Technical Reports of the Australian Museum Online

a peer-reviewed, open-access, serial publication of the
Australian Museum Research Institute
1 William Street, Sydney NSW 2010

ISSN 1835-4211 (online)
https://doi.org/10.3853/issn.1835-4211

Number 29 · 18 December 2019

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by

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Published by the Australian Museum, Sydney, Australia.
The Australian Museum is a statutory authority of,
and principally funded by, the NSW State Government.

Tech. Rep. Aust. Mus. Online
Number 29, pp. 1–100, 2019
https://doi.org/10.3853/j.1835-4211.29.2019.1710

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a peer-reviewed open-access journal
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communicating knowledge derived from our collections
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Microscopic Revelations: The Forms and Multiple Uses of Ground-edged Artefacts of the New South Wales Central Coast, Australia

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Abstract. Results of an exploratory study, that set out to investigate the types of use-wear that could be observed on ground-edged artefacts from the NSW Central Coast of eastern Australia, are presented. The main findings are the multiple activities for which the hatchets were used and the types of materials which they worked. Some of the activities and materials are not noted in historical accounts for southeastern Australia, and suggestions are raised about possible uses of hatchets by women. Among new results are uses for the unusual ground-edged hammer/pounders which are not recorded in the historical literature and which seem to be almost restricted to the NSWCC.

Basic functional data about the actions undertaken and materials worked by the hatchets and hammer/pounders were obtained using low- and high-power microscopy, and by comparing wear traces recorded in previous use-wear studies and on experimental basalt tools.

The use-wear analyses, not only identified activities that created the 'battered' edges, but also revealed a greater multiplicity of uses of the ground-edged artefacts than hitherto identified. Eighteen wear-types document use of ground-edged artefacts for working wood, skin and ochre, abrading and polishing bone, and as hammers and anvils in working stone. Non-woody plant material was processed by both hatchets and hammer/pounders. The activities and processed materials identified by the use-wear analysis, especially those referred to as hammer/pounders, give new insights into understanding the diversity of forms and multiple functions of this class of implement in Australia.

Introduction

Ground-edged stone hatchets (axes) are one of the commonest Aboriginal implements referred to in historical accounts, and are amongst the most numerous large-sized stone artefacts in museum collections (e.g., Dickson, 1976: 34, 1981: 1; McCarthy *et al.,* 1946: 44). It is the only stone implement found in archaeological contexts whose counterpart can be found unambiguously in historical descriptions and illustrations (Attenbrow, 2010:100). Yet, despite their historical and archaeological prominence, there are very few published descriptions of the use-damage sustained by ground-edged artefacts or residues that may survive on their surfaces (e.g., Clarkson *et al.,* 2015, 2017; Dickson, 1976: 42; Fullagar, 2011; Gillieson & Hall, 1982; Hall *et al*.,1989; McCarthy, 1976: 47; McCarthy *et al*., 1946: 44, 59).

During a broader provenancing study of ground-edged artefacts (GEAs) in the Sydney Basin (Attenbrow *et al*., 2017; Grave *et al*., 2012), a group of GEAs in the NSW Central Coast (NSWCC), referred to as 'hammer/pounders' were noted as having an unusual form and restricted distribution. They have a 'battered' ground edge and are found principally in the Mangrove Mountain area of the NSWCC (McCarthy, 1976; McCarthy *et al*., 1946; Thorpe, 1932).

The initial aims of this use-wear study were to identify activities for which eleven hammer/pounders were used and the materials that were processed with them. To provide a

Keywords: Ground-edged artefacts; hatchets/axes; NSW Central Coast; use-wear analysis; eastern Australia.
Corresponding author: Val Attenbrow Val.Attenbrow@austmus.gov.au
Received: 17 November 2017 **Accepted**: 25 September 2018 **Published**: 18 December 2019 (online only)
Publisher: The Australian Museum, Sydney, Australia (a statutory authority of, and principally funded by, the NSW State Government)
Citation: Attenbrow, Val, and Nina Kononenko. 2019. Microscopic revelations: the forms and multiple uses of ground-edged artefacts of the New South Wales Central Coast, Australia. *Technical Reports of the Australian Museum, Online* 29: 1–100. https://doi.org/10.3853/j.1835-4211.29.2019.1710

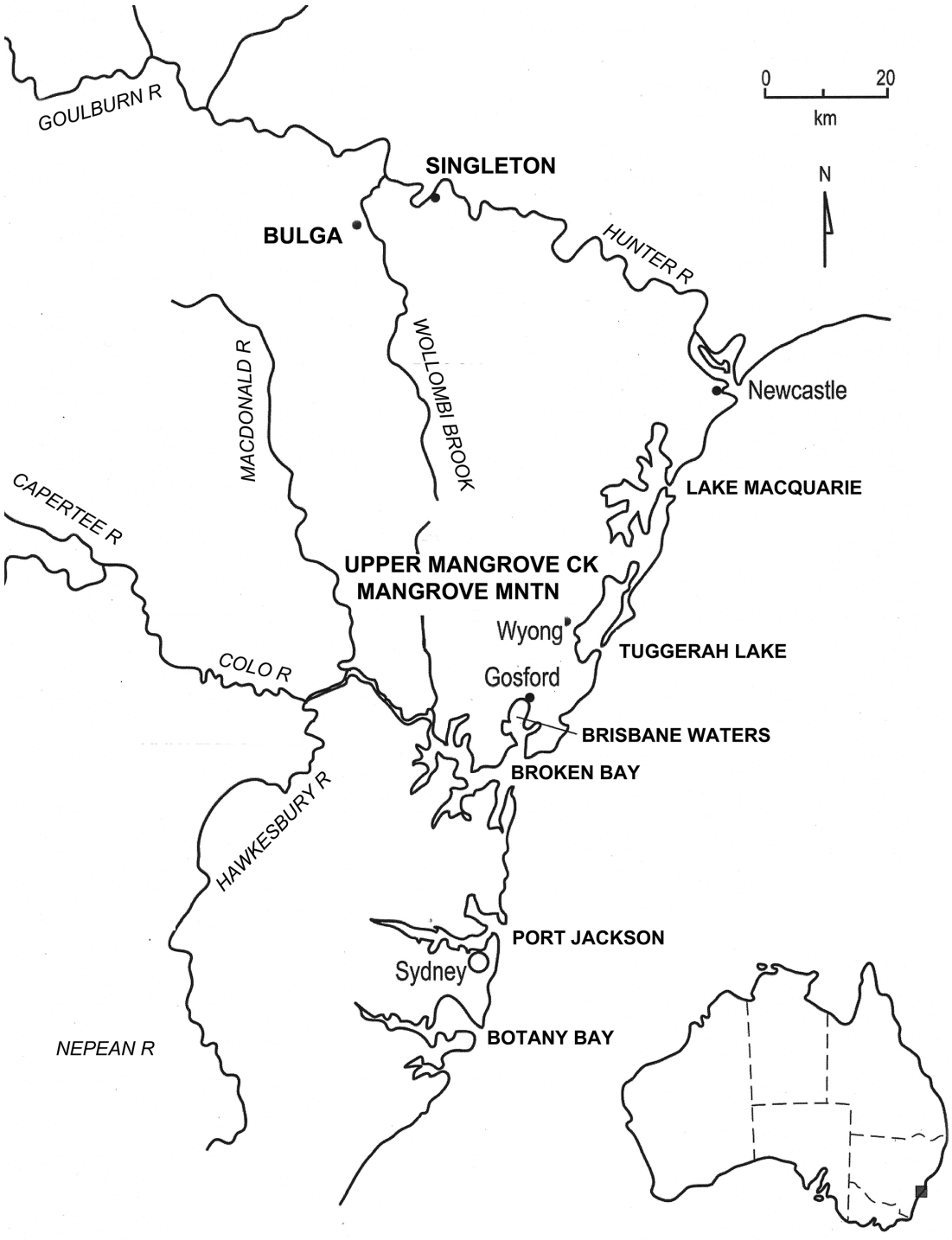

Figure 1. Location of New South Wales (NSW) Central Coast, Sydney Basin, Australia.

comparative context for the hammer/pounders, 40 NSWCC GE hatchets were included in the study. The use-wear analyses, not only identified activities that created the 'battered' edges, but also revealed a greater multiplicity of uses of the ground-edged artefacts than hitherto identified.

Our study expands knowledge about the particular functions of these ground-edged artefacts, including how they were used (e.g., chopping, pounding) and not just what they were used for (e.g., making shields, processing food plants). Our research investigates their functions by conducting an extensive use-wear analysis and by studying the historical descriptions and assumptions of early 20th century collectors and museum curators. Particular attention is paid to the identification and description of their functional attributes.

The category 'ground stone artefact' includes non-cutting implements (e.g., grinding and pounding tools, hammerstones and abraders) as well as cutting tools such as knives, hatchets and adzes (Dubreuil & Savage, 2014: 139). In our study, ground-edged artefacts are considered to be implements intentionally shaped by grinding on suitable bedrock such as sandstone or with a portable abrading tool (Dickson, 1976: 36; Geneste *et al*., 2012). The term 'ground edge' refers to an edge deliberately sharpened by grinding to be used for actions such as cutting and chopping.

In this paper, we use the term 'ground-edged artefact' (GEA) when referring collectively to items that have been called hatchets (axes), 'hammer/pounders' and Bulga knives. The term hatchet is used rather than stone axe following Dickson (1976: 33, 35, 44), who said that in Australia 'a stone axe, is more correctly termed a hatchet since it conforms to the design requirements of a tool made for one-handed use' (see also Dickson, 1981: 212, 216). Many officers who came

Figure 2. Different forms of NSW Central Coast ground-edged artefacts. Hatchets E012712, E025249, E054857; Hammer/pounders E033479, E052619; and Bulga knife E054864c. Australian Museum registration numbers and Project ID numbers. Scale in 1 cm divisions. Photographs of ground-edged artefacts were taken by Nina Kononenko, except E076561, which was taken by Finton Mahoney.

to Port Jackson (Sydney Harbour) with the First Fleet in 1788 used the term 'hatchet' for these implements that they saw used in Port Jackson and surrounding country (e.g., Collins, 1975: 487 [1798]; Tench, 1979: 284 [1793: 191]).

The ground-edged artefacts

The 51 artefacts described in this report are held in the Australian Museum Archaeology Collection. They are a sub-set of 121 ground-edged artefacts (GEAs) from the NSW Central Coast (NSWCC) (Fig. 1), which are included in an ARC-funded sourcing project (Attenbrow *et al.* 2017; Grave *et al*. 2012). The artefacts were selected because they have macroscopic evidence of being used for multiple functions, with a variety of materials (several have evidence of having had a wrap-around handle). They also include several GEAs that have an unusual form. McCarthy *et al.* (1946: 59) described them as having the ground edge 'battered to a flat percussion face'. We refer to these GEAs as 'hammer/pounders' and describe their ground edge as 'battered' (Fig. 2, E052619; Tables 1, A1). The term 'hammer/pounder' comes from the nomenclature of early 20th century collectors and museum curators (e.g., Thorpe 1932: 302; Australian Museum (AM) Ethnology Register entries for Nos E011247 in 1902,

E033655 in 1930—see Table A1). These tools appear to have begun life as a hatchet with a sharp ground edge (cf. Thorpe, 1932: 303). The 51 artefacts have a bevelled edge ground on both faces or evidence that they once had a ground edge. Non-ground artefacts that have been referred to as 'hammers' or 'pounders' in the AM Register have not been included; nor have unifacially flaked pebbles with minor grinding at one end: McCarthy's Windang-type (1976: 47). As will become clear the terms 'hatchet' and 'hammer/pounder' are a somewhat simplistic nomenclature for these ground-edged artefacts as most were used for more than one activity and for working more than one type of material.

As typical of Aboriginal ground-edged artefacts, those in this study are ground to the extent of creating only the bevels that form the blade or cutting edge (cf. Dickson, 1976: 36). Most ground-edged artefacts in our study are shaped simply by grinding both faces at one end of a whole cobble or minimally flaked cobble to form a sharp edge; though four (GEAs E033479, E033480, E054858d, E065196q) have two opposing deliberately made ground edges). A lesser number are made from quarried bedrock. For some, where the whole surface is ground and worked (flaked or hammer-dressed) prior to grinding, it is not possible to identify the pre-form.

Some GEAs have their non-ground surfaces extensively shaped by hammer-dressing (a pecking technique) (E012712, E052619, E052620, E054861a, E059798); E059798 has a fully encircling groove made by pecking and subsequent grinding/polishing to accommodate a wrap-around haft**.** Most of the hatchet heads and hammer/pounders have heavy percussive damage on their butt in the form of peck marks or pits on their faces (the latter often referred to as anvil pits) (Dickson 1981: 215; McCarthy *et al*., 1946: 59). They are made from a variety of rock types—principally basalts and other fine-grained volcanics, hornfels and quartzites; the basalts include local NSWCC basalts (e.g., Peats Ridge–Popran Creek, Kulnura) as well as rocks from other regions (Table A1; Attenbrow *et al*., 2017).

The hammer/pounders have a relatively restricted geographic distribution, with most being collected in the Mangrove Mountain–Upper Mangrove Creek–Bulga–Singleton area (Fig.1, Table A1) (McCarthy *et al.,* 1946: 59).

Many of the ground-edged artefacts discussed in this paper were found in rock-shelters (on the surface or dug out of the deposits at shallow depths), but others were found during farming and ploughing paddocks. Thorpe (1932: 302–304) observed that those in rock-shelters were found close to the back wall as if cached (an observation also made by one of the authors (VA) in Upper Mangrove Creek).

Recorded functions of southeast Australian ground-edged artefacts

Historical pre-1900 descriptions of Aboriginal tools indicate that hatchets had multiple functions (Table A2) (e.g., Attenbrow, 2010: 90–91; Brough Smyth, 1878, vol. 1: 379; Collins, 1975 [1798]: 487; Dickson, 1972: 207; Hunter, 1968 [1793]: 61]; McCarthy, 1976: 47; McCarthy *et al*., 1946: 44; Roth, 1904: 18; Thorpe, 1931, 1932; Tench, 1979: 284 [1793: 191]; Warner, 1958: 490 in Kamminga, 1982: 78. Brough Smyth (1878: vol. 1: 379) said: 'Its uses are so many and so various that one cannot enumerate them. It is sufficient to say that a native could scarcely maintain existence in Australia if deprived of this implement'. McCarthy (1976: 47) listed knapping and breaking up hard nuts and seeds as activities that would account for the evidence of heavy percussive use on the butt and laterals, concluding that 'the implement is thus really a hammer-axe'. Dickson (1976: 37; see also Roth, 1904: 18) said that in the case of ground-edged artefacts found without a wooden handle or evidence that they were hafted (e.g., without a partial or encircling groove or remnants of adhesive materials) they may have been 'a hatchet head, a hand-held chopper, a wedge, a chisel or adze or some combination of these'.

In pre-1900 historical accounts of south-east Australia, the recorded functions of hatchets relate principally to woodworking, but also include hunting and butchering animals, processing animal skins, making stone tools and occasionally used as a weapon (Table A2). However, we found no references to the use of ground-edged artefacts in processing non-woody plant materials. (Given the restricted distribution of the 'hammer/pounders' and Bulga knives, the authors cited were probably referring to 'hatchets' rather than other forms of ground-edged artefacts.)

There are, however, references to the use of stone in processing plant foods/materials. For example, rhizomes of ferns and roots of other plants were prepared by beating or pounding between two stones (e.g., Bradley, 1969 [1786–92]: 134, 117; Hunter, 1968 [1793]: 80; Threlkeld, 1825–26 in Gunson, 1974: 55). These roots and rhizomes probably came from plants such as *Blechnum indicum* (Bungwall), or *B. cartilagineum* (Gristle Fern) as well as *Doryanthus excelsa* (Gymea Lily) (Backhouse & Walker, 1836 in Gunson, 1974: 124). The bark of trees was used to make fishing lines and twine by being beaten between two stones for some time before being spun and twisted into two strands (e.g., Attenbrow, 2010: table 10.1; Hunter, 1968 [1793]: 63; Tench, 1979: 284 [1793: 191]); this probably included the bark of black kurrajong trees *(Brachychiton populneus)* (see also Roth, 1901: 7–16 for northern Queensland). In addition, the nuts (seeds) of *Macrozamia* sp. (Burrawang) required special processing that included pounding to remove the toxins from the kernels after they were removed from their shells (e.g., Hunter, 1968 [1793]: 479; Threlkeld, 1825–26 in Gunson, 1974: 55; see also Asmussen, 2011).

So, although there are many reports of non-woody plant materials being processed by beating or pounding between two rocks, we found no historical descriptions of the type of stone tools used. Since the use (or even the existence) of the ground-edged hammer/pounders and the use of hatchet heads as anvils in processing plant foods and non-woody plant materials are not specifically reported in the early historical literature, the implements used may or may not have been ground-edged hatchets.

The earliest references we have found to ground-edged hatchets being used for plant processing in eastern NSW are entries in the Australian Museum Ethnology Register dating to 1912. They describe several hatchets collected by R. H. Mathews as 'stone axes with husking holes' (AM Reg. Nos E020467–E020470; Table A1). Spencer (1915: 80, 83, 1922: 85, 88) also described 'stone axes' in the National Museum of Victoria as having 'husking holes'. A little later in 1928 Thorpe & Stanley (1928: 211) wrote that 'depressions' seen about the centre of the stone on each side '… are referred to as "thumb and finger holes", but were more probably used for nut-husking, the axe head serving as an anvil' (see also McCarthy, 1976: 47; McCarthy *et al*., 1946: 44, 59).

In 1932, W. W. Thorpe described a group of ground-edged artefacts from the Mangrove Mountain area as being 'originally axes, but being used for pounding, they could no longer serve for cutting' (Thorpe, 1932: 302–305). He called these tools 'hammers or pounders'. He considered the use of the artefacts was still a matter for conjecture, but he annotated several entries for ground-edged 'axes' in the AM Ethnographic Register: '?used for crushing Zamia nuts

Figure 3. *Macrozamia communis* with cone breaking up; seeds with red outer fleshy layer (sarcotesa) intact; at right are pale brown hard shells (sclerotesta) which have kernels inside. Photograph Val Attenbrow.

preparatory to macerating kernels' (E025660–E025666; E033473, E033479–E033481; see similar E011247; Table A2). McCarthy *et al.* (1946: 59) thought the restricted distribution of the large number of hatchets on which 'the blade is battered to a flat percussion face' indicated they had 'a special [but unstated] use'. [Note: the question mark is in the register; Zamia is an earlier name for *Macrozamia* sp. (Fig. 3)].

Mathews, Spencer, Thorpe and McCarthy *et al.* do not provide any source/s for their statements about the functions of ground-edged artefacts relating to plant processing. However, descriptions of Queensland pounders and hammers with a wrap-around handle, in which the head was an unworked cobble (Roth 1901: 23; Thomson, 1936: 71–72) may have provided an analogy. Or, in the case of Mathews and Spencer they may have seen or been told about this use during their visits to Aboriginal communities.

In southeast Queensland stone tools known as 'east coast choppers' (aka bevelled pounders or Bungwall bashers) have a similar though much larger form than the NSWCC/Hunter Valley Bulga knives. They are argued to have been used to process the rhizomes of *Blechnum indicum,* but whether their ground edge was intentionally formed or whether it formed through use is debated (Gillieson & Hall, 1982; Kamminga 1981, 1982: 54). Gillieson & Hall, (1982) carried out ad hoc processing experiments but they were inconclusive as sufficient quantity of the rhizome was not available to them. Subsequent residue analysis, however, revealed the presence of starch grains of *Blechnum indicum* on both experimental tools and artefacts (Hall *et al*., 1989: 153–154).

Analytical methods and material

Igneous rocks such as basalt and other fine-grained volcanics, and metamorphic rocks such as hornfels, were generally selected for the manufacture of ground-edged artefacts in the Sydney Basin (Attenbrow *et al.,* 2017). These are tough durable rocks with a fine-grained texture. The constituent small grains of nearly equal dimensions fit closely together with narrow gaps or interstices between the grains. There are often larger crystals scattered through the fine-grained matrix resulting in asperity, or roughness, of the surface. A combination of grains, crystals and minerals and their elevational differences is reflected in the surface topography.

Some wear traces on the upper and lower microtopography can be observed macroscopically and under magnification (Adams *et al.,* 2009). Raised crystals of minerals and grains on the surface topography are damaged first when two surfaces come into contact (Adams, 1993: 61, 2014: 130; Dubreuil & Savage, 2014: 145; Hayes, 2015: 15). Surface alteration in the form of crushed grains, levelled areas, striations and sheen is often visible without magnification and may be an indication that the tool's surfaces were used. In our study, we adopt the term 'sheen' rather than 'polish' as being more appropriate for describing worn surface reflectivity on ground tools made of fine-grained raw materials. The term 'highly reflective gloss' is reserved to describe hafting wear which has a different distribution and appearance from the sheen.

Table 1. Summary of multiple uses of ground-edged artefacts from the New South Wales Central Coast.

AM registration number	GEA form	Woodworking: chopping wood, using ground-edge as hatchet	Other wear types	Location of other wear types	Other activities—using GEA as:	No. of wear-types	No. of identified worked materials	Reference to figures in text	Reference to figures in Appendix
E005955	Ground-edged hatchet head	X	Polishing bone	Both faces, butt and one lateral	Polisher	2	2		A22
E011247	Ground-edged hammer/pounder		Polishing stone	Edge and butt	Polisher	1	1	27	
E012712	Ground-edged hatchet head	X	Polishing bone	Butt	Polisher	2	2	2	A23
E017183	Ground-edged hatchet head		Wedging/splitting wood	Edge and butt	Wedge	1	1	6, 31	
E020467	Ground-edged hatchet head	X	(a) Cracking nuts and (b) pounding kernels	(a) Both faces, (b) butt	(a) Anvil, (b) pounder	3	3	18	
E020469	Ground-edged hatchet head	X	Knapping stone	(a) Butt, (b) both faces	(a) Hammerstone, (b) anvils	3	2	25	
E020470	Ground-edged hatchet head	X	(a) Cracking nuts and (b) pounding kernels	(a) Both faces, (b) butt	(a) Anvil or possible hammer, (b) pounder	3	3		A13
E025249	Ground-edged hatchet head	X	Polishing bone or shell	Butt	Polisher	2	2	2	A24
E027596	Ground-edged hatchet head	X	Wedging/splitting wood	Edge and butt	Wedge	2	1		A2
E031054	Ground-edged hatchet head	X	Breaking bone	Butt, one lateral and possibly one face	Hammerstone	2	2		A27
E031898	Ground-edged hatchet head	X	(a) Grinding plant/seeds and (b) grinding/pounding non-woody plants/seeds	(a) Both laterals, (b) butt	Grinder and pounder	3	2		A9
E032843	Ground-edged hatchet head	X	(a) Grinding plant/seeds and (b) pounding/grinding non-woody plants/seeds	(a) One lateral, (b) butt	Grinder and pounder	3	2		A10
E033280	Ground-edged hatchet head	X	Pounding non-woody plants/seeds	Butt	Pounder	2	2		A3

continued ...

Table 1 (cont.). Summary of multiple uses of ground-edged artefacts from the New South Wales Central Coast.

