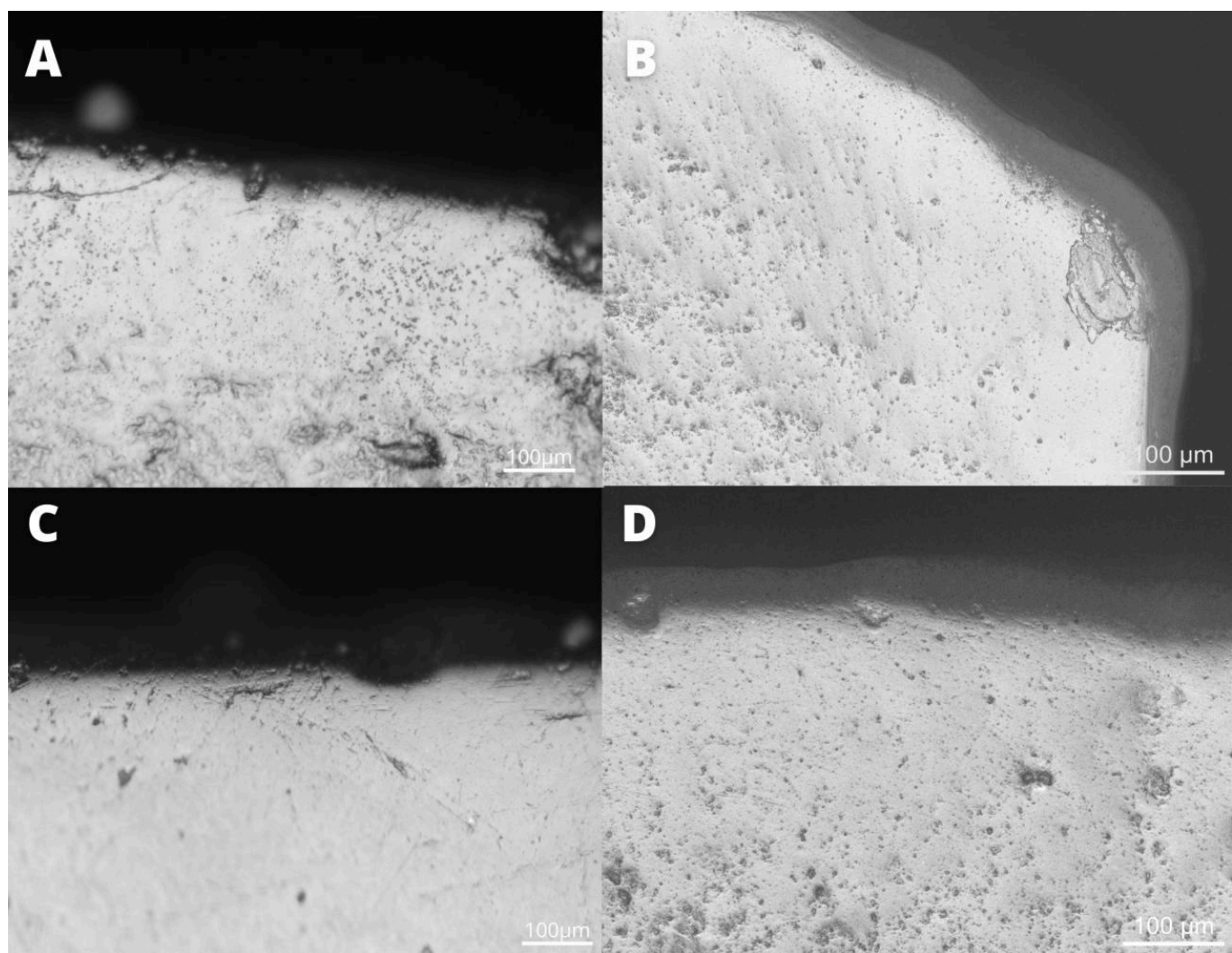


FIG 10. A) BAND OF SMOOTH AND MATT POLISH WITH STRIATIONS ON TOOL 4731 FROM SCHIPLUIDEN; B) SIMILAR TRACES OBSERVED ON EXPERIMENT 2254 USED TO SCRAPE SEALSKIN WITH CLAY; C) BAND OF SMOOTH AND MATT POLISH WITH STRIATIONS ON TOOL 4731 FROM SCHIPLUIDEN; D) SIMILAR TRACES OBSERVED ON EXPERIMENT 2262 USED TO SCRAPE SEALSKIN WITH CLAY. IMAGE BY ANNELOU VAN GIJN AND LASSE VAN DEN DIKKENBERG