AM registration number	GEA form	Woodworking: chopping wood, using ground-edge as hatchet	Other wear types	Location of other wear types	Other activities—using GEA as:	No. of wear-types	No. of identified worked materials	Reference to figures in text	Reference to figures in Appendix
E033479	Ground-edged hammer/pounder		Chopping/pounding non-woody plants by edge and butt	Edge and butt	Chopper/pounder	1	1	2, 11	
E033480	Ground-edged hammer/pounder		Chopping/pounding non-woody plants by edge and butt	Edge and butt	Chopper/pounder	1	1		A6
E033647	Ground-edged hatchet head	X	Knapping stone	Both laterals	Hammerstone	2	2	24	
E035987	Ground-edged hammer/pounder		(a) Cracking nut and (b) pounding non-woody plants/seeds	(a) One face, (b) edge	(a) Anvil or possible hammer, (b) pounder	2	2		A16
E036242	Ground-edged hatchet head		(a) Cracking nuts and (b) pounding non-woody plants/seeds	(a) One face, (b) edge and butt	(a) Anvil, (b) pounder	2	2		A17
E042883	Ground-edged hatchet head	X	Pounding non-woody plants/seeds	Butt	Pounder	2	2	10	
E042926	Ground-edged hatchet head	X	(a) Breaking bone and (b) polishing bone	(a) Both laterals, (b) one face	(a) Hammerstone (b) polisher	3	2	23	
E042928	Ground-edged hatchet head		(a) Scraping animal skin and (b) pounding non-woody plants/seeds	(a) Edge, (b) butt	(a) Scraper, (b) pounder	2	2		A33, A34
E042929	Ground-edged hatchet head	X	Pounding non-woody plants/seeds	Butt	Pounder	2	2		A4
E042997	Ground-edged hatchet head	X	Cracking nuts	Both faces	Anvil	2	2	19	
E044118	Ground-edged hatchet head	X	Polishing bone	Both faces and butt	Polisher	2	2		A25
E052617a	Ground-edged hatchet head	X	Polishing bone	Both faces and butt	Polisher	2	2	22	
E052617b	Ground-edged hatchet head	X	Polishing bone	Both faces and butt	Polisher	2	2		A29

continued ...

Table 1 (cont.). Summary of multiple uses of ground-edged artefacts from the New South Wales Central Coast.

AM registration number	GEA form	Woodworking: chopping wood, using ground-edge as hatchet	Other wear types	Location of other wear types	Other activities—using GEA as:	No. of wear-types	No. of identified worked materials	Reference to figures in text	Reference to figures in Appendix
E052618	Ground-edged hatchet head	X	Pounding non-woody plants/seeds	Butt	Pounder	2	2	8	
E052619	Ground-edged hammer/pounder		Polishing bone	Edge and butt	Polisher	1	1	2	A35
E052620	Ground-edged hammer/pounder		(a) Cracking nuts, (b) pounding non-woody plants/seeds and (c) chopping/pounding non-woody plants	(a) Both faces, (b) butt, (c) edge	(a) Anvil (b) pounder, (c) chopper/pounder	3	2		A14
E053281	Ground-edged hammer/pounder		Polishing bone	Edge and butt	Polisher	1	1	20	
E054640	Ground-edged hatchet head		(a) Scraping (to soften) skin, (b) chopping/pounding non-woody plants and (c) pounding non-woody plants/seeds	(a) Both laterals and one face, (b) edge, (c) butt	(a) Scraper, (b) chopper/pounder, (c) pounder	3	2	29, 30	
E054857	Ground-edged hatchet head	X	Pounding non-woody plants/seeds	Butt	Pounder	2	2	2	A5
E054858a	Ground-edged hammer/pounder		(a) Pounding/grinding non-woody plants/seeds, (b) grinding non-woody plants/seeds and (c) chopping/pounding non-woody plant	(a) Butt, (b) both laterals, (c) edge	(a) Pounder, (b) grinder, (c) chopper/pounder	3	1		A8
E054858c	Ground-edged hammer/pounder		(a) Pounding kernels, (b) pounding plant/seeds and (c) polishing bone or shell	(a) Both faces and edge, (b) butt, (c) butt	(a) Anvil, (b) pounder, (c) polisher	3	3		A12
E054858d	Ground-edged hammer/pounder		Pounding kernels	(a) Both faces, (b) butt and (c) edge	(a) Anvil and pounder, (b) pounder, (c) pounder	2	1	17	
E054859c	Ground-edged hatchet head	X	Polishing bone	Butt	Polisher	2	2		A26

continued ...

Table 1 (cont.). Summary of multiple uses of ground-edged artefacts from the New South Wales Central Coast.

AM registration number	GEA form	Woodworking: chopping wood, using ground-edge as hatchet	Other wear types	Location of other wear types	Other activities—using GEA as:	No. of wear-types	No. of identified worked materials	Reference to figures in text	Reference to figures in Appendix
E054859d	Ground-edged hatchet head	X	Chopping/pounding non-woody plants by edge and butt	Butt and edge	Chopper/pounder	2	2	12, 31	
E054859f	Ground-edged hatchet head		(a) Breaking bone and (b) pounding non-woody plants/seeds	(a) Edge, (b) butt	(a) Hammerstone, (b) pounder	2	2	21	
E054861a	Ground-edged hatchet head	X	(a) Cracking nuts and (b) pounding non-woody plants/seeds	(a) One face, (b) butt	(a) Anvil, (b) pounder	3	3	31	A18
E054882	Ground-edged hatchet head	X	(a) Pounding/grinding non-woody plants/seeds and (b) grinding non-woody plants/seeds	(a) Butt, (b) lateral	Pounder, grinder	3	2	13	
E057828	Ground-edged hatchet head	X				1	1		A1
E059797	Ground-edged hammer/pounder		(a) Chopping/pounding non-woody plants and (b) pounding non-woody plants/seeds	(a) Edge, (b) butt	(a) Chopper/pounder, (b) pounder	2	1	31	A7
E059798	Ground-edged hatchet head	X	(a) Cracking nuts and (b) pounding non-woody plant/seeds	(a) Both faces, (b) butt	(a) Anvil, (b) pounder	3	3	31	A19
E059849	Ground-edged hatchet head	X	Breaking bone	Butt	Hammerstone	2	2	31	A28
E060861a	Ground-edged hatchet head	X	(a) Pounding non-woody plants initially , then (b) knapping stone, and last (c) knapping stone	(a) butt, (b) both faces, (c) butt	(a) Pounder, (b) anvil, (c) hammerstone	4	3		A32
E060861b	Ground-edged hatchet head	X	Knapping stone	Both laterals and butt	Hammerstone	2	2		A30

continued ...

Table 1 (cont.). Summary of multiple uses of ground-edged artefacts from the NSW Central Coast.

AM registration number	GEA form	Woodworking: chopping wood, using ground-edge as hatchet	Other wear types	Location of other wear types	Other activities—using GEA as:	No. of wear-types	No. of identified worked materials	Reference to figures in text	Reference to figures in Appendix
E060861c	Ground-edged hatchet head	X	Knapping stone (a) and (b)	(a) both faces, (b) one lateral and butt	(a) Anvils, (b) hammerstone	3	2	26	
E060861d	Ground-edged hatchet head	X	Knapping stone	One lateral	Hammerstone	2	2		A31
E065196a	Ground-edged hatchet head	X	(a) Cracking nuts, (b) pounding kernel and (c) pounding ochre	(a) One face, (b) butt, (c) 1 face	(a) Anvil or possible hammer, (b) pounder, (c) anvil	3	4		A20, A21
E065196e	Ground-edged hatchet head	X				1	1	4	
E065196q	Ground-edged hatchet head	X	Cracking nuts	Both faces	Anvil	2	2		A15

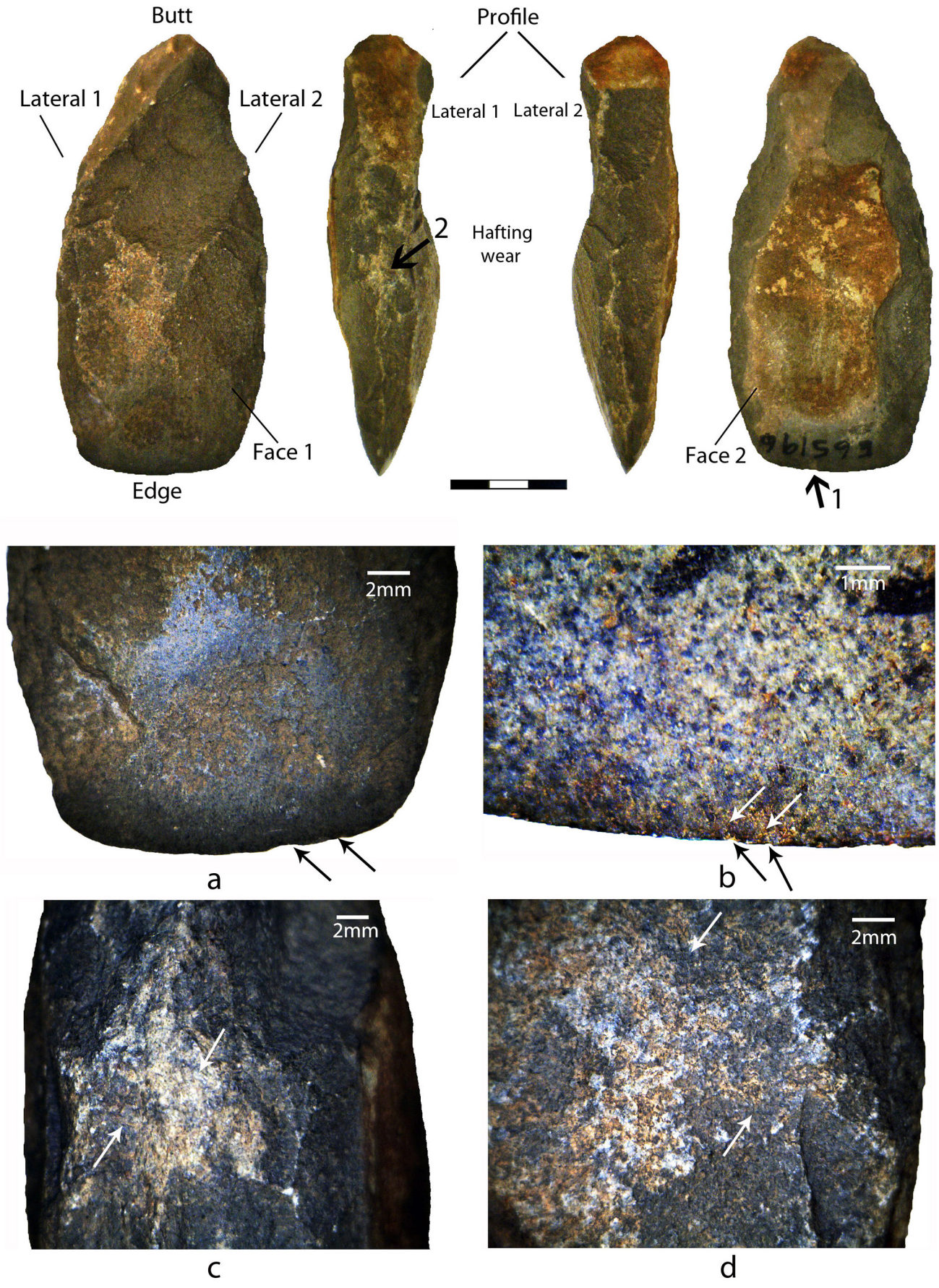

Figure 4. E065196e. Hatchet. Woodworking. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, discontinuous scars indicated by arrows; *(b)* point 1, microscars indicated by black arrows and striations indicated by white arrows; *(c)* point 2, hafting wear on the lateral: white-coloured surface attrition, alignment and striations indicated by arrows; *(d)* point 2, hafting wear: white-coloured surface attrition, alignment and striations indicated by arrows. Terminology used to refer to locations of wear on ground-edged artefacts. Photographs Nina Kononenko, scale in 1 cm divisions.

Identification of the working edges and surfaces, and location of use-wear on the tool, can provide information about its use-life—whether it was used only once or multiple times (e.g., Adams, 1993; Dubreuil, 2004; Dubreuil & Savage, 2014; Hamon, 2008). The ground-edged artefacts in our study usually display several used areas which can be located on different parts as indicated on Fig. 4: the ground bevelled edge, the butt, both faces and both laterals.

Some methodological aspects of microscopic analysis of ground tools

According to Adams (1993, 2014; Adams *et al.,* 2009), the formation of use-wear on ground stone tools is associated with four interactive processes, which occur during the relative movement of two contacting surfaces: adhesive, abrasive, fatigue and tribochemical wear. During adhesive and fatigue wear (in the form of plastic deformation of the asperities by levelling), cracks, fractures and micro-pits are formed; loosened rock grains and particles remain between surfaces and act as abrasive agents in the wear process. These abrasive agents create scratches, grooves and striations across the stone's surface (see below for details of these wear-types). It has been argued that the heat produced by friction between two surfaces initiates chemical interactions resulting in tribochemical wear visible on the surface of the stone as sheen (Adams, 1988, 1993, 2014; Adams *et al.,* 2009; Dubreuil & Savage, 2014; Hamon, 2008).

The development and morphological variations of the use-wear features on ground tools depend on:

- the properties of the stone(s) used (e.g., basalt or sandstone);
- the intermediate material (if any) that is being processed between two stones (e.g., plants or mineral ochre);
- the action or way the material is worked (e.g., grinding or pounding); and
- the duration and intensity of use of the tools (Adams, 1993; Dubreuil, 2004; Hamon, 2008; Hamon & Plisson, 2009).

Use-wear alters the surface microtopography of ground stone tools. Some of these surface alterations can be observed under low magnification stereomicroscopy (from 10× to 80×) with oblique lighting (e.g., Adams, 1993; Dubreuil, 2004; Dubreuil & Savage, 2014; Hamon, 2008; Van Gijn, 2014). Some forms of wear are more clearly visible under vertical incident light, at higher magnifications (from 100× to 1000×). This enables better resolution of micropolish, grain microfractures, grain edge-rounding, linear traces, abraded areas, prehension wear and micro-residues. The analysis of ground artefacts at high magnifications with a metallographic microscope is now commonplace (e.g., Adams, 1993; 2014; Adams *et al*., 2009; Asmussen, 2010; Clarkson *et al*., 2017; Dubreuil & Savage, 2014; Fullagar & Field, 1997; Fullagar *et al.,* 2012; Fullagar *et al.,* 2016; Hayes, 2015; Hayes *et al.,* 2016; Smith *et al.,* 2015), although most analysts now utilize high and low magnifications in conjunction with various optical, SEM and other microscopes (Dubreuil & Savage, 2014; Hayes, 2015: 100).

The wear observed on ground stone tools can encompass information not only about their last stage of use, but also, when different types of use-wear are preserved, a range of utilization episodes. Sometimes, distinct episodes of use can be identified. The tools with multiple uses are considered 'multifunctional' or 'multiple tools' (Dubreuil & Savage, 2014:142; Van Gijn, 2014). The use-life of a ground-edged artefact can be restricted to the activities for which it was initially made, or it can include subsequent utilization when it was used for several other activities.

Cobbles or bedrock blanks for some ground-edged artefacts were probably purposefully chosen for their shape and size with the intention of using the hafted hatchet head as a multifunctional implement. For example, the deliberately ground edge would be used for activities such as woodworking, and the butt as a hammer or pounder for processing non-woody plant materials; such a combination of uses being facilitated by the wrap-around handle. McCarthy (1976: 47) used the term 'hammer-axe' for ground-edged hatchets bearing heavy percussive wear on the butt and laterals.

Use-wear and experimental replication studies (e.g., Adams, 1989, 1993, 2014; Dubreuil, 2004; Dubreuil and Savage, 2014; Fullagar *et al.,* 2012, 2015*,* 2016; Goren-Inbar *et al.,* 2002; Hamon, 2008; Hamon & Plisson, 2009) have established some common wear traces on ground tools *visible under low power magnification.* They are generally consistent over a variety of stone materials and suggest criteria that may be diagnostic of activities and materials processed. Fullagar *et al.* (2012: 34) conclude however that 'overlapping wear patterns from multiple uses are problematic and residues are needed to identify details of processed materials'.

In summarising frameworks of earlier work, Adams *et al*., (2009) and Dubreuil & Savage (2014) recommended four characteristics of wear for low magnification observations:

1 **Levelling the overall topography** of the worn surface by abrasion of the asperities and the removal of rock grains. Levelling can affect individual grains or a larger area and result in the formation of homogeneous zones. The texture of the levelled topography can be rough or smooth. The removal of grains from the matrix commonly occurs on most ground stone tools, particularly in the early stages of utilization. Grain removal may be described as the basis for the shape, depth and density of the pits, depressions or 'peck marks' (Adams, 2014: 133) left on the worn surface.

2 **Modification of the morphology of larger grains** which are embedded into the fine matrix of the rock (e.g., basalt and hornfels). This modification includes crushing, microfractures, edge-rounding and abrasion of the top, face and edges of the grains. Microfractures and crushing of rock grains tend to be particularly common on tools manufactured by pecking, or tools used as a hammer or pounder. Edge-rounding of grains is commonly associated with contact with soft, pliable materials such as non-woody plant or animal skins which penetrate into the interstices.

3 **The presence of linear traces** in the form of striations, scratches and grooves, which are more likely to be seen macroscopically on fine-grained rocks. Scratches and grooves are typically associated with the processing of abrasive or hard materials (e.g., ochre, stone, bone, shell).

4 **The reflectivity of the surface** in the form of sheen which is closely linked to the degree of levelling, as flatter surfaces have greater potential to reflect light. Increased reflectivity can also be caused by a combination of mechanical and chemical wear that occurred during processing relatively soft and greasy substances (e.g., animal skins, nuts).

Sheen on fine-grained stones (e.g., basalt) is clearly visible under low magnification. In addition, the use of high power microscopes with increased magnification allows the identification of micropolish within the surface

microtopography. The presence of micropolish can be observed on the high points of rock grains and in the depths of the interstices (Adams *et al*., 2009: 55; Dubreuil & Savage, 2014: 148).

Use-wear analysis of NSW Central Coast ground-edged artefacts

The variables of wear and residues that we analysed to identify and interpret use on ground-edged artefacts are derived from previous studies (e.g., Adams, 2014; Adams *et al*., 2009: 50; Dickson, 1976; Dubreuil, 2004; Dubreuil & Savage, 2014; Fullagar *et al.,* 2012; Hamon, 2008; Hayes, 2015; Hayes *et al*., 2016; Gillieson & Hall, 1982; Kamminga, 1982: 62–64). The following variables are used to describe these characteristics:

1 macroscopic surface and edge modification including scars and micro-scars (continuous, discontinuous), edge rounding (light, moderate or intensive), and battering;

2 surface levelling through abrasive smoothing (flat, undulating or rounded), and texture (smooth or rough) (Adams *et al.,* 2009);

3 changes in grain morphology on worn surfaces (crushed, rounded, flattened);

4 presence of pits and/or peck marks caused by grain removal, their density (on the GEA surface: scattered, dense, overlapping), and depth (fine, superficial, wide, deep);

5 the presence of linear traces:
   (a) alignments in the form of shallow, wide, discontinuous and poorly defined striations (Kamminga, 1982: 14) and their distribution on high or low surface topography;
   (b) striations (rough, fine, dense, isolated) and their spatial arrangement in relation to each other (random, crossed, concentric, parallel, oblique or perpendicular);
   (c) scratches, or linier traces with more than 0.5 mm width in contrast to striations with a width 0.5mm or less (Adams *et al*., 2009: 49), and cracks (deep, irregular, isolated, dense);

6 the presence and appearance of sheen as a visible alteration of the natural surface, its texture (smooth, slightly smooth), and extent 'only on the topographic highs, or also in the interstices' (Adams *et al*., 2009: 50). The terms *'superficial'* and *'invasive'* are used for the characterization of the extent of sheen on the topographic highs and in the interstices.

7 the presence and appearance of hafting traces in the form of 'a highly reflective gloss'; its reflectivity and its extent. To distinguish hafting wear from other functional surfaces of the tool with visible reflectivity from use, we use the term 'gloss' rather than 'sheen' (Adams, 2014:136; Dubreuil, 2004: 1617); and

8 the type of any preserved residues (plant, animal and/or mineral).

This set of characteristics was used, first, to reconstruct the action, or mode of use, performed by the tool, and second, to identify (within a broad scale) the type of material that was processed (Table A3). Second, wear patterns on the NSWCC GEAs, were compared with experimental wear patterns described by other researchers (Adams, 1988, 1989, 1993, 2014; Adams *et al.,* 2009; Dubreuil, 2004; Dubreuil & Savage, 2014; Fullagar *et al,*. 2012; Fullagar *et al.,* 2016; Goren-Inbar *et al*., 2002; Hamon, 2008; Hamon & Plisson, 2009; Hayes, 2015; Hayes *et al.,* 2016; Kamminga, 1981, 1982). In addition, ethnographic and historical accounts provided valuable information about interpreting possible use of ground-edged artefacts (see above).

Each artefact's use-wear characteristics were examined at low magnification (from 10× to 60×) using a Dino-Lite™ (AM413ZT) digital microscope with direct vertical light and with an additional oblique light from an external light source. The microscope was mounted on a rack (Dino-Lite™MS35B) with multiple brackets that enable larger artefacts to be placed under the microscope. High power analysis of some artefacts was performed with an Olympus BX60M metallographic microscope at magnifications from 100× to 1000×, with vertical incident and transmitted light, bright and dark field illuminations and polarizing filters. Images of artefacts and wear patterns were captured with a Dino-Lite™ digital microscope and a ColorView II camera and a Soft Imaging System GmbH attached to the metallographic microscope. All images of GEAs and use-wear were created by Nina Kononenko, except for E076561 in Fig. 2, which was taken by Finton Mahoney.

Since all of the NSWCC GEAs are housed in the Australian Museum Archaeological Collection, their preparation for use-wear study was limited to cleaning the surface with warm water using a soft gentle brush to remove loosely adhering fine films and soils. In some cases, surfaces with recent grease or residues were additionally cleaned with diluted alcohol.

Wear-types and multiple uses of NSW Central Coast ground-edged artefacts

Microscopic examination of the surfaces of the 51 ground-edged artefacts identified 18 different wear-types resulting from processing a variety of materials in several different ways (Tables 1, 2). Use-wear traces observed on NSWCC GEAs enabled interpretation of tool functions, including materials worked (see Table A3). Results are presented below by wear-type with discussion of the basis for identifications (prior studies including experiments) and the NSW GEAs with this wear-type.

The visibility of particular wear damage on each artefact depends on a number of factors including the properties and structure of the stone material and their post-depositional surface alteration, the intensity of use, and the material worked by the implement. Wear alteration on natural surfaces, however, can be differentiated even at low magnification.

The cutting edge of a ground-edged hatchet is generally characterized by abrasion in the form of relatively well-defined continuous striations (Figs 4a, 6a). The striations are often aligned in sets, which sometimes intersect each other as a result of the direction of movement of the tool (or the abrading stone) being altered during grinding to shape the working edge (cf. Kamminga, 1982: 14). The arrangement, appearance and distribution of grinding striations are usually distinct from those overlapping wear traces (levelling surface topography, sheen, patterned striations) that resulted from use. However, continual re-sharpening of used tool edges potentially complicates interpretations. Of the 51 GEAs, 40 have blunted/rounded but well-preserved ground edges (Table A3). The exceptions are the 11 tools that are referred to as 'hammer/pounders', which have their ground edge dramatically modified (battered) by subsequent use/s unrelated to woodworking, indicating their engagement in different activities.

Table 2. Wear-types identified on ground-edged artefacts from the New South Wales Central Coast.

	Wear types	Tool ID (AM registration number)	Number of GEA with wear-type
1	Wear from chopping wood [as hatchet]	35 artefacts, including two with chopping wood as sole use (E057828, E065196e)	35
2	Wear from splitting wood [as wedge]	E017183, E027596	2
3	Wear from pounding non-woody plants, including seeds, roots	E031898, E032843, E033280, E035987, E036242, E042883, E042928, E042929, E052618, E052620, E054640, E054857, E054858a, E054858c, E054859f, E054861a, E054882, E059797, E059798, E060861a	20
4	Wear from grinding non-woody plants, seeds	E031898, E032843, E054858a, E054882	4
5	Wear from chopping/pounding plant	E033479, E033480, E052620, E054640, E054858a, E054859d, E059797	7
6	Wear from cracking nuts [as anvil]	E020467, E020470, E035987, E036242, E042997, E052620, E054861a, E059798, E065196a, E065196q	10
7	Wear from cracking nuts [as hammer]	Possible E020470, E035987, E065196a	3
8	Wear from pounding kernels [as anvil]	E054858c, E054858d	2
9	Wear from pounding kernels [as pounder]	E020467, E020470, E054858c, E054858d, E065196a	5
10	Wear from polishing/abrading bone/shells	E05955, E012712, E025249, E042926, E044118, E052617a, E052617b, E052619, E053281, E054858c E54859c	11
11	Wear from breaking bone [as hammer]	E031054, E042926, E054859f, E059849	4
12	Wear from knapping stone [as hammer]	E020469, E033647, E060861a, E060861b, E060861c, E060861d	6
13	Wear from knapping stone [as anvil]	E020469, E060861a, E060861c	3
14	Wear from polishing stone	E011247	1
15	Wear from scraping skin	E042928	1
16	Wear from scraping (to soften) skin	E054640	1
17	Wear from pounding ochre [as anvil]	E065196a	1
18	Hafting wear	E017183, E025249, E027596, E031054, E033280, E033479, E033480, E033647, E042883, E042928, E042929, E044118, E052617a, E052617b, E052619, E054857, E054859d, E054859f, E054861a, E059797, E059798, E059849, E065196a, E065196e	24

Wear-types 1 and 2 from woodworking

Two types of wear from using GEAs for woodworking are described: 1. their use as hatchets in chopping wood, and 2. their use as a wedge in splitting wood. Only four tools had a single use associated with woodworking; two were used solely for chopping wood and another two were used solely as wedges.

Wear-type 1
from chopping wood as a hatchet (Fig. 5)

Previous studies. Though there are historical images of people chopping wood, there are no descriptions of wear damage on woodworking tools in the historical literature. Replicative experiments with flaked hatchets used for working wood show that the most noticeable wear traces are edge-fracturing by step, feather and rarely bending scars observable on both faces of the edge (Hayden, 1979: 108; Kamminga, 1982: 63). Shaping and smoothing the edge by grinding minimize edge-fracturing although minute crushing can be occasionally seen (Hayden, 1979: 125; Kamminga, 1982: 63). Blunting the edge by rounding and the formation of striations and sheen on both faces of the tool are due to the presence of abrasive agents such as sand or grit, and broken edge fragments (Dickson, 1976: 42; Hayden, 1979: 125–126; Kamminga, 1982: 63–64).

NSWCC artefacts. The macroscopic use-wear from woodworking in the form of scars is insignificant on the ground edge of most NSWCC hatchets. This includes discontinuous and rare continuous small scars with mixed bending, step and feather terminations (Figs 4a, 6a). In addition, the blunted edges show continuous microscars that are visible under low magnifications (Figs 4b, 6a).

A well-developed sheen is smooth, relatively bright and reflective, and extends on all prominences of the surface-topography (Figs 4b, 6a, A1, A2). Distinctive short and wide striations of furrow-type (cf. Kamminga, 1982: 12) usually run slightly diagonal or perpendicular to the edge and are observed on both faces (Figs 4b, 6a, A2).

Only two of the 40 hatchets with well-preserved ground edges were used solely for chopping wood (E057828 and E065196e); they were made by flaking both laterals and by grinding the edge (Figs 4, A1). The central part of one of the laterals on tool E065196e preserves patches of surface alteration consisting of abrasive smoothing with few isolated striations and alignments (Fig. 4c,d). These wear traces were probably formed as a result of hafting with a wrap-around handle (see Fig. 2, E076561 ID0235). The remaining 38 hatchets, in addition to having used ground edges, display wear on other locations from performing several other activities and being used with different materials (see below).

Wear-type 2
from splitting wood as a wedge (Fig. 7)

Previous studies. Bifacial flaking on the butt of a ground-edged artefact is a significant indicator of it having been used as a wedge by Aboriginal people (Kamminga, 1982: 61). The use of large stone wedges to split wood and rotten logs, and remove bark and wood for shields, canoes and containers, has been reported widely in Australia (e.g., Dickson, 1976: 37; Goddard, 1934; Hayden, 1979: 53–54; Kamminga, 1982: 61–62; Mathews, 1907 in Thomas, 2007: 64; McCourt, 1975: 92; Thorpe, 1932). The wedge with a relatively blunt edge was usually inserted into a crack in the log, held by its wrap-around handle, and hammered with another stone or heavy piece of wood until the log split. It is emphasized that the butt

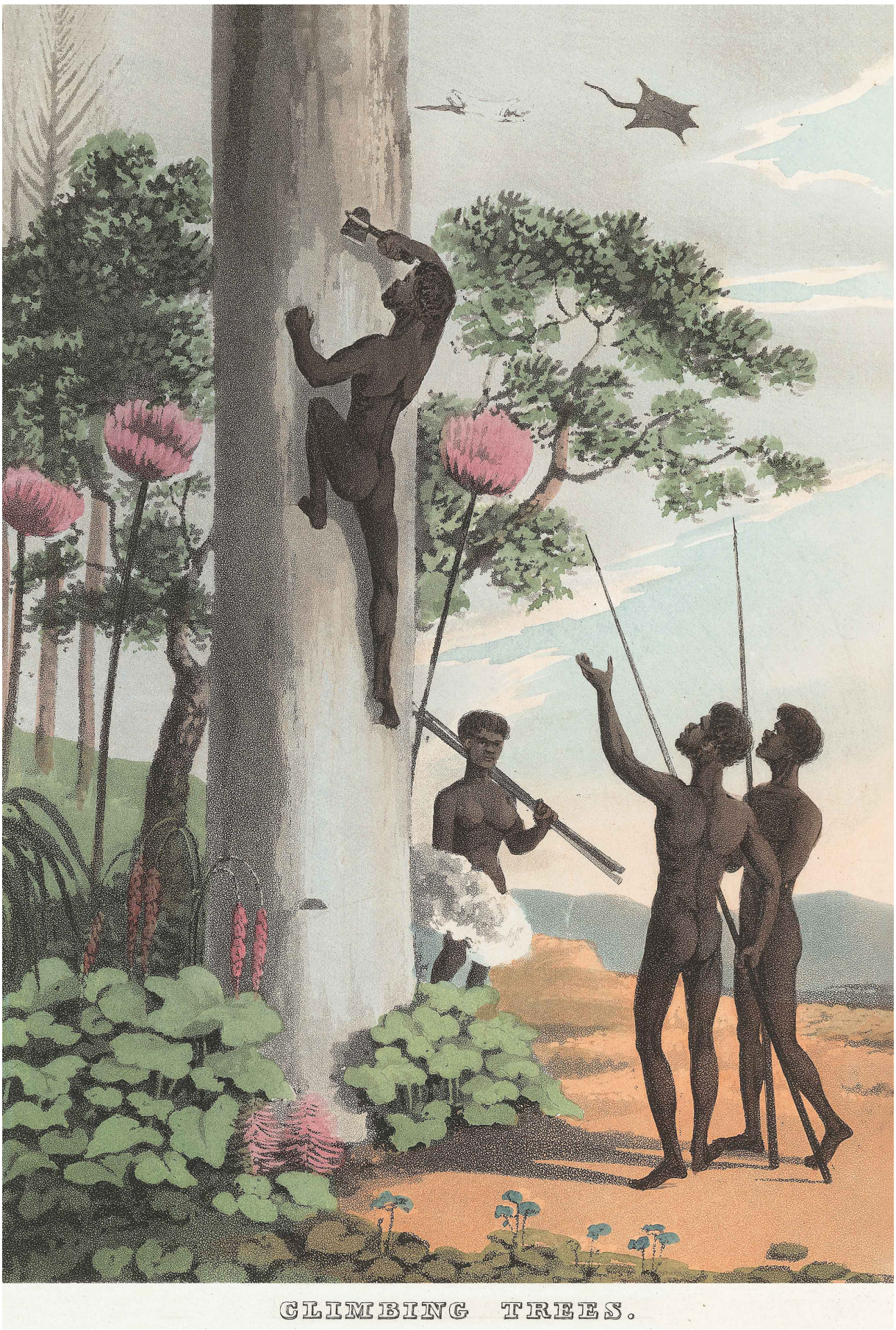

Figure 5. Climbing trees by John Heaviside Clark (del.), M. Dubourg (sculpt). 1813 *Field Sports of the Native Inhabitants of New South Wales.* London. (Reproduced from hand-coloured aquatint owned by Val Attenbrow).

Figure 6. E017183. Wedge. Splitting wood. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, scars, smoothed sheen, dense grinding striations, which are overlapped by isolated wear striations from use, indicated by arrows (×40); *(b)* point 2, the butt with bifacial damage by scars; *(c)* point 3, hafting wear: smoothed surface, alignment, gloss (white arrow) and striations (black arrows) (×15). Photographs Nina Kononenko, scale in 1 cm divisions.

Figure 7. Birpai men, Peter Budge and Charlie Murray, demonstrate the removal of a blank from a mangrove for the manufacture of a shield (heliman) using stone technology near Port Macquarie NSW c.1912. Image from the Thomas Dick Photographic Collection. Reproduced courtesy of the Australian Museum and the Thomas Dick Photographic Collection Family Stakeholder Group. Australian Museum Archives Reg. No AMS319_v7786.

which was hammered became damaged as flakes came off bifacially, and the surface and/or edge in percussive contact became rounded by battering (e.g., Hayden, 1979: 53–54; Kamminga, 1982: 61–62; McCourt, 1975: 92).

NSWCC artefacts. Two large ground-edged artefacts in our study (E017183 and E027596) have wear similar to that described above (Figs 6, A2). They have partially flaked laterals, ground edges blunted by microscars and rounding and damaged butts. The butt damage of E017183 includes feather and step scars caused by heavy bifacial fracturing. The margins of the scars are crushed and appear flattened. Prominent points of the surface topography are slightly abraded (Fig. 6b). These wear traces indicate that the butt was damaged by forceful percussive impacts from contact with a hammerstone. The presence of hafting wear on the faces and laterals, in conjunction with wear on the edge and on the butt, suggests that this heavy GEA was used as a hafted wedge for splitting wood. The butt of E027596 also shows bifacial fracturing but the scars are relatively small in area and shallow. The margins of scars and the edges of rock grains are flattened and rounded. The surface has been levelled by smooth abrasion (Fig. A2). This wear pattern on the butt apparently formed as a result of percussive impacts by a softer surface, possibly hard wood. This suggests that E027596 was used as a wedge but was probably hammered by a piece of hard wood rather than a block of stone. The laterals of E027596 preserve spots of hafting wear (Fig. A2d).

Wear-types 3, 4 and 5 from processing plant materials by pounding, grinding and chopping/pounding

Previous studies. Experimental replications of grinding non-woody plants show that use-wear damage from pounding and grinding occurs as a result of the percussive impact between the surface of the tool and processed plants, and occasionally from stone-on-stone contact between the hammer and anvil (e.g., Dubreuil, 2004; Hamon, 2008). The primary features of these use-wear traces include surface levelling by abrasion and grain removal, grain rounding and fracturing, impact pecking, broad, bright alignments of sheen and striations with multiple orientations and varying widths and depth (e.g., Adams, 1993; Dubreuil, 2004; Fullagar *et al*., 2015; Gillieson & Hall, 1982; Hamon, 2008; McCarthy, 1976: 63).

NSWCC artefacts. Several multi-functional NSWCC GEAs have evidence that they were used for pounding and grinding as well as chopping/pounding relatively pliable plant materials such as roots, seeds and nuts (Figs 8–10). Three types of wear from processing non-woody plants have been identified on the NSWCC GEAs:

- Wear-type 3—pounding non-woody plants and seeds
- Wear-type 4—grinding non-woody plants and seeds
- Wear-type 5—chopping/pounding non-woody plants

These wear-types co-occur on many artefacts, and three ways of using the GEAs for processing plants have been identified.

The first is associated with *use of the butt for pounding*. Use damage from pounding plants and/or seeds *(Wear-type 3)* is seen on hatchets E033280, E035987, E036242, E042883, E042929, E052618, E054857, E054858c, E054859f, E054861a and E059797. On these artefacts, contact between the plant and the hard surface of the tool produced slight to moderate impact fractures in the form of shallow fine peck marks (Figs 8, 10). The worn area appears as a flat, levelled surface with smooth, moderately reflective sheen and irregular domes or peaks of asperities (Fig. 8b,c). The edges of the rock grains are flattened and rounded and interstices are filled with resultant residues (Fig. 10b). Forceful crushing-pounding strokes and the occasional stone-on-stone contact apparently loosened and dislodged rock grains which acted as an abrasive agent producing a small number of thin narrow and shallow striations and alignments (Figs 8b, 10b, A5a). Linear striations with parallel and crossed orientations indicate that pounding occurred with occasional grinding actions (*Wear-type 4*—see below). The surfaces and laterals of the GEAs have preserved patches of hafting wear *(Wear-type 18)* (Figs 10, 12, A3, A4, A5) and this suggests that these hatchets were probably hafted and used alternately for both chopping wood *(Wear-type 1)* and pounding softer, non-woody plants *(Wear-type 3)*.

The second way of using GEAs to process non-woody plants was *use of the ground edge for chopping/pounding (Wear-type 5) and pounding actions (Wear-type 3).* Obvious *Wear-type 5* damage consists of an intensive blunting and flattening of the ground edge with a well-defined boundary in the form of margins between the worn surface and adjacent faces (Figs 11a,b, 12c). The margins often have scattered small step and feather fractures. The used surface shows highly intensive levelling and is covered by dense and closely-spaced impact pits, or peck marks, with crushed and rounded edges (Figs 11b,c, 12b,c). This indicates that when the tool was used in percussive actions, it apparently struck both the relatively tough exterior plant tissue and frequently the underlying anvil made of stone or wood, causing damage to the edge. Visible alignments and fine sub-parallel striations running across the bevel from the adjacent faces are associated with a smooth sheen (Figs 11b,c, 12d).

Wear-types 3 and 5 observed on the ground edge of the GEAs probably resulted from processing plants such as roasted or dried fern rhizomes and roots (cf. Bradley, 1969 [1786–92]: 117, 134; Brayshaw, 1986: 74–75; Dickson, 1976: 37; Gillieson & Hall, 1982; Kamminga, 1982: 54; McCarthy, 1976: 57). Three hammer/pounders (E033479, E033480, E054858d) and a hatchet (E059797) exhibit the wear pattern described above. These three hammer/pounders have deliberately shaped ground edges at each end, although one or both edges are damaged by chopping/pounding actions (Figs 11, 12, A6). The butt of the fourth tool (E059797) is flat and partially damaged and was probably used for pounding seeds (Fig. A7c). The ground edge is intensively flattened by peck marks with rounded and flattened rock grains, sheen and striations (Fig. A7a,b) suggesting that it was probably used for chopping and pounding non-woody plant parts like rhizome or roots. Spots of hafting wear are observed on all these tools (Figs 10b, A7d) indicating that they were hafted when used, possibly alternately, for chopping/pounding and pounding.

The ground edge of one tool (E054858a) shows traces of being used for chopping/pounding plant material *(Wear-type 5)* (Fig. A8). There are no signs of hafting wear on the faces or laterals, though hafting traces on its laterals would have been removed by grinding actions. The use of laterals clearly indicates that these tools were no longer useful for woodworking/chopping, and were de-hafted and used for pounding and grinding softer plant materials.

Wear traces indicate a third way that these tools were used: interchangeably pounding and grinding plants *(Wear-types 3 and 4),* which is seen on three hatchets (E031898, E032843, E054882), and a hammer/pounder (E054858a). The distinctive feature of these tools is the location of wear on two different parts of the tool: on the butt and on one or both laterals. There is also slight variation in wear appearance. The working surface of the butt is usually characterized by dense and shallow peck marks with flattened and rounded edges created by crushing strokes *(Wear-type 3)* (Fig. 13). The topography of the worn area is level and preserves smooth reflective sheen and linear striations resulting from occasional grinding strokes (Figs 13, A9). Wear traces on laterals show grinding actions rather than pounding. The asperities in the used area are levelled and rounded (Fig. 13c,d). The margins between the laterals and faces are also intensively rounded (Fig. 13c). A grinding mode of use produced visible abrasion, pronounced alignment with shallow sub-parallel striations running across the lateral and a smooth surface with lustrous sheen on elevated points of the surface topography (Figs 13d, A9c,d, A10c,d). This type of use-wear is similar to wear patterns produced by experimental replications of grinding plants (e.g., Adams, 1988; Dubreuil, 2004; Fullagar *et al.*, 2012; Fullagar *et al*., 2015; Hamon, 2008).

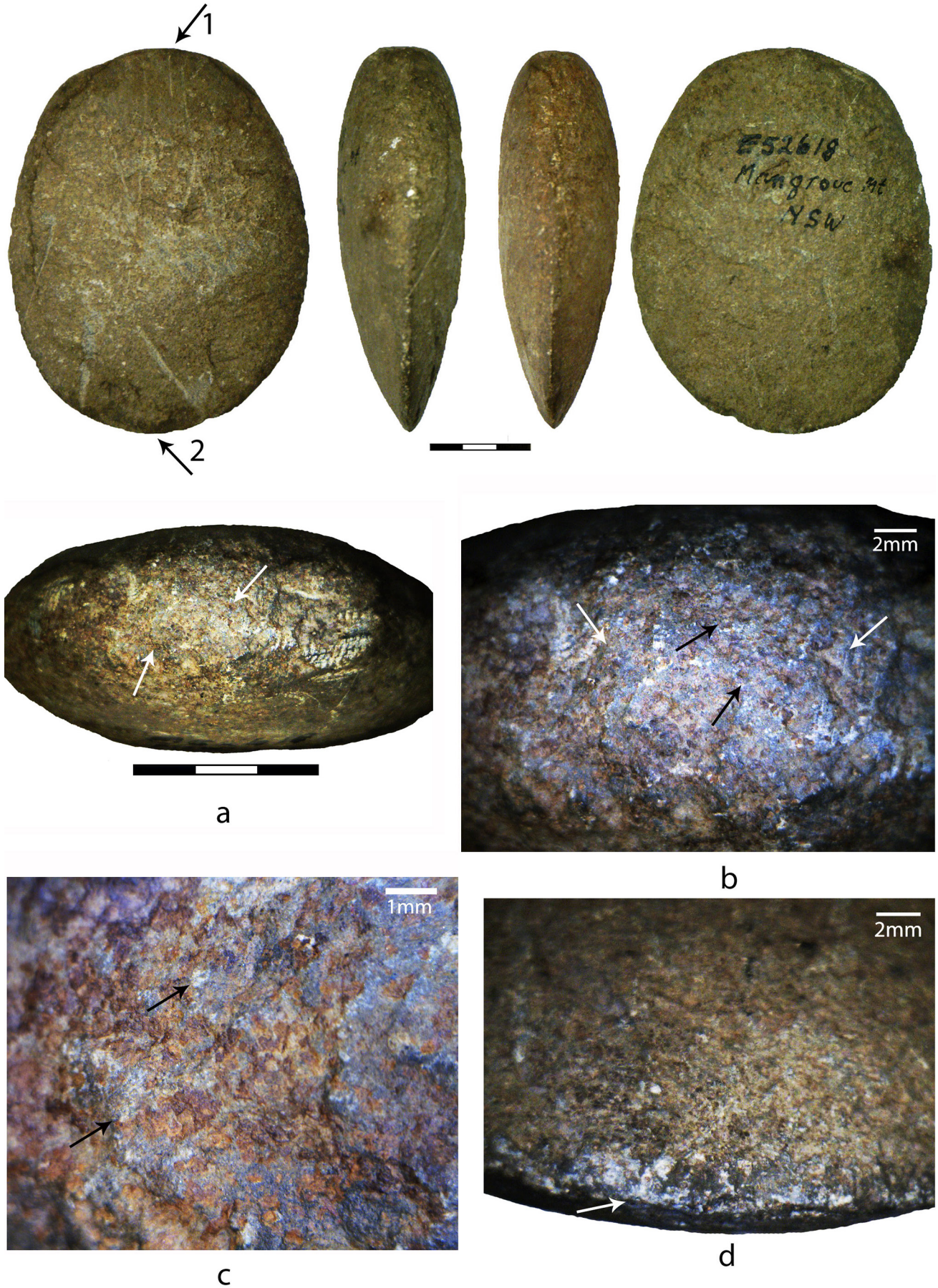

Figure 8. E052618. Hatchet. Chopping wood; pounding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface and peck marks indicated by arrows; *(b)* point 1, peck marks (black arrows) and striations (white arrows) (×20); *(c)* point 1, peck marks and crushed rock grains indicated by arrows (×45); *(d)* point 2, edge rounding, and sheen indicated by arrow (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

Figure 9. Girl preparing seeds at Yirrkalla, Arnhem land, by pounding and grinding them with the one implement. Water from the baler shell is squirted on them from time to time. Photograph F. D. McCarthy 1948 (1976, fig. 52 left). Reproduced courtesy of the Australian Museum Archives Reg. No V8955-22. Scale in 1 cm divisions.

Wear-types 6, 7, 8 and 9 from cracking nuts and pounding kernels (as hammer and anvil)

Nuts, often called hard-shelled seeds (Asmussen, 2011; Bril *et al*., 2012; Goren-Inbar *et al.,* 2002), are widely used by Aboriginal peoples in Australia as a food resource (e.g., Asmussen, 2011; Beck *et al*., 1988). Common methods of processing nuts include cracking the outer shell between two stones, separating the shell and kernels and then crushing the kernels by pounding (Asmussen, 2010: 2120; 2011: 148; Beck *et al*., 1988: 141–143). A pair of tools is required: an anvil and a hammer. The most common wear is often observed on the anvil in the form of deep pits or shallow depressions (i.e., incipient pits) *(Wear-types 6 and 8).*

Deliberately made pits are 5–13 mm deep, circular in plan-view with a diameter between 20–30 mm. There are also shallow, circular or oval depressions or incipient pits (Goren-Inbar *et al.,* 2002: 2457) of minimal depth (1–3 mm).

Previous studies. *Wear-type 6 from use as an anvil in cracking/breaking nuts/seeds* (Fig. 14). Cracking or breaking and pounding nuts/seeds are subsistence activities that have been identified in the archaeological record. The surface of many stone hammers and anvils have deliberately produced pits, of varying size, shape and arrangement (e.g., McCarthy, 1976: 47; McCourt, 1975: 139–140; Pardoe *et al*., 2019; Thorpe, 1932: 305). Artefacts with percussive pits on their surfaces are often referred as 'pitted anvils', 'pitted stones', 'nutting stones', and the formation of pits is commonly interpreted as rejuvenation of the seed grinding surfaces or as a result of either bipolar knapping of stone or cracking nuts (e.g., Goren-Inbar *et al*., 2002; Lentfer *et al.,* 2013; McCarthy, 1976: 47; see discussions above). The overseas literature includes a limited number of replicative experiments designed to investigate the process of surface modification on tools used for cracking and pounding edible hard-shelled seeds/nuts (e.g., Dubreuil, 2004; Fullagar *et al*., 2012; Goren-Inbar *et al.,* 2002).

Wear-type 7 from use as a hammerstone in cracking nuts/seeds. Our experiments with cracking seeds (Fig. 15) (Nina Kononenko Lab notes Feb. 2014) show that wear damage similar to that on an anvil can also form on a hammer (Fig. A11a,b). There is only a slight difference in the shape of the pit: the wear damage on the hammer has less regular boundaries than the rounded or oval pits on an anvil.

Wear-types 8 from use as an anvil and 9 from use as a hammerstone in pounding kernels. The reasons for pounding extracted kernels between two stones are to soften and reduce them to a desired texture, and aid in the subsequent leaching of toxins. The surfaces of a hammer/pounder and an anvil used in pounding actions are each affected by the percussive impact: first, by the slightly resistant and pliable oily kernels and, secondly, by the stone-on-stone contact (cf. Dubreuil, 2004; Hamon, 2008). Our experiments show that the stone-on-stone contact between the hammer and anvil occurred much more often during the pounding of fleshy kernels than in cracking nuts (Nina Kononenko Lab notes) (Fig. 16). This results in the formation of pronounced use damage on both the hammer and the anvil (Figs A11c–f). Moreover, experiments with the Australian *Macrozamia* nuts (seeds) indicate that extracted kernels require initial breaking into small pieces before the small pieces are pounded to produce coarse-grained and fine-grained nut flour. These two connected actions can be performed effectively by slicing the kernels with a bone knife (McCarthy, 1976: 88), or with a chopping tool with a relatively sharp edge (Gillieson & Hall, 1982);

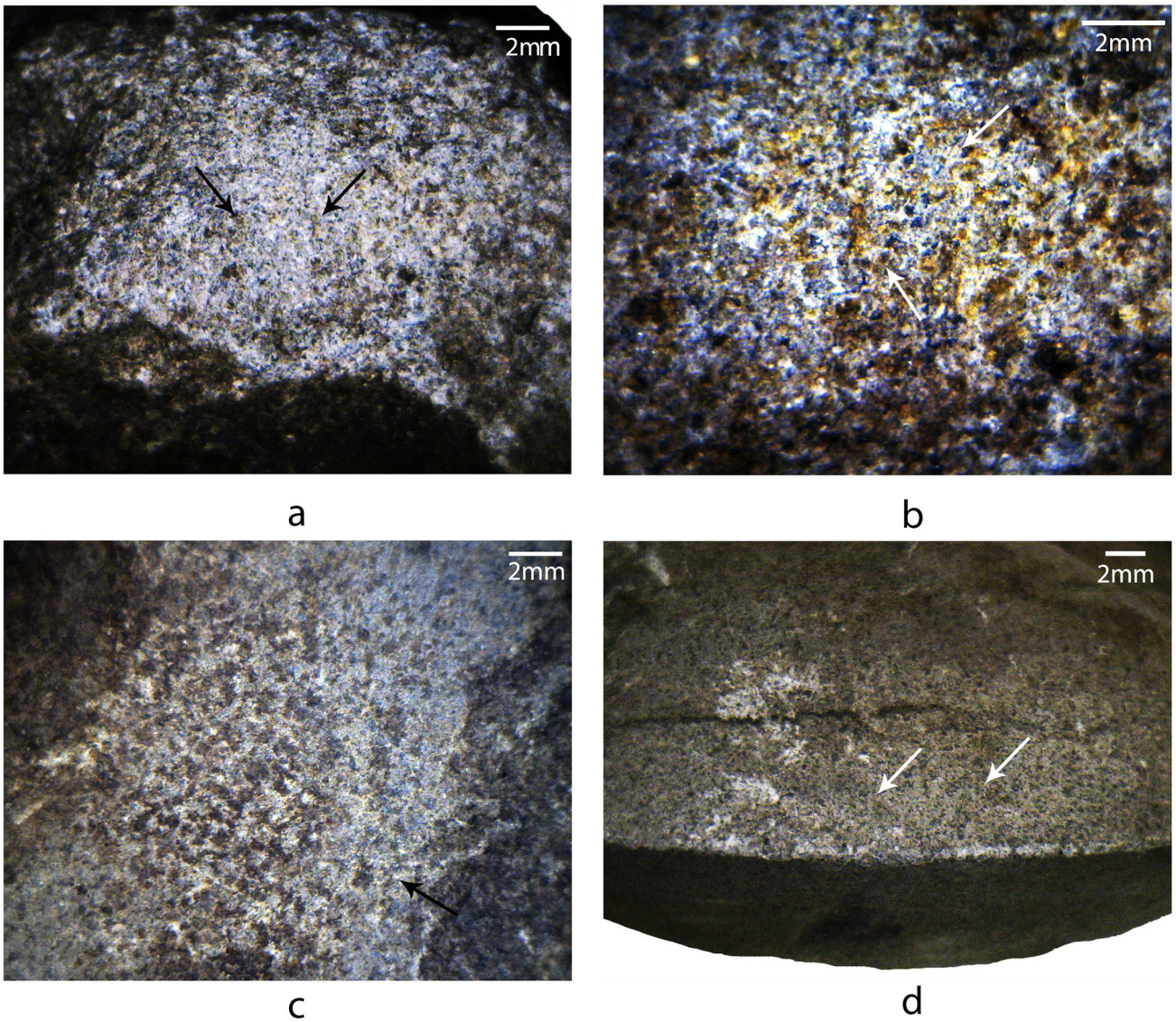

Figure 10. E042883. Hatchet. Pounding non-woody plants/seeds. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, smoothed surface with alignment and peck marks indicated by arrows (×20); *(b)* point 1, peck marks and striations indicated by arrows (×30); *(c)* point 2, hafting wear: sheen, isolated striations and alignment indicated by arrow (×20); *(d)* point 3, microscars, edge rounding and shallow perpendicular striations indicated by arrows (×15). Photographs Nina Kononenko, scale in 1 cm divisions.

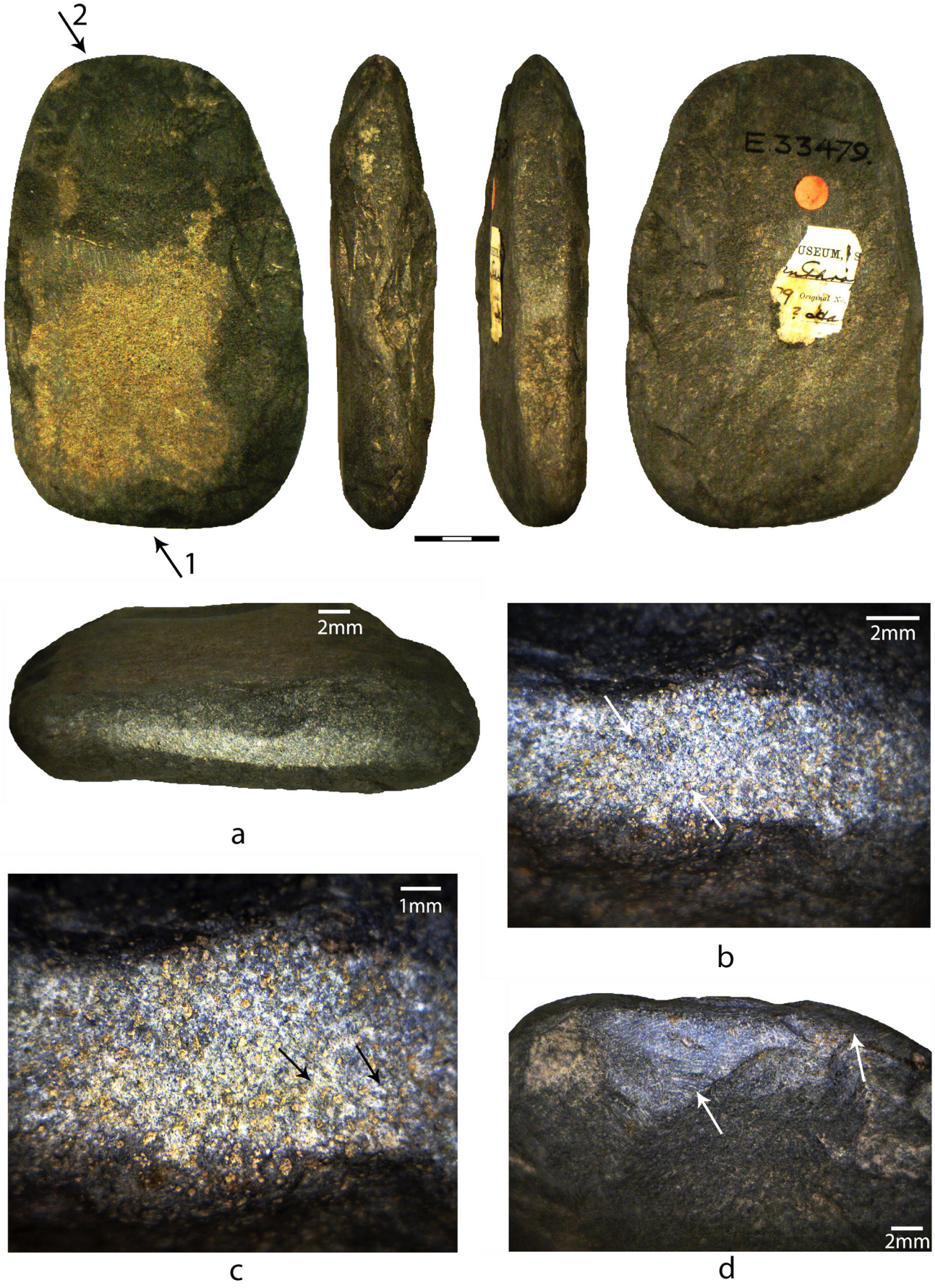

Figure 11. E033479. Hammer/pounder. Chopping/pounding non-woody plant. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, smoothed sheen and alignment (×15); *(b)* point 1, levelled surface, sheen, alignment and peck marks indicated by arrows (×25); *(c)* point 1, levelled surface with rounded rock grains, sheen, peck marks and striations indicated by arrows (×40); *(d)* point 2, blunted edge with grinding striations indicated by arrows (×15). Photographs Nina Kononenko, scale in 1 cm divisions.

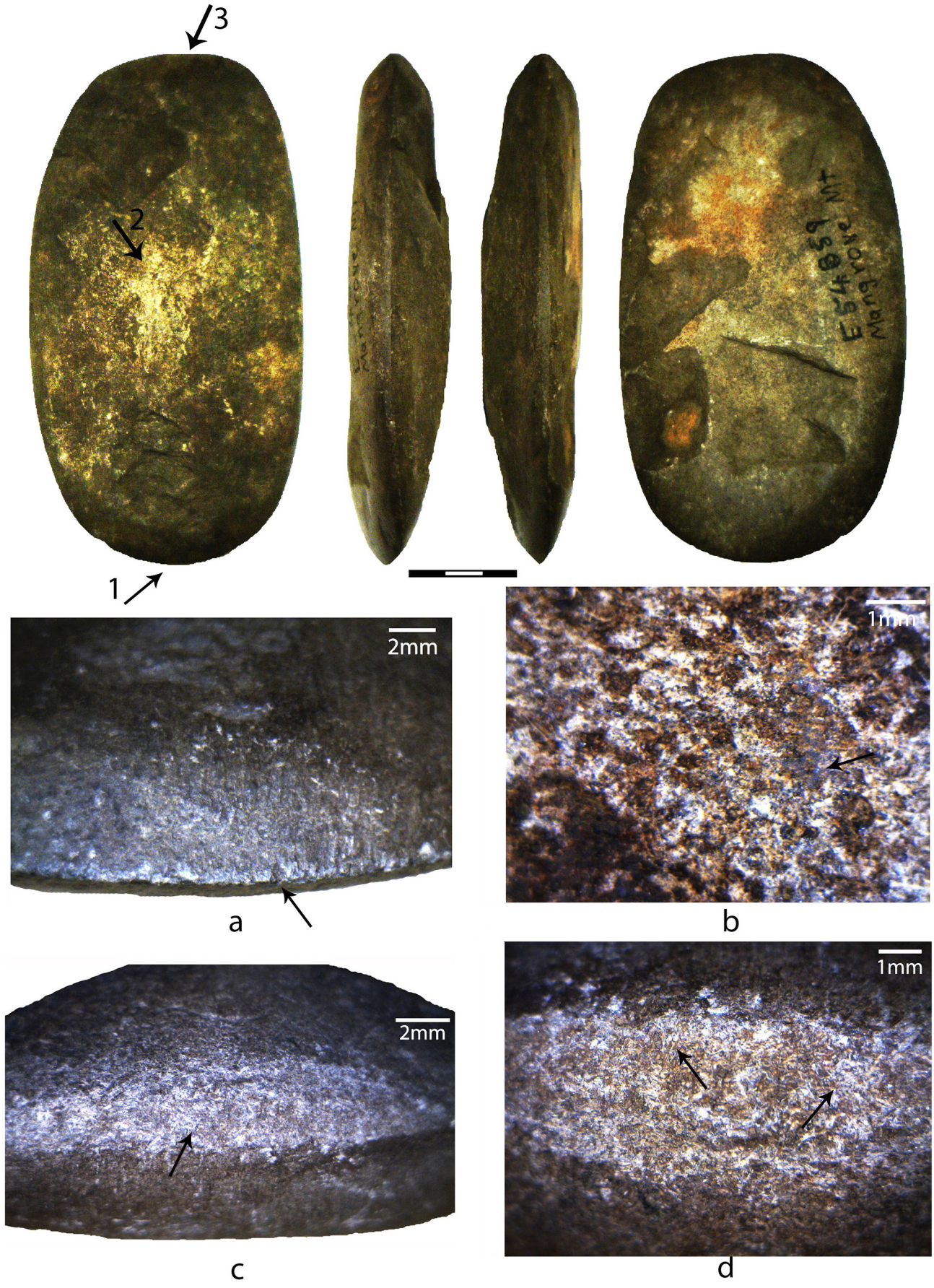

Figure 12. E054859d. Hatchet. Chopping wood and chopping/pounding non-woody plant. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, microscars, polish and striations on the edge. The arrow indicates microscars (×15); *(b)* point 2, hafting wear on the face: alignment and gloss indicated by arrow (×50); *(c)* point 3, levelled surface with peck marks and rounded rock grains indicated by arrow (×25); *(d)* point 3, levelled surface, peck marks, sheen and striations indicated by arrows (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

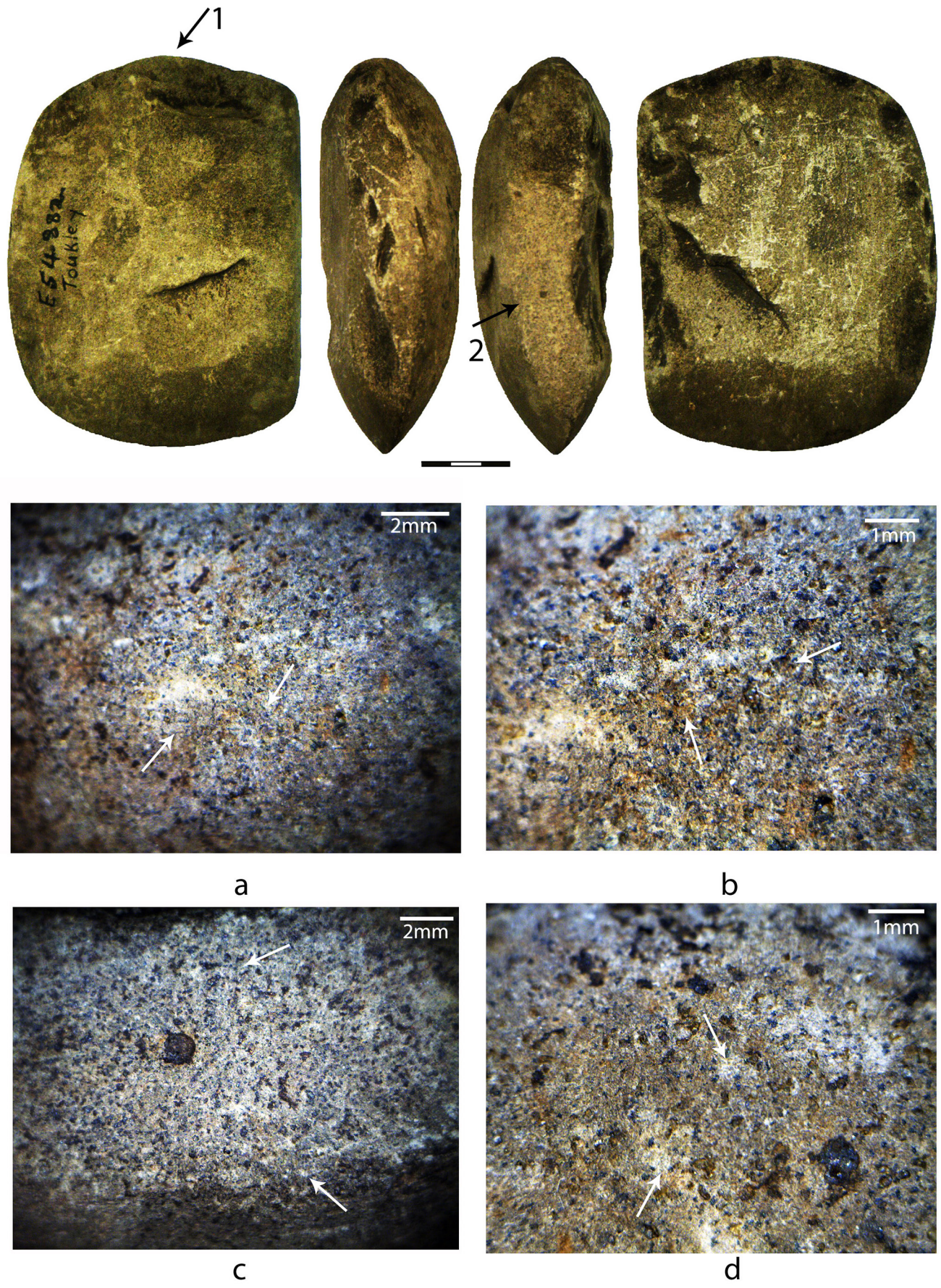

Figure 13. E054882. Hatchet. Chopping wood; pounding/grinding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks, alignment and striations indicated by arrows (×30); *(b)* point 1, levelled surface, alignment, striations and peck marks indicated by arrows (×50); *(c)* point 2, levelled surface, sheen and striations indicated by arrows (×25); *(d)* point 2, alignment and sheen indicated by arrows (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

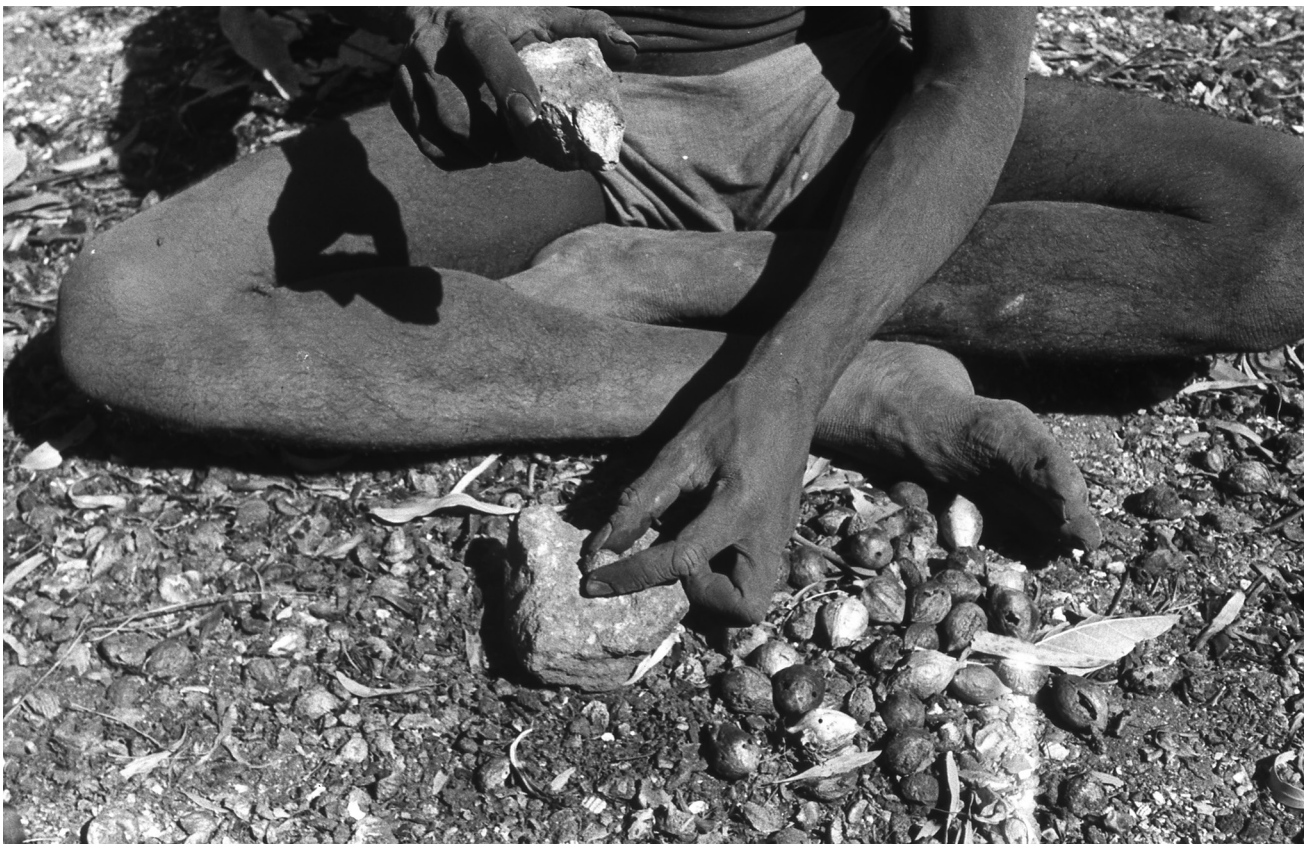

Figure 14. Man at Millingimbi, Arnhem Land, breaking open hard woody seeds to obtain the kernels. After he had broken open several hundred seeds a percussion pit was worn in the mortar. Photograph F. D. McCarthy (1976, fig 52 bottom right). Reproduced courtesy of the Australian Museum Archives Reg. No V8955-01.

for example, a ground-edge hatchet is able to both slice and pound kernels.

NSWCC artefacts. Wear on the hammer/pounders used for pounding kernels *(Wear-type 9)* is characterized by fracturing and dulling of the edge by scars and dense deep and shallow peck marks (Figs 17a, A12a). Rock grains and high points of the surface topography show extensive rounding and flattening (Figs A12a, A13c,d), and the interstices are filled by impacted residues. The worn surfaces exhibit a well-developed reflective sheen with alignments (Fig. 17b). A similar wear pattern was observed on an experimentally made, basalt ground-edged tool that was used to pound *Macrozamia* kernels for five hours (Fig. A11c,d) (Nina Kononenko Lab notes Feb. 2014).

Twelve GEAs have distinctive wear indicating their use as an anvil and/or hammer in processing nuts, including cracking nuts and pounding kernels *(Wear-types 6–9)*. Four of these tools exhibit pits deliberately made by continual pecking (E020467, E042997, E052620, E065196q) and eight show shallow depressions (incipient pits) (Goren-Inbar *at al.,* 2002: 2457) produced by pounding (E020470, E035987, E036242, E054858c, E054858d, E054861a, E059798, E065196a).

Deliberately made pits are visible on one or both faces of the GEAs *(Wear-type 6)*. The surface outside the pit margins preserve numerous rough, deep peck marks with slight abrasive smoothing of rock grains (Fig. 18a). The walls and the base of each pit are generally smoothed and show intensive flattening and rounding of the rock grains (Fig. 18a, d). The worn surfaces include a well-developed reflective sheen, alignment and a few isolated striations. The wear pattern within the pits suggests that the processed material was relatively hard but pliable and contained natural lubricants such as occur in oily nuts (cf. Dubreuil, 2004). The depth (5–13 mm) and rounded shape of the pits point to their use in cracking spherically shaped nuts possibly similar to north Queensland's yellow walnut *(Beilschmiedia bancroftii)* or black walnut *(Endiandra palmerstonii)* (cf. Ferrier & Cosgrove 2012: 110; Field *et al*. 2006). More intensive use of a hatchet as an anvil for cracking nuts is evidenced by the presence of two or more pits on both faces of E020467 (Fig. 18), E042997 (Fig. 19), E052620 (Fig. A14), E065196q (Fig. A15, A16). Hammer/pounder E052620 shows only one deliberately made pit but both faces preserve incipient pits (Fig. A14). The edge and the butt of hammer/pounder E052620 both display wear from pounding and chopping/pounding non-woody plants (Fig. A14a,b) which clearly points to it having multiple uses. The wear on the butt of hatchet E020467 is probably the result of pounding kernels (Fig. 18b). The use of its faces for cracking nuts is probably one of the last stages of its use after de-hafting.

Eight GEAs have shallow, circular or oval depressions or incipient pits (cf., Goren-Inbar *et al.,* 2002: 2457) of minimal depth (1–3 mm) *(Wear-type 6)*. These were apparently formed as a result of repetitive percussive impact between the stone surfaces and hard-shelled nuts in order to extract edible kernels (e.g., Goren-Inbar *et al.,* 2002; Lentfer *et al*., 2013; McCarthy, 1976: 47). Well-defined shallow pits contain dense rough and fine peck marks and some irregular scratches and deep cracks with rounded and levelled edges. These percussive pits also contain a lustrous sheen with a 'greasy' appearance on elevated points of the microrelief and alignment and exhibit few relatively pronounced linear and crossed striations (Figs 17d–f, A13a,b).

Based on the irregular boundary of pits on anvils, some GEAs with incipient pits were probably used as anvils (E036242, E054861a, E059798) but some were possibly used as nut-cracking hammers *(Wear-type 7)* (hatchets E020470, E065196a and hammer/pounder E035987). The

Figure 15. Experimental study—cracking *Macrozamia* seeds with stone hammer and anvil. Photograph Val Attenbrow.

Figure 16. Experimental study—pounding *Macrozamia* kernels with stone hammer and anvil. Photograph Val Attenbrow.

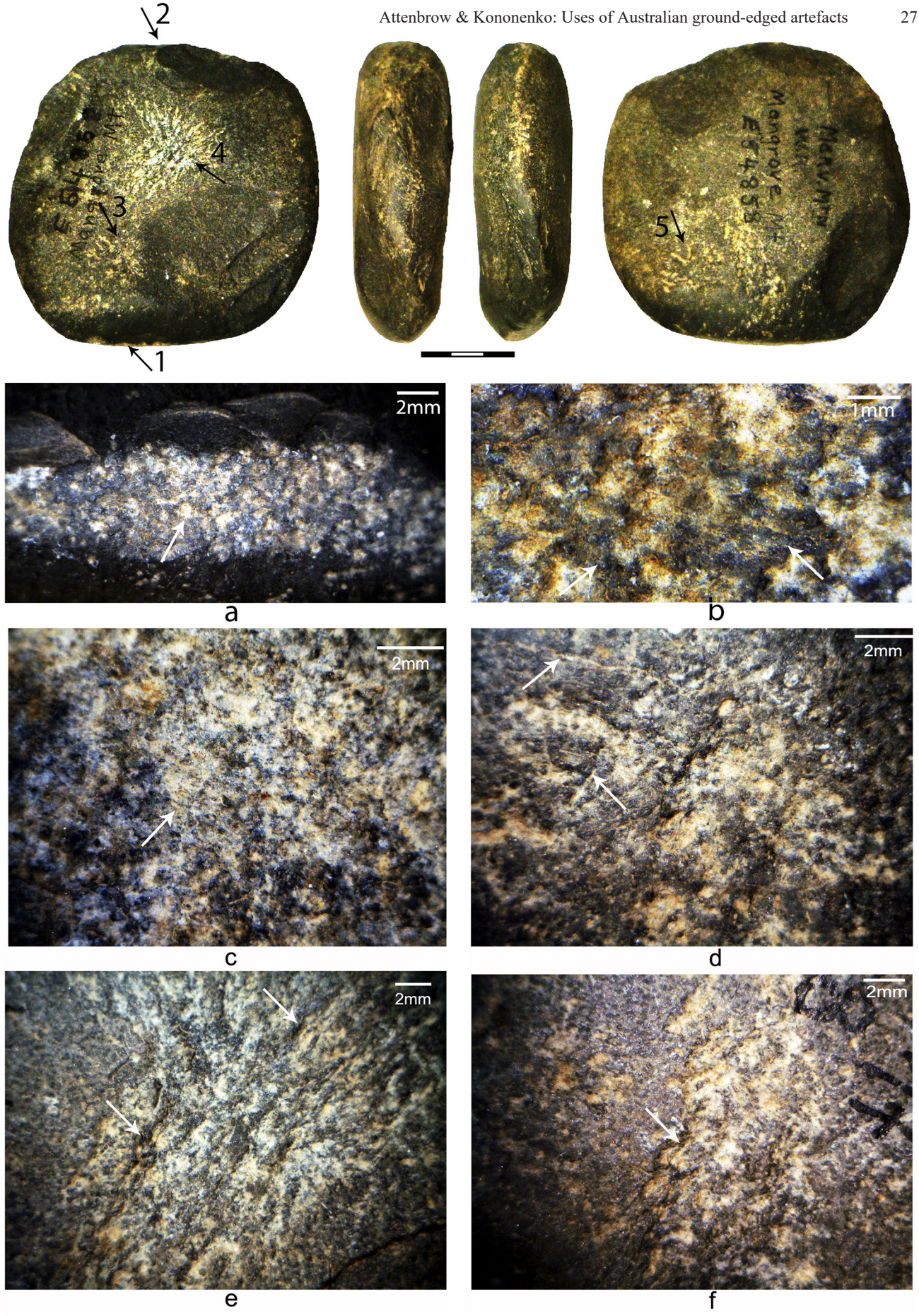

Figure 17. E054858d. Hammer/pounder. Pounding kernels. Faces and laterals with points 1–5 where images of wear patterns were taken: *(a)* point 1, levelled surface, alignment and dense peck marks filled by residues indicated by arrow (×20); *(b)* point 1, dense peck marks and levelled and rounded rock grains indicated by arrows (×40); *(c)* point 2, levelled surface, sheen, peck marks and fine striations indicated by arrow (×35); *(d)* point 3, incipient pit: levelled surface, shallow and deep peck marks, sheen, alignment and scratches indicated by arrows (×30); *(e)* point 4, incipient pit: dense peck marks, sheen, cracks and scratches with levelled edges indicated by arrows (×15); *(f)* point 5, incipient: peck marks with levelled edges, striations and scratches indicated by arrow (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

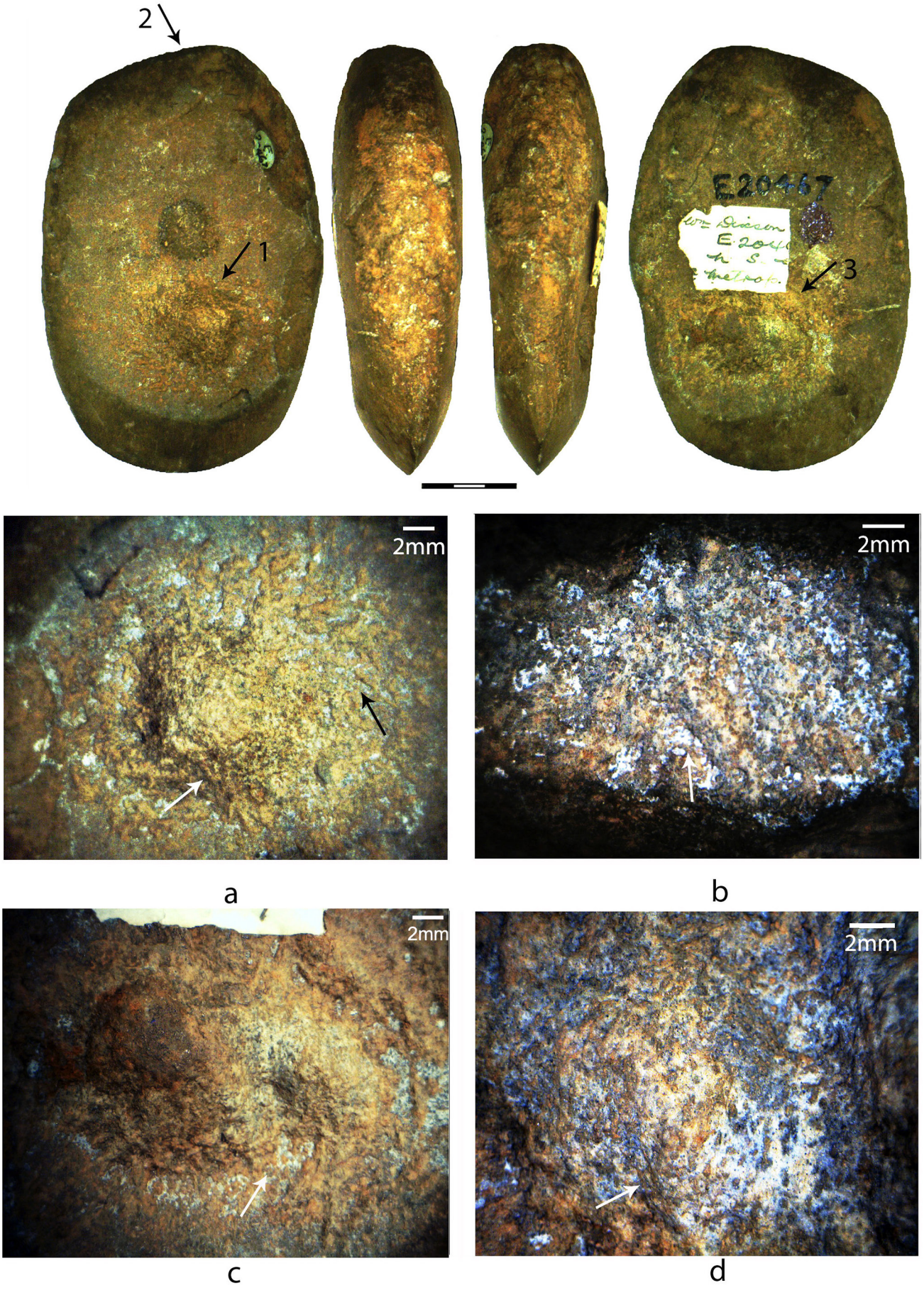

Figure 18. E020467. Hatchet. Chopping wood; cracking nuts (as anvil) and pounding kernels (as pounder). Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, pit: white arrow indicates levelled surface and sheen on the wall, black arrow indicates rough deep peck marks and abrasive smoothing (×15); *(b)* point 2, overlapped deep and shallow peck marks, levelled surface, alignment and rounded and flattened rock grains indicated by arrow (×35); *(c)* point 3, two overlapped pits with crushed rock grains indicated by arrow (×15); *(d)* point 3, levelled surface of the base and walls of the pit, sheen, alignment and striations indicated by arrow (×35). Photographs Nina Kononenko, scale in 1 cm divisions.

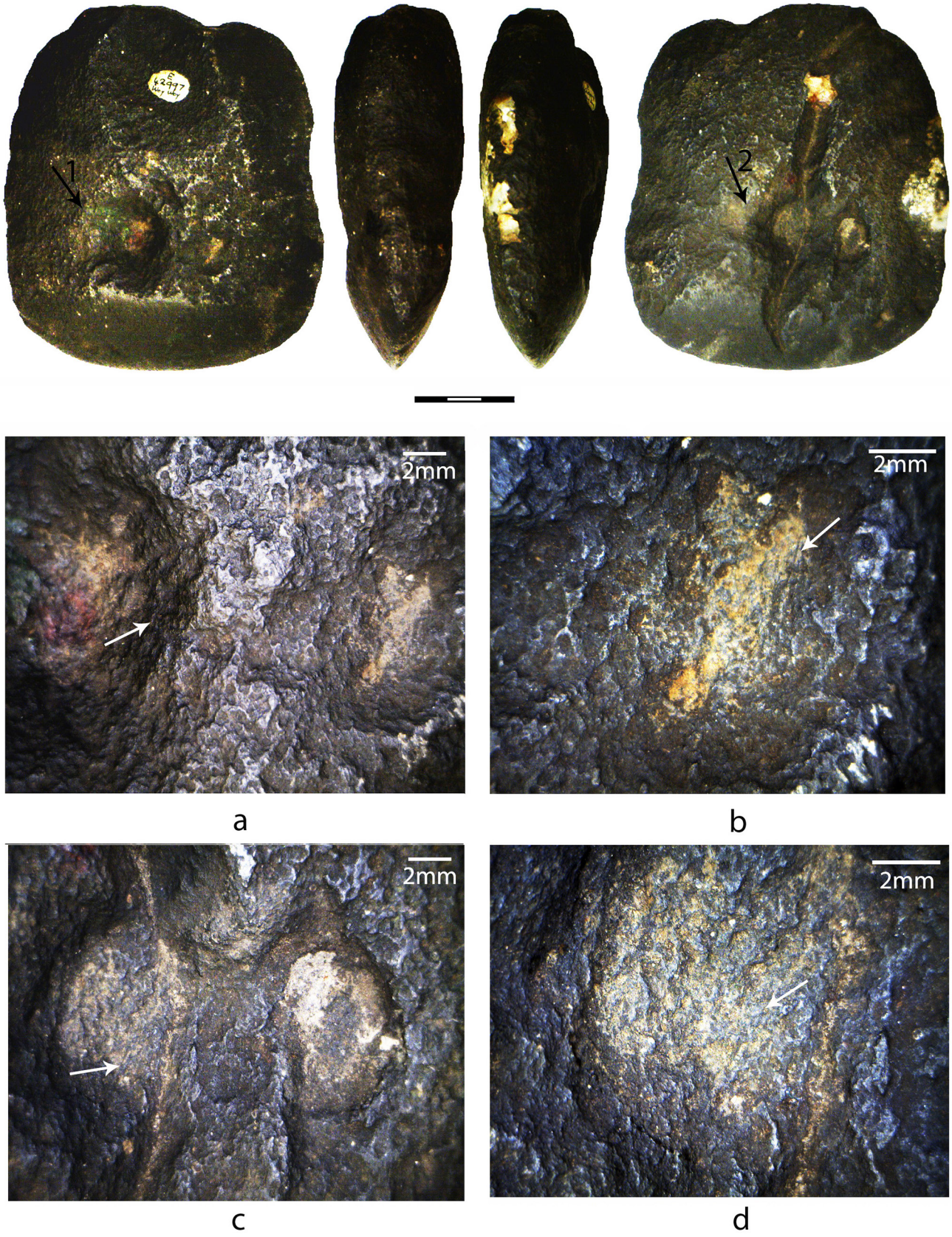

Figure 19. E042997. Hatchet. Chopping wood; cracking nuts as anvil. Faces and laterals of the hatchet with points 1–2 where images of wear patterns were taken: *(a)* point 1, pit depressions: peck marks and levelled surface of the wall indicated by arrow (×20); *(b)* point 1, pit depression: levelled surface, sheen and striations indicated by arrow (×30); *(c)* point 2, two overlapped pits with peck marks, alignment and striations indicated by arrow (×20); *(d)* point 2, pit: smoothed surface of the base and flattened rock grains indicated by arrow (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

butts of these tools, and in one case the ground edge, were also used for pounding either soft non-woody plant tissue *(Wear-type 3)* (Figs A16–A19) or kernels *(Wear-type 9)* (Figs A13, A20, A21). One artefact (E065196a) preserves wear from pounding kernels with the butt and cracking nuts with one of its faces; the opposite face shows use-wear from pounding ochre (Figs A20, A21).

Two hammer/pounders (E054858c and E054858d) have wear traces indicating their use as anvils in the processing of plant tissue such as kernels *(Wear-type 8)*. The flat faces of these tools preserve incipient pits, which are usually observed on flat faces of GEAs suggesting they were used as anvils. Semi-oval pits on the tools began as isolated scratches and peck marks and developed into deeper, closely packed cracks and pits lowering the worn surface (Figs 17e, A12b, A12d). The margins of scratches, cracks and elevated rock grains are extensively rounded and flattened (Fig. 17e). A reflective sheen with a 'greasy' appearance and alignment contain few shallow thin striations (Figs 17d, A12b, A12d). These wear patterns are similar to the surface modifications on the experimental basalt slab used as an anvil for pounding kernels for nine hours (Fig. A11e,f) (Nina Kononenko Lab notes Feb. 2014). The wear attributes on the experimental hammer and anvil used for pounding *Macrozamia* kernels for five and nine hours respectively are still only in an initial stage of formation. This indicates that more use-time is required to develop the well-defined wear patterns observed on the archaeological ground-edged hammer/pounders.

The ground edge of hammer/pounder E054858c was also used as a hammer for pounding kernels *(Wear-type 9)*. The butt, in contrast, shows two wear patterns (Fig. A12c). Firstly, a partly preserved area of percussive impacts in the form of peck marks, surface levelling and smooth sheen suggests that the butt was initially used for pounding plants. Secondly, a wide groove with a deep u-shaped cross-section, probably from polishing bone (see *Wear-types 10 and 11*), overlaps this wear pattern.

Wear from pounding kernels as a hammer *(Wear-type 9)* (E020467, E020470, E065196a) is characterized by fracturing and dulling of the edge by scars and numerous deep and shallow peck marks (Figs 18b, A13c,d, A14b, A21a,b). Rock grains and high points of the surface topography show extensive rounding and levelling (Figs 18b, A12a) and the interstices are filled by impacted/absorbed residues. The worn surfaces exhibit a well-developed reflective sheen and alignment (Fig. 17b). A similar wear pattern was observed on an experimentally made basalt ground-edged tool that was used to pound *Macrozamia* kernel for five hours (Fig. A11c,d) (Nina Kononenko Lab notes).

Wear-types 10 and 11
associated with polishing/abrading bone or shell and breaking bone

Previous studies. Bone implements were an important part of many ancient tool kits. As a raw material, bone is softer than many stones from which GEAs are made, and harder than most wood species. The hardness and resilience of bone made it a particularly useful raw material. Bone modification can be achieved by grinding or by breaking the bone on an anvil with a hammerstone *(Wear-type 11)*. This latter technique was commonly employed to extract nutritious marrow from the bone cavity and to produce sharp splinters suitable for immediate use as picks or scrapers or for further modification into more sophisticated tools (e.g., Henshilwood *et al.* 2001). The final shaping of a bone into a tool was usually done with a grinding technique using stone abraders and polishers *(Wear-type 10)* (e.g., Dubreuil & Savage, 2014; Galán *et al.,* 2009; Legrant & Dadi, 2008). According to historical and ethnographic records, bone and shell were used by Aboriginal people in various parts of Australia to make points, knives, fishhooks and other implements (e.g., Attenbrow, 2010; Francis, 2002; Kamminga, 1982: 47–51; McCarthy, 1976: 86–91). Hammerstones were also used to remove shellfish from rock-platforms. Roth (1901: 23) describes a specialized oyster-pick that was used in northern Australia for detaching oysters and other molluscs from rocks, and for breaking open the shells. McCarthy (1976: fig. 44[3]) describes one from Milingimbi (AM Reg. No E055480) as being made from 'a ground edge axe [sic]', albeit broken, and possibly no longer used for cutting/chopping. Fine-grained abrading and polishing stones were used for finishing the surfaces of bone, wood and shell implements (e.g., Kamminga, 1982: 47; McCarthy, 1976: 86; Woodford, 1908).

Experimental replication of working bone and shell by stone abraders produces a set of wear characteristics including elongated patches of smooth levelled surfaces, noticeable reflective sheen, fine long striations and rounding of edges of individual rock grains (e.g., Adams, 1993; Dubreuil, 2004; Galán *et al.,* 2009; Hamon, 2008, 2014; Hamon & Plisson, 2009; Legrant & Dadi, 2008). These characteristics were identified and used in our interpretation of wear observed on the NSWCC GEAs. There are some practical difficulties, however, in differentiating wear traces on stone tools used for working bone from those involved in processing shell. This requires further study, particularly residue analysis and experimental replication using basalt and hornfels as a raw material.

NSWCC artefacts. *Wear-type 10.* Microscopic analysis identified nine ground-edged hatchets (E005955, E012712, E025249, E042926, E044118, E052617a, E052617b, E054858c, E054859c) and two hammer/pounders (E052619, E053281) that were used in abrading/polishing bone or shell (Tables 1, 2). The common wear characteristics on these tools include a pronounced levelling of the surface with a well-developed or moderately reflective and 'greasy' sheen on the high points of the topography (Figs 20, 22). The individual rock grains are flattened and difficult to distinguish. The deep interstices are apparent as pits with sharp margins (Figs 20, A22). Alignments and a few fine striations are generally oriented in the direction of the working motion (Figs. 20, A23). The location of wear demonstrates that all parts of the tool were used for polishing: butts, laterals and both faces on E005955, E044118, E052617a and E052617b; one face on E042926; edges and butts on E052619 and E053281; or only the butt of E012712, E54858c and E54859c) (Figs 22, 23, A12, A22–A29, A35). The butt of E054858c has a wide groove with a deep U-shaped cross-section, probably from polishing bone, that overlaps pounding wear (Fig. A12c). Within the groove, the rock grains are intensively rounded and flattened. A slightly invasive smooth sheen with a 'greasy' appearance is evenly distributed across the surface topography. An alignment in the form of shallow poorly defined striations that run parallel with and slightly diagonal to the axis of a groove, reflects the direction of the actions. This wear pattern is consistent with polishing bone objects such as awls, needles, spear barbs and nose-bones (cf. McCarthy, 1976:61). One tool E052617b has evidence that its butt was probably used for breaking/crushing bone (Fig. A29b).

Working bone and shell produces pronounced surface levelling, but the fractured rock grains and striations created by shell abrasion can still be distinguishable (Hamon 2008).

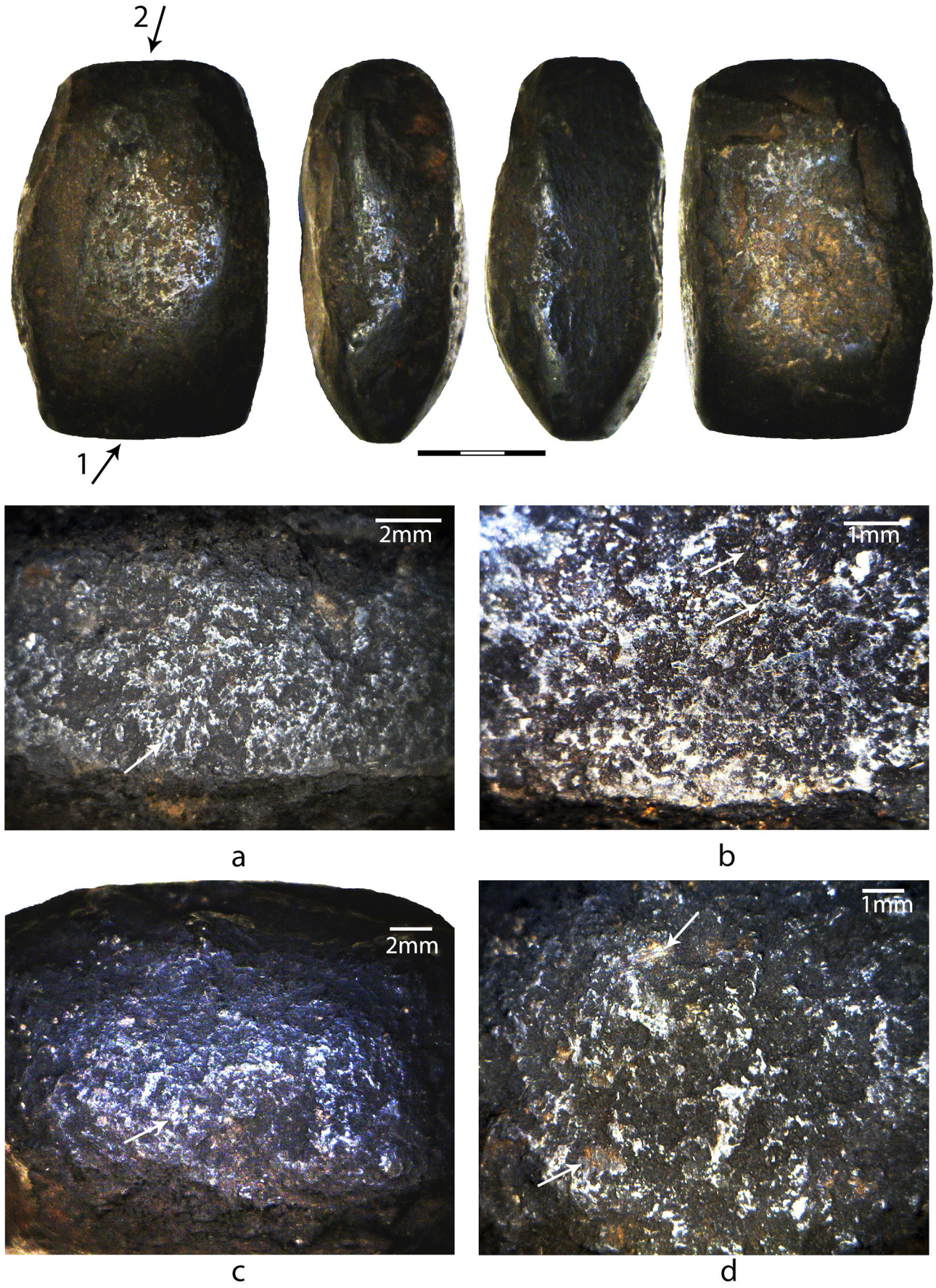

Figure 20. E053281. Hammer/pounder. Polishing bone. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface and sheen indicated by arrow (×30); *(b)* point 1, levelled surface, sheen striations indicated by arrows (×50); *(c)* point 2, levelled surface, alignment and sheen indicated by arrow (×20); *(d)* point 2, sheen and flattened rock grains indicated by arrows (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

Individual rock grains with rounded edges and fine striations are identifiable on the butt of two hatchets (E025249 and E054859c) even though the surface is extensively levelled (Figs A24a,b, A26b, d), suggesting that these tools were possibly used for abrading/polishing shell objects *(Wear-type 10).*

Wear-type 11. Four ground-edged hatchets (E031054, E042926, E054859f, E059849) have visible impact fractures in the form of step and feather scar terminations, and dense, deep peck marks (Fig. 21). All exposed edges of the rock grains are flattened, crushed and slightly rounded on worn surfaces and a slightly or moderately reflective sheen is unevenly distributed on the highest points of the topography (Figs 21, 23). Relatively levelled zones contain some long and thin striations and few deep cracks (Figs A28c, A29b). The combination of impact damage with surface levelling, sheen distribution and the presence of a few cracks and striations on this group of tools, indicate that they were used as hammers to strike and break relatively soft and resilient substances such as bone or shell *(Wear-type 11)*. Historical examples cited above support such a use for stone artefacts.

The location of percussive use damage is usually restricted to the butt and laterals (Figs A27, A28) and sometimes to the edge, as seen on hatchet E054859f. The butt of this tool preserves wear resulting from pounding plants *(Wear-type 3)* (Fig. 21). The tool E031054 is damaged by numerous deep and shallow peck marks (Fig. A27a) apparently formed during occasional use of its face as an anvil for breaking bone. Hatchet E042926 shows the use of both laterals as hammers for breaking/chipping bone or shell and additionally one of its faces indicates its use as a polisher for bone or shell (Fig. 23e).

Wear-type 12
from use as a hammerstone in knapping stone
Wear-type 13
from use as an anvil in knapping stone
Wear-type 14
from polishing/abrading stone

Previous evidence. Hammerstones and anvils involved in knapping and bipolar flaking of stone materials exhibit distinctive macroscopic damage *(Wear-types 12 and 13).* Abrasive agents are created by dislodged and crushed rock grains during forceful percussive strokes. These result in the margins of flake scars and the edges of peck marks becoming intensively levelled. The interstices are filled up by the fine powder of crushed rock grains (Adams, 1993). Similar impact fractures from percussive stone-on-stone contact were observed on the tools used as anvils for knapping stone (Goren-Inbar *et al.,* 2002; Hamon, 2008). Polishers or abraders, which also include 'files' (Hayes, 2015) *(Wear-type 14),* produce recognizable wear on the tool, in the form of a prevalent levelling of the entire surface and production of fractures on the top of the polisher's grains (Adams, 1993: 64; Hamon, 2008: 1504).

NSWCC artefacts. Ground-edged hatchets used as hammerstones for knapping stone *(Wear-type 12)* (E20469, E033647, E60861a, E060861b, E60861c, E060861d) have obvious impact fractures on several locations (Figs 24, 26, A30, A31, A32) These are heavily damaged by deep step and feather scars resulting from an immediate stone-on-stone contact (Fig. 24b–e). The edges of scars and peck marks are intensively levelled by abrasion. Abraded areas commonly have a rough texture, slightly reflective sheen on the highest points of the surface and isolated deep striations and linear cracks.

Localized areas, with shallow pitting, or incipient pits with irregular boundaries and rough interior surfaces (Figs 25c–f, 26a, A32) on the flat faces of three hatchets (E020469, E060861a, E060861c) indicate their use as anvils for knapping *(Wear-type 13)*. Numerous large deep peck marks, rough scratches and groove-like cracks on the worn surfaces have a linear appearance (Figs 25, 26). The edges of cracks and rock grains are crushed and rounded; the interstices are filled with fine powder and the surface covered by rough abrasion and isolated deep striations. The slightly reflective sheen is unevenly distributed on the highest points of the surface microtopography (Fig. 25d–f). This wear pattern is present on both faces of all three hatchets.

The butts of these tools were also used as hammerstones *(Wear-type 12)* (Figs 25b, 26b, A30) suggesting that some ground-edged hatchets were deliberately chosen for knapping stone.

The edge and butt of one hammer/pounder (E011247) are uniformly levelled by their use as a polisher (abrader or file) to work stone *(Wear-type 14)*. Rock grains on the worn surfaces are intensively fractured and flattened. A smooth reflective sheen is covered with densely packed fine and long striations indicating contact with fine-grained abrasive particles (Fig. 27). This idea is supported by comparing the wear pattern with experimentally produced wear on polishers/abraders used for polishing stone (Dubreuil, 2004; Hamon, 2008). Faces and laterals of the tool are highly polished. Deep, dense, patterned striations on well-developed reflective polished areas indicate that the surface of the tool was deliberately ground using medium-grained abrasives. Both faces of this tool have a number of fresh scratches, probably made after the artefacts were collected (Fig. 27).

Wear-types 15 and 16
from cleaning (scraping/abrading) and softening animal skins (Fig. 28)

Processing animal skin may require distinct activities and processing stages including defleshing, dehairing, braining, graining and colouring or whitening (e.g., Dubreuil & Grosman, 2009). In some parts of the world, the first stage of the skin working is to remove excess flesh, fat and extra layers of skin using a tool with sharp edges such as a scraper or knife. In the later phases of skin working, non-flaked medium- or coarse-grained stone tools are the most useful in removing remnants of flesh and connective tissue, to soften the skin, to apply braining solution, to raise the nap on the skin, or to apply colorants to the skin (e.g., Adams, 1988; Dubreuil, 2004; Hamon, 2008; Kamminga, 1982: 42–43). When a processed skin is more than a day or two old, it needs to be soaked in a solution such as eucalyptus sap, charcoal and water or lime and water. Charcoal acts as an absorbent of fat and grease and causes the epidermis to swell, making it easier to scrape off with a blunt scraper (Kamminga, 1982: 39).

Previous studies. The use of stone tools to process skins in Australia is known from the historical records (Brough Smyth, 1878: 273, 379; references cited by Flood, 1980: 54–56; Kamminga, 1982: 38–42). Overseas ethnographic studies (e.g., Adams, 1988) describe a common and widespread use of coarse- to fine-grained stone tools to abrade skins to soften them, and to work substances such as ashes, charcoal and ochre into them to improve their quality and further soften them (e.g., Adams, 2014; Dubreuil, 2004; Hamon, 2008; Kamminga, 1982: 38–42).

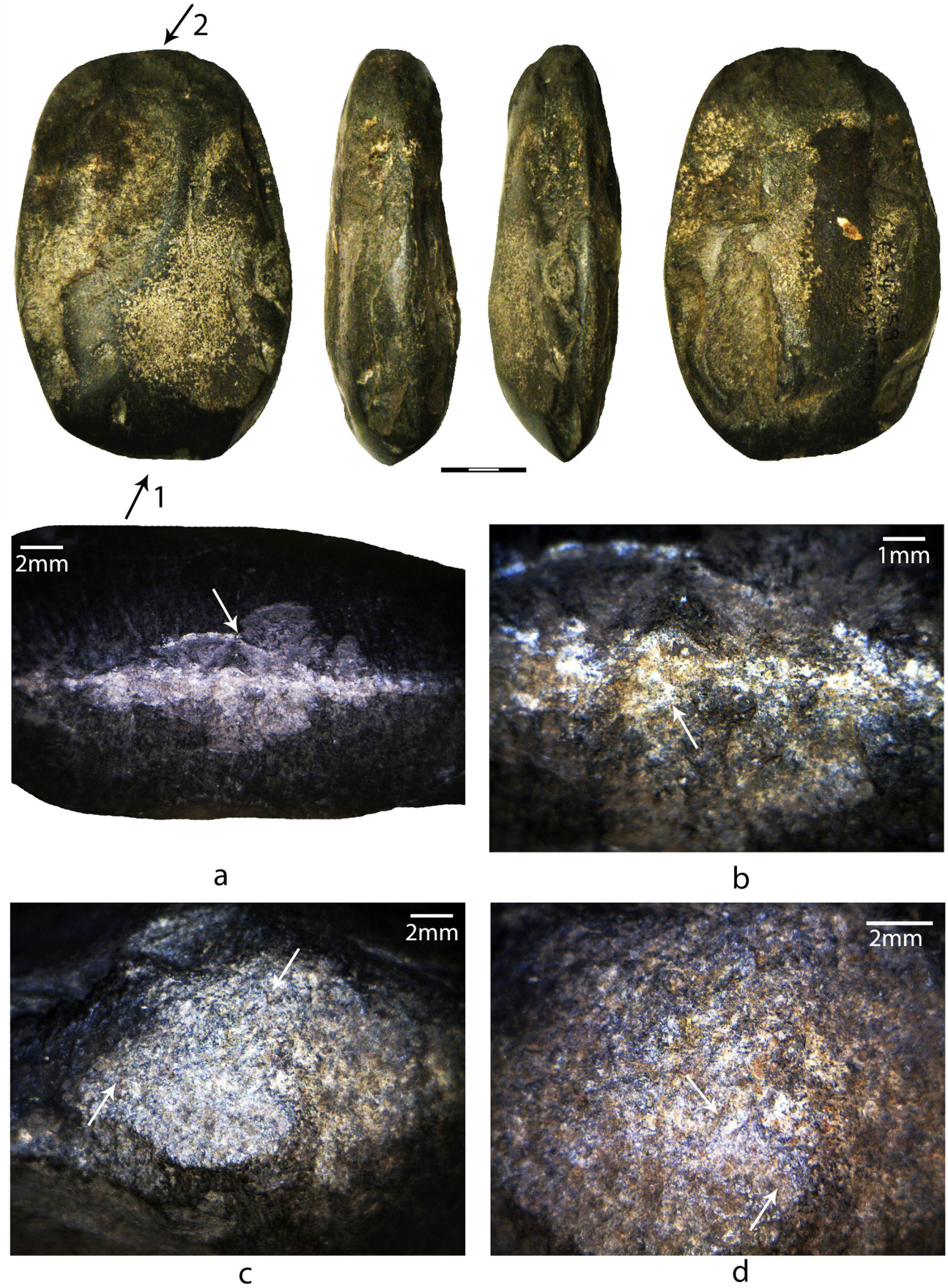

Figure 21. E054859f. Hatchet. Breaking bone as hammerstone; pounding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, battered edge and scars indicated by arrow (×20); *(b)* point 1, levelled surface and crushed rock grains indicated by arrow (×40); *(c)* point 2, smooth levelled surface, sheen and fine peck marks indicated by arrows (×20); *(d)* point 2, levelled surface, sheen, alignment and striations indicated by arrows (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

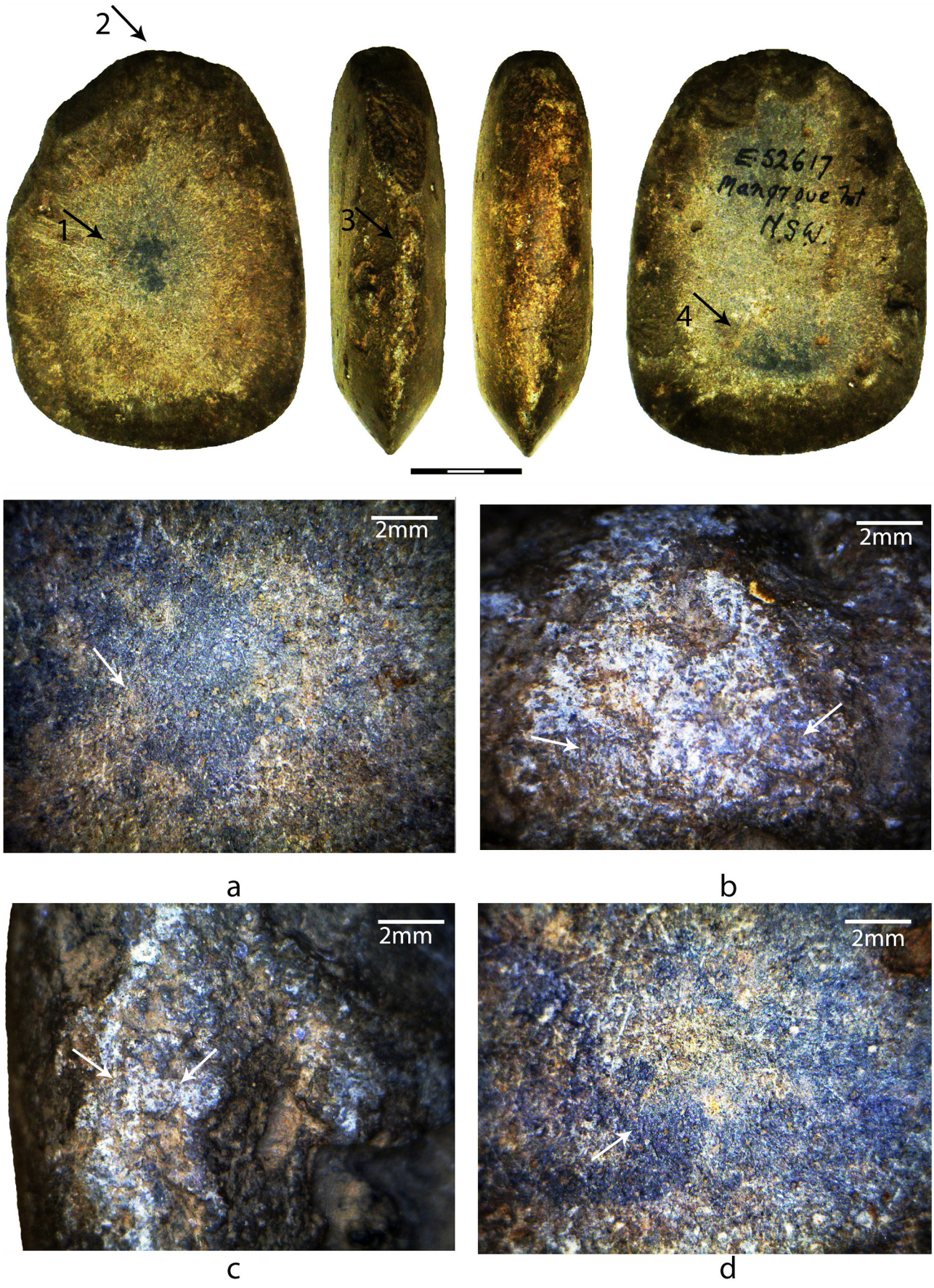

Figure 22. E052617a. Hatchet. Chopping wood; polishing bone. Faces and laterals of the hatchet with points 1–4 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen and fine striations indicated by arrow (×30); *(b)* point 2, flattened rock grains, sheen and fine striations indicated by arrows (×30); *(c)* point 3, hafting wear: gloss and isolated striations indicated by arrows (×30); *(d)* point 4, levelled surface, sheen indicated by arrow, alignment and fine striations (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

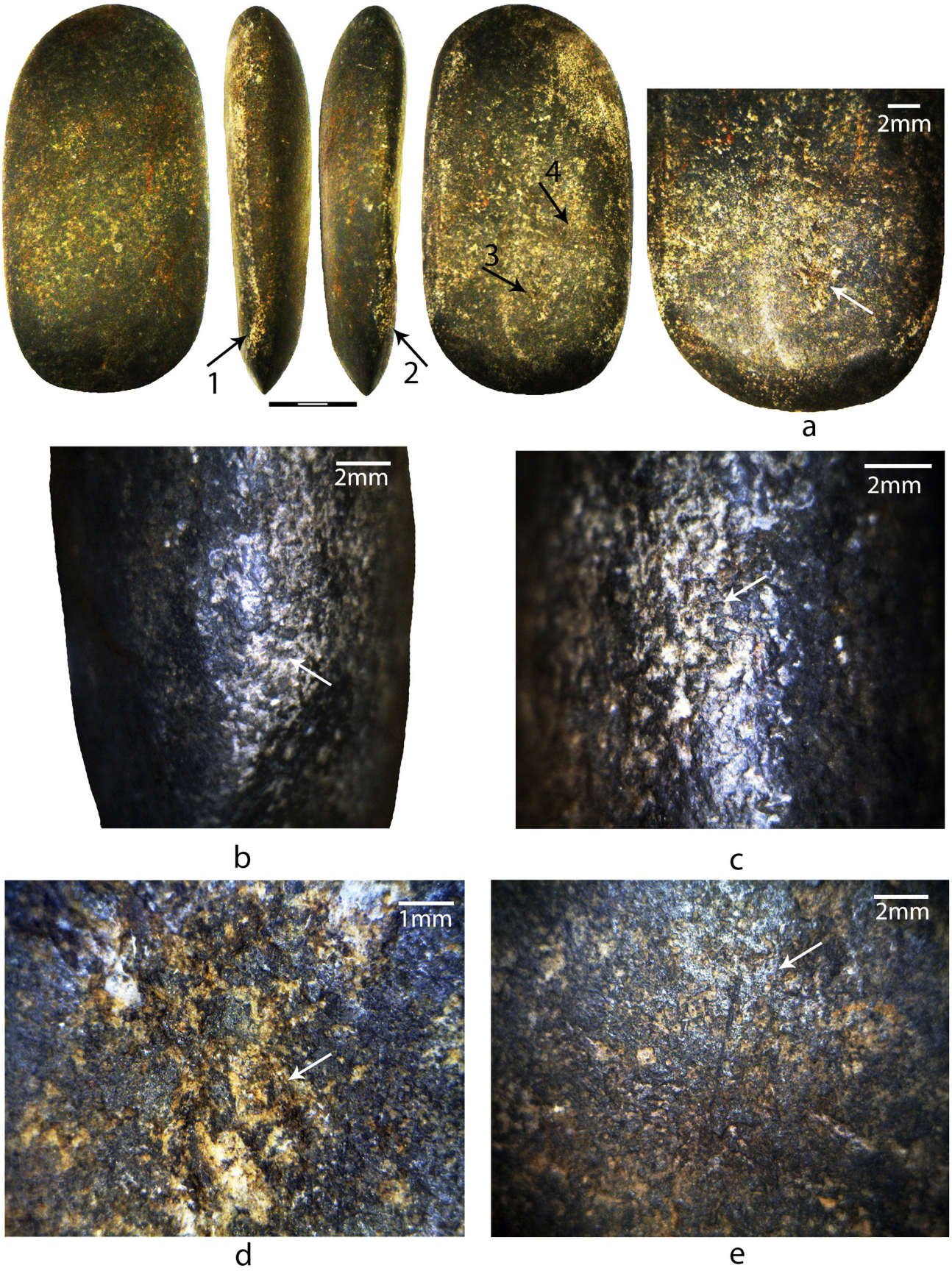

Figure 23. E042926. Hatchet. Chopping wood; breaking and polishing bone. Faces and laterals of the hatchet with points 1–4 where images of wear patterns were taken: *(a)* face 2 with impact marks indicated by arrow (×15); *(b)* point 1, alignment, rough peck marks with rounded edges indicated by arrow (×25); *(c)* point 2, alignment and rough peck marks with rounded edges indicated by arrow (×30); *(d)* point 3, rough peck marks, sheen, alignment and striations indicated by arrow (×50); *(e)* point 4, smooth levelled surface, alignment, striations and sheen indicated by arrow (×25). Photographs Nina Kononenko, scale in 1 cm divisions.

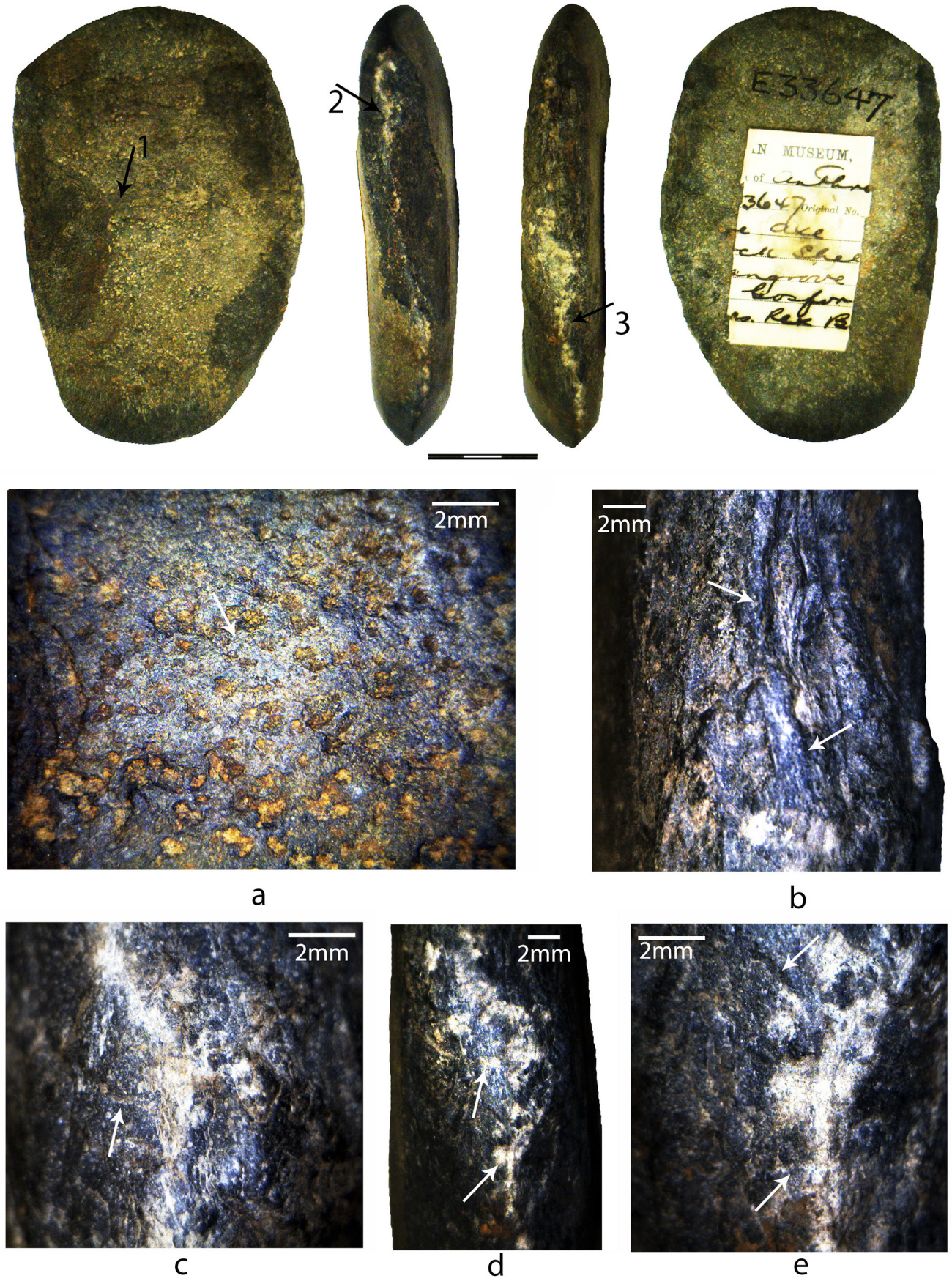

Figure 24. E033647. Hatchet. Chopping wood; knapping stone as hammerstone. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, hafting wear: smooth levelled surface, gloss, alignment and few fine striations indicated by arrow (×30); *(b)* point 2, multiple scars with rounded edges indicated by arrows (×20); *(c)* point 2, battered levelled surface, alignment and cracks indicated by arrow (×30); *(d)* point 3, scars levelled surface, alignment and peck marks indicated by arrows (×15); *(e)* point 3, peck marks, sheen and cracks indicated by arrows (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

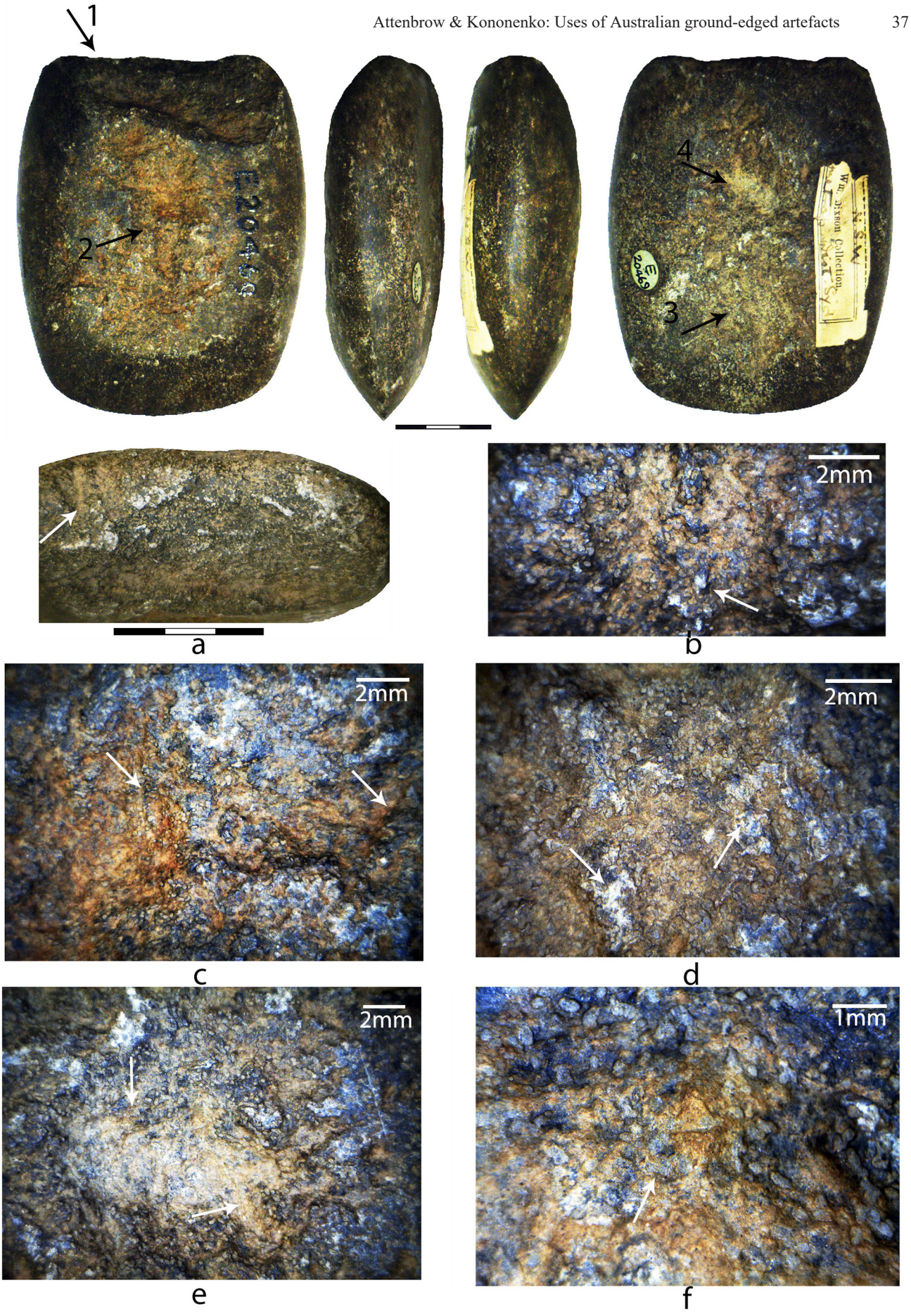

Figure 25. E020469. Hatchet. Chopping wood; knapping stone as hammerstone and anvil. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, battered surface, peck marks and groove-like scratches indicated by arrow; *(b)* point 1, groove-like scratches, deep peck marks and crushed rock grains (×30); *(c)* point 2, deep overlapping peck marks and scratches indicated by arrows (×25); *(d)* point 3, deep overlapping peck marks, crushed rock grains and superficial sheen indicated by arrows (×30); *(e)* point 4, peck marks, abrasive smoothing, superficial sheen and striations indicated by arrows (×20); *(f)* point 4, peck marks and crushed and flattened rock grains indicated by arrow (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

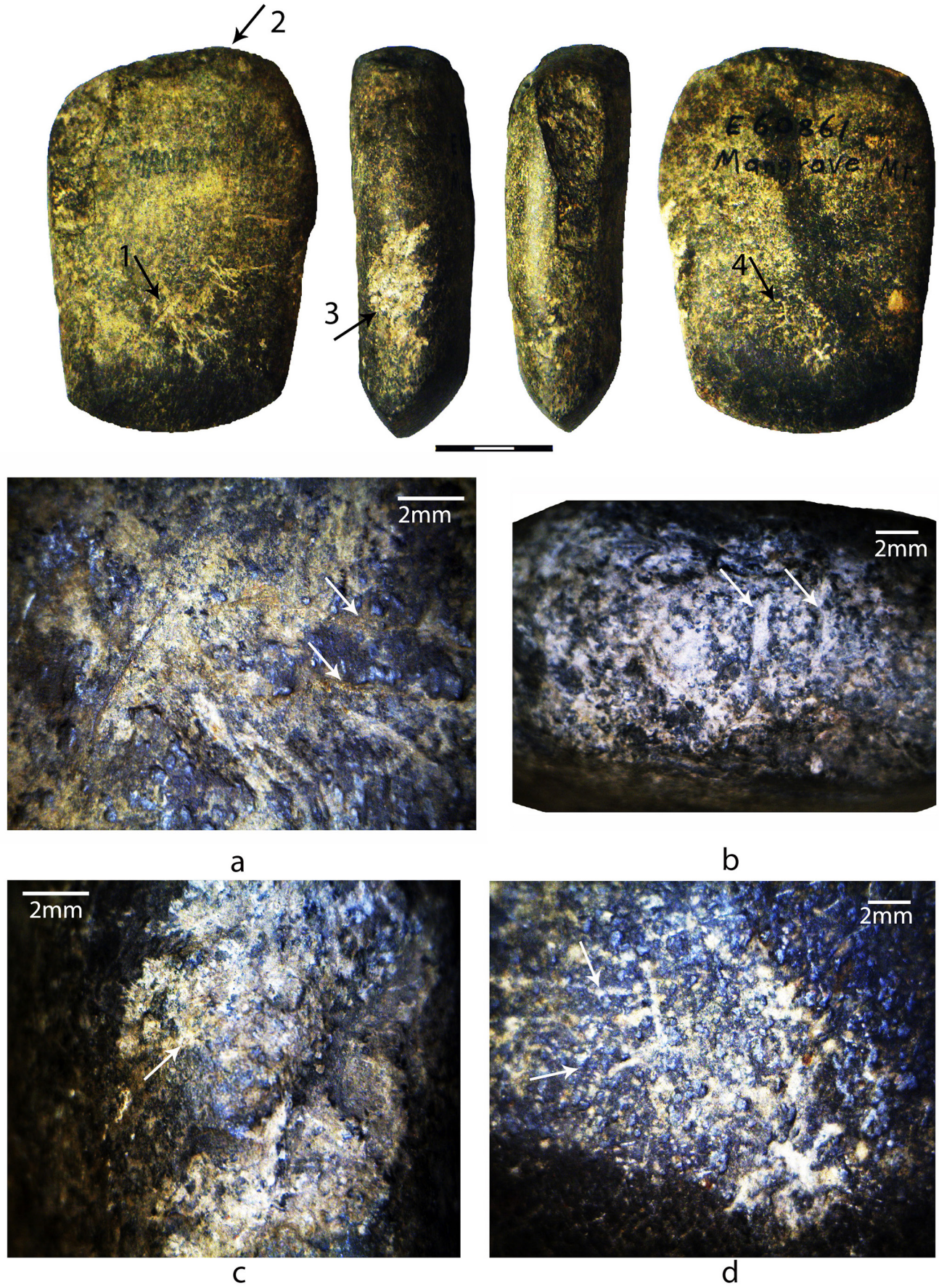

Figure 26. E060861c. Hatchet. Chopping wood; anvil and hammerstone used to knap stone. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, deep impact marks, crushed rock grains, striations and cracks indicated by arrows (×30); *(b)* point 2, peck marks with crushed rock grains and grooves-like scratches indicated by arrows (×20); *(c)* point 3, scars, peck marks and crushed and flattened rock grains indicated by arrow, (×30); *(d)* point 4, peck marks with crushed and flattened rock grains, striations and groove-like scratches indicated by arrows (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

Scraping and softening a well-lubricated, soft material, such as animal skin, produces firstly, a bright, lustrous sheen visible on the edge of scrapers and knives and on the used surfaces of handstones and ground stones, and secondly, a distinctive smoothing of the edges of the rock grains (Adams, 1988). The addition of charcoal, ashes and ochre fills the interstices with noticeable residues. Ochre, as an abrasive material, creates dense striations oriented in the direction that the tool moves, and densely patterned fractures on the rock grains (Hamon, 2008).

NSWCC artefacts. Two hatchets have use-wear on the edge and surfaces produced by skin processing (E042928, E054640). The wear on E042928 is visible as an intensively rounded edge covered by a lustrous invasive sheen *(Wear-type 15)* (Fig. A33a,b). An alignment with shallow, thin striations oriented perpendicularly to the edge together with embedded charred residues (Fig. A33b) indicate that the hatchet was used for scraping skin, possibly covered by ashes or charcoal.

In contrast, skin-working wear traces on the tool E054640 were observed on the surface of its laterals and on both faces (Figs 29, 30). The worn surfaces are characterized by lustrous sheen that surrounds the individual grains and extends into the depths of lower topographic zones. The individual grains are smoothed and levelled; and interstices are filled by ochre residues (Fig. 29a,b, e). Fine, dense striations indicate the direction of tool motion, and are associated with the distribution of sheen and ochre residues. This wear pattern with ochre suggests that the tool may have been used for softening, smoothing and perhaps colouring and curing the skin (Adams, 1988; Dubreuil, 2004; Dubreuil & Grosman, 2009; Hamon, 2008; Kamminga, 1982: 38–42).

The butts of both E042928 and E054640 were also used for pounding plant *(Wear-type 3)* (Figs 29c, A33c,d). The edge of E054640 was also used for chopping/pounding plant material *(Wear-type 5)* (Fig. 29b).

Wear-type 17
from processing/pounding ochre

Previous studies. Utilitarian and ceremonial uses of red and yellow ochre and stone tools involved in pigment preparation are widely recorded in Australian archaeology and early historical writings (e.g., Akerman *et al.,* 2014; Attenbrow *et al*., 2009; Cooper & Nugent, 2009; Geneste *et al.,* 2012; Gunn, 2009; McCourt, 1975: 138; Robertson, 2009; Robertson & Attenbrow, 2008; Robertson *et al.,* 2009). Grinding stones and hammerstones used for processing seeds could have been recycled or used intermittently for crushing dry ochre into powder (Hamon, 2008: 1516). Experimental grinding and pounding of ochre with ground stone tools shows that the abrasive property of ochres produces pronounced and distinct wear damage on the working surfaces of tools, including prevalent chipping and removal of rock grains, crushing the edges of remaining grains, levelled surfaces and shallow striations (e.g., Dubreuil, 2004; Hamon, 2008).

NSWCC artefacts. One of the faces of hatchet E065196a has an elongate incipient pit with irregular boundaries (Figs A20, A21c,d). A dense pattern of peck marks within the pit indicates frequent removal of rock grains, as well as micro-crushing and flattening of the remaining rock grains. The levelling of the worn surface is significant and the grains lack interstitial spaces (Fig. 21d). The sheen has low reflectivity and is associated with a dense concentration of fine striations with multidirectional orientations (Fig. A21c,d). There are some spots of embedded ochre residues (Fig. A21c,d,e). The combination of wear and residues suggests that this face was used for pounding ochre. Hatchet head E065196a was used for multiple activities and on more than one type of material. For example, the butt and one face of the tool has wear indicating the pounding and cracking of nuts (*Wear-types* 6 and 9) and the other face has traces of pounding ochre (Figs A20a, A21a,b).

Wear-type 18
from hafting

Previous studies: A ubiquitous method of hafting in Aboriginal Australia was the wrap-around handle, characterized by bending a strip of split vine, bark or wood around the hatchet head and filling the gaps between the stone and handle with resin or gum cement (Fig. 2, E076561). It is widely recorded in Australian historical sources (e.g., Beveridge, 1889: 68–69; Brough Smyth, 1878: Vol. 1: 365–368, figs 176–181; Dawson, 1830: 202–203; Dickson, 1976: 46; Mathews, 1895: 303; McCarthy, 1976: 47; Roth, 1904: 19; Thomson, 1936). Hafting wear is generally observed on the laterals and, sometimes, on the flat faces of GEAs. Wear is usually limited to the central portion of the artefact where it was in contact with the handle. Use-wear consists of spots of smooth highly reflective gloss with slight levelling of the topography, alignment and few shallow striations (Fig. 31). Raised grains on the worn microtopography are levelled and grain margins are rounded (Fig. 31b, d). Gloss is more developed on the highest points of the surface topography where it has been affected by contact with the handle. These shiny surfaces, or 'frictional spots' (Rots 2010: 85), were apparently formed by rock grains which were detached from the stone within the haft during use causing intense, very flat localised wear.

NSWCC artefacts. Wear from hafting has been identified on 21 of the ground-edged artefacts including one (E059798) with a deep encircling groove deliberately made by pecking and subsequent grinding. It went around the hatchet head to seat the handle (Fig. A19). The groove on E059798 contains wear in the form of gloss and striations resulting from attrition by a wrap-around handle (Figs. 31b, A19c). The appearance and distribution of hafting wear on the ground-edged artefacts suggests that they were commonly used with wrap-around handles made of woody plants.

The laterals of three GEAs (E054861a, E059798, E065196a) (Figs A18, A19, A20) have patches of wear indicating that they were hafted before or during use in nut-processing activities. The ground edge of E054861a and E065196a is damaged by scars from woodworking (Wear-type 1), and the butt has evidence of its use in pounding plants (Wear-type 3). It is equally possible that both of these two functions could have been performed while a handle was attached. Incipient pits on the faces, however, suggest percussion use after de-hafting. Hafting wear observed on the faces and laterals of another seven other tools (Figs 21, A24, A25, A27, A28, A29, A35) is apparently related to earlier events when these artefacts were used as woodworking tools (E025249, E031054, E044118, E052617b, E052619, E059849 and E054859f).

Hatchet head E044118 has resinous residues probably related to hafting (Fig. A25d). Plant fibres on hatchet E042928 (Figs A33, A34) are associated with wear from hafting, but the fresh state of residue preservation points to a modern contaminant of recent origin.

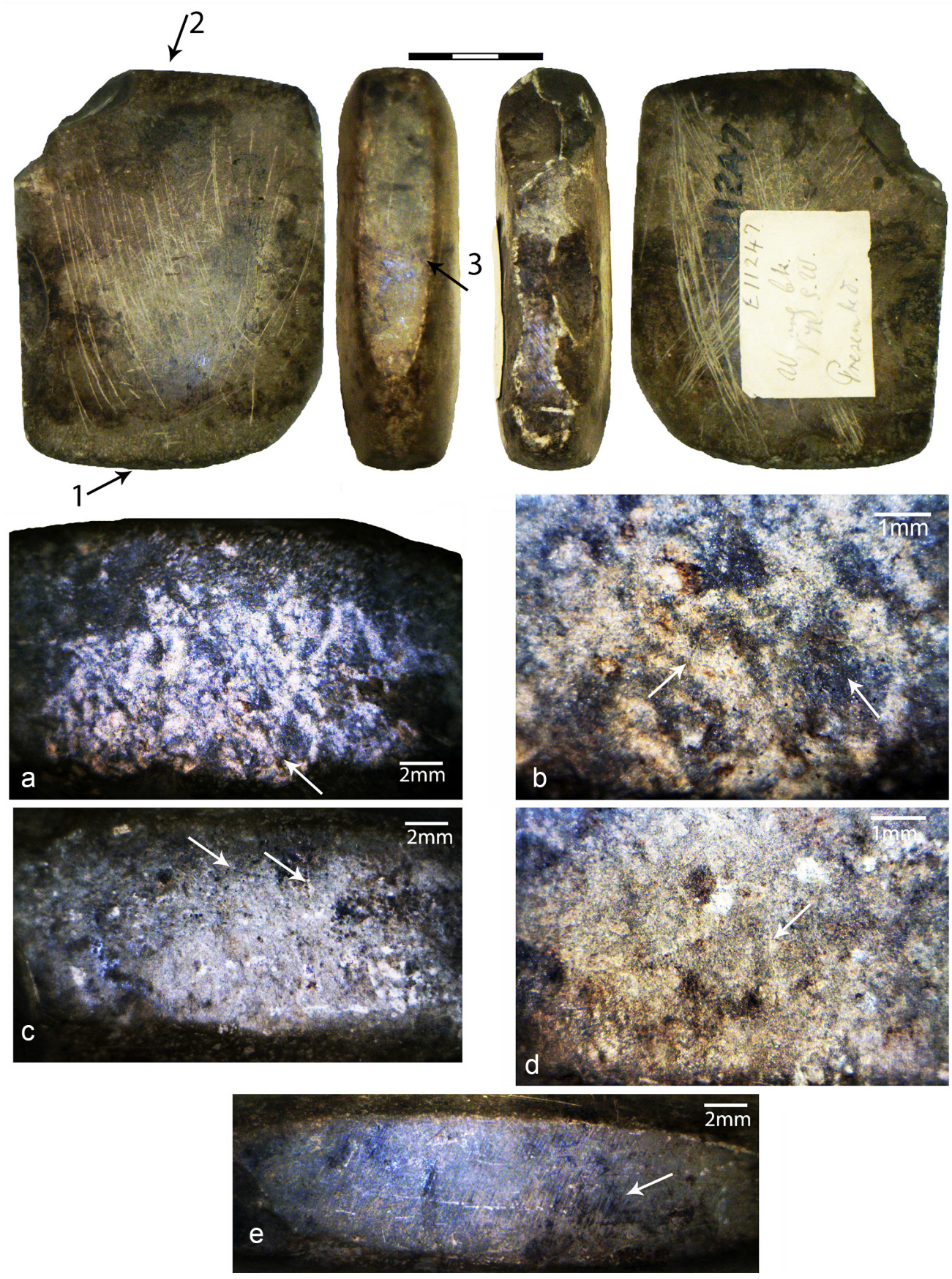

Figure 27. E011247. Hammer/pounder; polisher for stone. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen, alignment and striations indicated by arrow (×20); *(b)* point 1, levelled surface, sheen, alignment and striations indicated by arrows (×50); *(c)* point 2, levelled surface, sheen, alignment and striations indicated by arrows (×20); *(d)* point 2, smoothed surface, flattened rock grain, sheen, alignment and striations indicated by arrow (×50); *(e)* point 3, ground profile with grinding striations indicated by arrow (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

Figure 28. People processing skins, NSW South Coast c.1840–1850, by J. Browne (State Library of New South Wales, PXA 1689/f.64).

Summary and discussion

Our use-wear analysis has established that each of the 51 NSW Central Coast GEAs has evidence of having or having had a deliberately made ground edge, despite the presence of heavy battering on some GEAs. In addition to the edge, use-wear survives on other parts of the GEAs: butts, faces and laterals. Wear patterns identified on these 51 GEAs lead to a number of important observations regarding the use of this group of tools. In addition to the activities recorded in the historical literature, our study identified a range of other functions and materials for which they were used. Many have evidence of having been hafted.

Use-wear traces and wear-types

Use of GEAs as pounders, hammers and anvils created distinctive wear patterns characterized by:

- particular forms of scarring;
- closely-spaced and often overlapped impact peck marks;
- fractured and crushed rock grains;
- flattening and abrasive smoothing of the working surfaces;
- broad alignments of sheen; and
- striations with varying orientations.

Use of GEAs for non-percussive actions such as grinding and polishing/abrading is associated with the formation of:

- distinctive smoothing and levelling of the worn areas; and
- evenly distributed sheen on elevated points of the surface topography with pronounced alignment and shallow sub-parallel striations.

Use-wear in the form of scattered peck marks occurs on a few grinding stones or polishers that suggest interchangeable grinding in conjunction with pounding actions (E031898, E032843, E054858a, E054882) (Figs 13, A8, A9, A10).

The ground edges on 40 of the GEAs are relatively well-preserved but blunted by intensive microscars and rounded from woodworking, with no evidence of other contact materials. In contrast, other parts of these tools (butt, laterals, faces) were used for several other functions and with a variety of materials (Table 1). Exceptions are four hatchets that were used solely for woodworking activities: E057828 and E065196e were used for chopping wood (Figs 4, A1), E017183 was used as a wedge, and E027596 was for chopping wood as well as being used as a wedge.

While working similar materials, the same part of the tool was often used for different activities, e.g., the butt of a GEA was used to pound and occasionally grind non-woody plant material. However, different parts of a tool could be used for different activities (e.g., the butt was used for pounding non-woody plant, the ground edge was used for chopping/pounding non-woody plant, while the faces served as anvils to crack nuts or knap stone.

The 11 tools referred to as ‘hammer/pounders’ have their ground edge dramatically modified (battered to a flat or flattish surface) by activities unrelated to woodworking (see below). The faces of these tools still preserve distinct design features that are associated with grinding the edges to

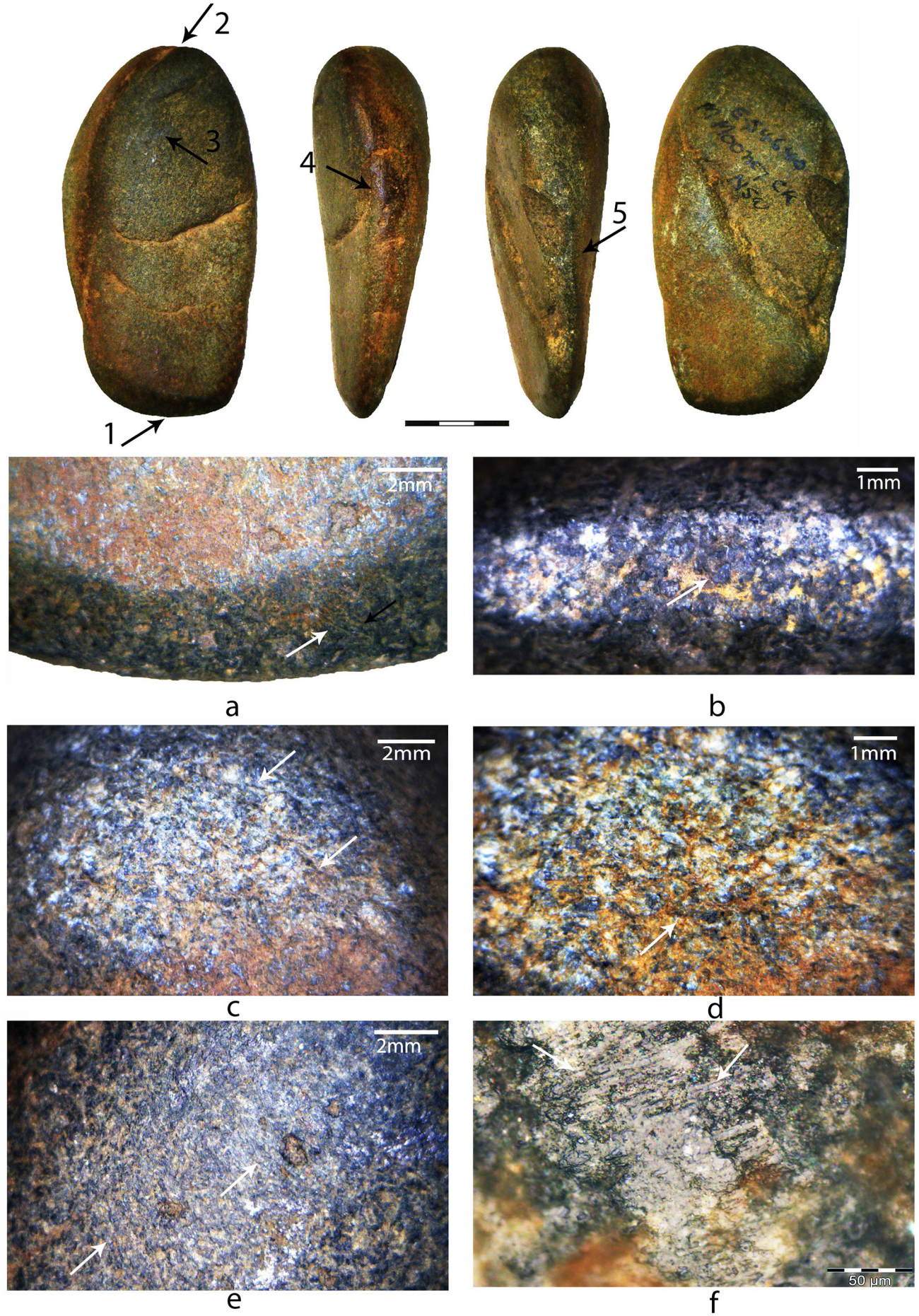

Figure 29. E054640. Hatchet. Skin-working; chopping/pounding non-woody plant; pounding non-woody plant/seeds. Faces and laterals with points 1–5 where images of wear patterns were taken: *(a)* point 1, ground edge with abrasive striations from resharpening indicated by arrows (×30); *(b)* point 1, levelled surface, alignment, sheen and peck marks with rounded rock grains indicated by arrow (×40); *(c)* point 2, levelled surface, sheen, alignment, peck marks and scratches indicated by arrows (×25); *(d)* point 2, levelled surface and scratches indicated by arrow (×40); *(e)* point 3, smooth levelled surface, sheen, alignment and fine striations indicated by arrows (×30); *(f)* point 3, micropolish and striations indicated by arrows (×500). Photographs Nina Kononenko, scale in 1 cm divisions.

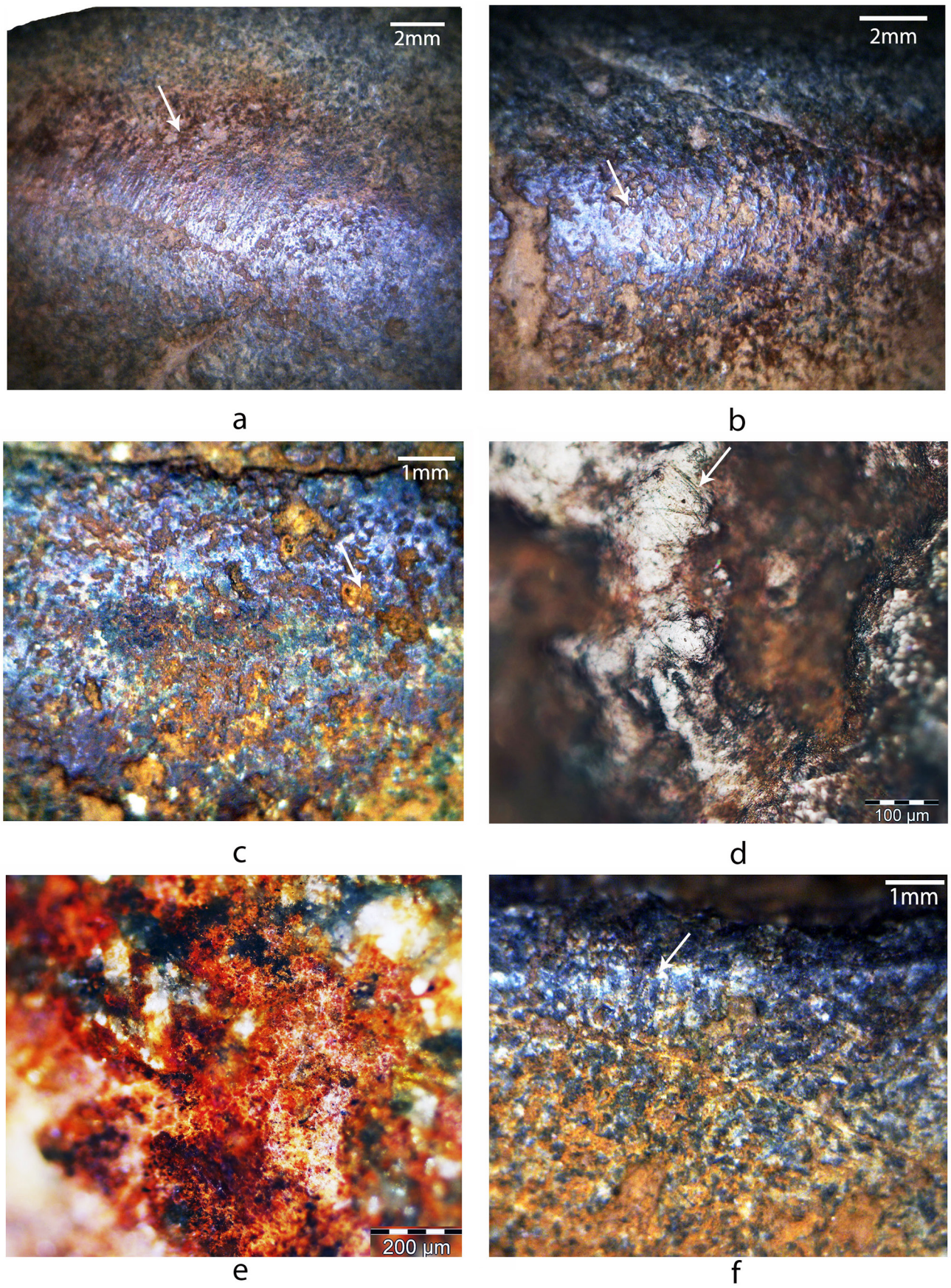

Figure 30. E054640. Hatchet. Skin-working; chopping/pounding non-woody plant; pounding non-woody plant/seeds. Wear patterns and residues at points 4–5: *(a)* point 4, levelled surface, sheen, striations and ochre residues indicated by arrow (×25); *(b)* point 4, levelled surface, alignment and bright invasive sheen indicated by arrow (×30); *(c)* point 4, levelled surface, sheen, alignment and fine striations indicated by arrow (×50); *(d)* point 4, micropolish and fine striations indicated by arrow (×200); *(e)* point 4, embedded ochre residues (×100, polarized light); *(f)* point 5, edge rounding, sheen, alignment and rounded rock grains indicated by arrow (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

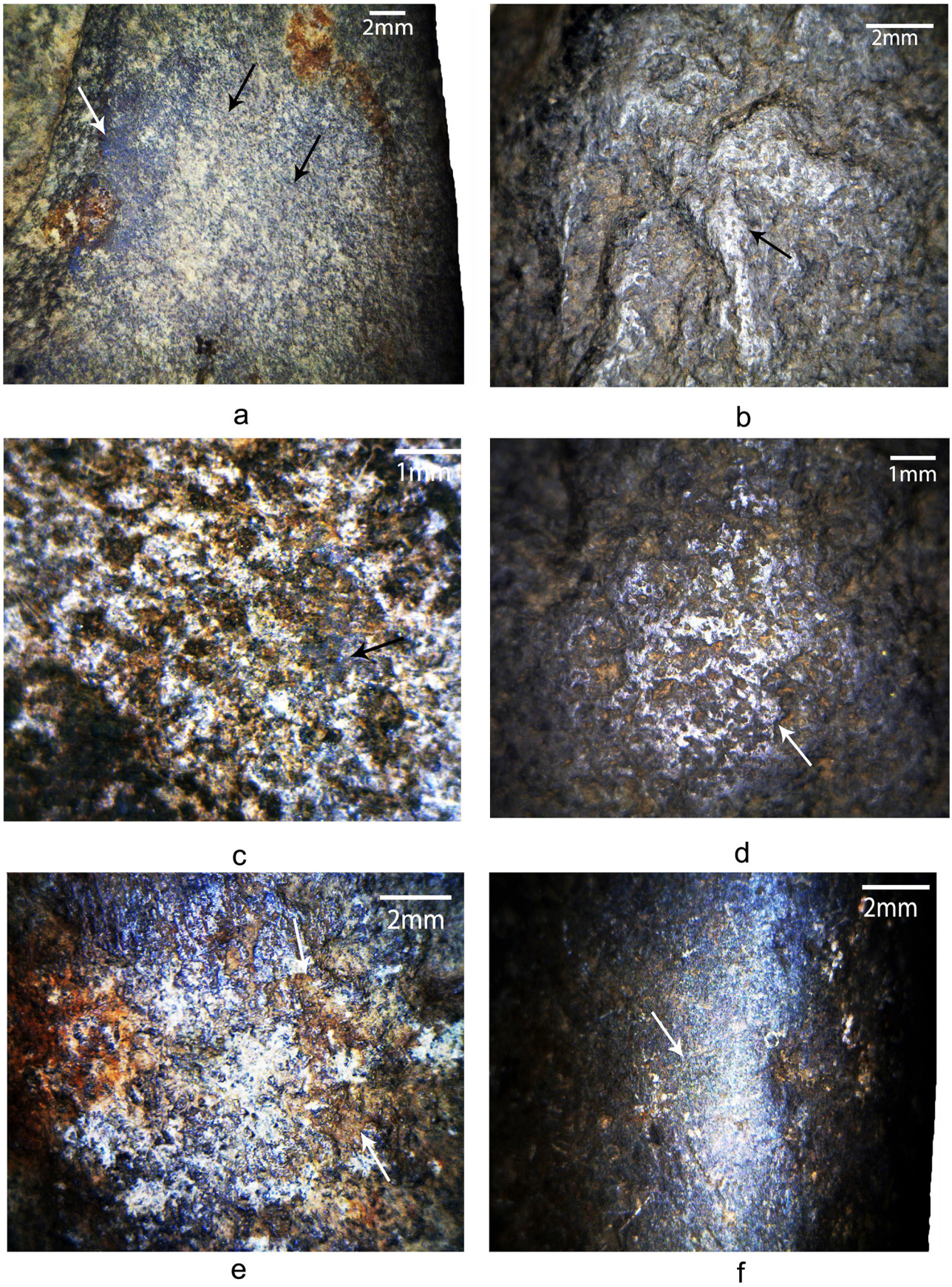

Figure 31. Hafting wear on hatchets and hammer/pounders: *(a)* E017183, smoothed surface, alignment, gloss (white arrow) and striations (black arrows) (×15); *(b)* E059798, rounded ridges with reflective gloss indicated by arrow (×30); *(c)* E054859d, levelled surface and gloss indicated by arrow (×50); *(d)* E059797, levelled surface and bright sheen indicated by arrow (×40); *(e)* E054861a, gloss, alignment and striations indicated by arrows. Red coloured residue is associated with wear traces and is probably resulted from the hafting (×30); *(f)* E059849, gloss, alignment and fine striations indicated by arrow (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

Table 3. Tools, activities and materials worked by ground-edged artefacts from NSW Central Coast.

tool-type, activity and material worked	number of GEAs with evidence of activity
HATCHET for chopping wood	35
WEDGE for splitting wood	2
CHOPPER/POUNDER for processing non-woody plants	7
GRINDER for processing non-woody plant	4
POUNDER for processing non-woody plants, seeds and roots	23
ANVIL for cracking nuts, pounding kernels, knapping stone and powdering ochre	15
HAMMER for breaking bone and knapping stone	10
POLISHER/ABRADER for working bone and stone	2
SCRAPER for cleaning and softening animal skins	2

Table 4. Number of wear-types on individual ground-edged artefacts from the New South Wales Central Coast (based on Table 1).

number of wear-types	GEAs	
	number	%
1	8	16
2	27	53
3	15	29
4	1	2

shape for woodworking. However, in the later stages of their use-life, their edges were used for activities such as pounding or chopping/pounding non-woody plants, polishing bone and stone, breaking bone and scraping skin (Tables 1, 2, A3).

Activities and materials worked

Our study identified a range of activities for which the GEAs were used (Tables 1, 2). In undertaking these activities, the GEAs acted as a number of different 'tool types' (Table 3). Most GEAs have evidence of being used for more than one activity, with the maximum being four (Table 4). Most GEAs had two or three wear-types identified.

The GEAs that had evidence for only one activity include the two hatchets with extensive evidence of only woodworking, and five hammer/pounders, on which the latest wear may (or may not) have obliterated traces of any previous activities that may have existed on the ground edge. Most of the hatchets and hammer/pounders with multiple activities had two or more working surfaces: i.e., the ground edge, one or both faces, one or both laterals, and/or the butt (Table 1).

Wood was the most commonly worked material (71% of the GEAs), followed by non-woody plants (including seeds and roots) (45% of the GEAs) (Table 5). Soft non-woody plants as a group (including kernels and nuts), however, were processed by a large proportion of GEAs (38, 75%).

A large number of GEAs (39, 76%) has evidence of more than one worked material (Table 6). One GEA has evidence of processing four different materials (E.65106a: wood, plant-nut shells, plant-kernels, ochre, as well as evidence for hafting; Table A3).

The combination of activities carried out, materials worked and parts of the GEAs with traces of use, varied for individual tools. For example:

- E042928 has wear from working wood and scraping animal skins on the ground edge, and pounding soft non-woody plants on the butt (Figs A33, A34);
- E054640 has wear from pounding plant/seeds on its butt, from chopping/pounding plant tissue on its ground edge, and from scraping skin on both laterals and one face (Figs 29, 30);
- E054859f has wear on its edge from its use as a hammerstone in breaking bone, and on its butt from pounding plant/seeds (Fig. 21);
- E060861a has wear from pounding plants on its butt which was overlain by wear from knapping stone (with the butt used as a hammerstone); both faces have wear from use as an anvil, in addition to chopping wood with its ground edge (Fig. A32);
- E065196a has wear on one face from its use as an anvil to crack nuts; its butt was used to pound kernels, and the other face was used as an anvil to pound ochre (Figs A20, A21).

On five GEAs (E033280, E042883, E042929, E054857, E054859d), the location of wear on the butt, or ground edge combined with hafting wear implies their alternating use for both chopping wood and chopping/pounding non-woody plants or seeds at a stage when the implements were hafted. GEAs removed from their handles were also used for percussion activities.

Table 5. Number of ground-edged artefacts from the NSW Central Coast with identified worked materials (based on Table A3).

material worked	number of GEAs with identified worked material	
	number	% [b]
Animal skin	2	4
Bone/shell	14	27.5
Kernels	5	10
Nuts	10	20
Ochre	1	2
Soft [a]	23	45
Stone	7	14
Wood	36	71

[a] non-woody plant tissue (including seeds and roots)
[b] percentage of 51 ground edged artefacts (GEAs)

Table 6. Number of materials worked on individual ground-edged artefacts from the New South Wales Central Coast (based on Table 1).

number of worked materials	number of GEAs
1	12
2	32
3	6
4	1

Hammer/pounders

Hammer/pounders were initially identified on the basis of macroscopic edge damage—a battered ground edge resulting from use (Attenbrow *et al*. 2017). Eleven hammer/pounders were selected for use-wear analysis: E011247 (Fig. 27), E033479 (Fig. 11), E033480 (Fig. A6), E035987 (Fig. A16), E052619 (Fig. A35), E052620 (Fig. A14), E053281 (Fig. 20), E054858a (Fig. A8), E054858c (Fig. A12), E054858d (Fig. 12), E059797 (Fig. A7).

During the use-wear analysis, several other hatchets were seen to have battered laterals and/or butts (but not battered ground edges) (e.g., E036242 (Fig. A17), E054640 (Fig. 29) and E054859d (Fig. 12). It would seem that, in addition to the GEAs listed as hammer/pounders in Table A2, these GEAs could also be regarded as 'hammer/pounders'.

Some hammer/pounders, e.g., E054858c (Fig. A12) and E054858d (Fig. 17), apparently had a long and complex use-history. E054858d has three deliberately ground edges used initially for woodworking and then re-used as a hammer for pounding kernels. The flat faces of E054858d also served as anvils for pounding kernels (Fig. 17).

Our use-wear analysis confirmed the distinctiveness of the hammer/pounders and identified their use for a variety of non-woodworking functions. In addition to use-wear on their ground edges, other parts (butt, faces, laterals) of all hammer-pounders preserve wear traces that indicate they were used for multiple activities (Table 2). It is also important to stress that, in the case of hammer/pounders E052619 and E053281, though the final stage of their use is related to polishing bone (Figs 20, A35), the intensively flattened and widened ground edges of these artefacts suggest that they were previously engaged in chopping/pounding non-woody plants.

Craft activities and food processing

In addition to woodworking, 29 GEAs have evidence of other craft activities (cf. Van Gijn, 2010) that include making stone tools, polishing bone or shell, breaking bone, preparing skins and processing ochre (Wear-types 2 to 17). Many of the GEAs were used as a hammerstone or an anvil (Tables 1, 2). Surprisingly, a large number of these tools (13) were used for working bone or shell as polishers/abraders and, to a lesser extent, as hammerstones (Tables 1, 2). Wear from polishing bone is observed on all parts of several GEAs while percussive use-wear on those used as a hammerstone is usually restricted to the butt and laterals.

Fewer GEAs were involved in activities such as making stone tools (7) and cleaning, softening and colouring animal skins (3); one was used for pounding ochre as well as for cracking and pounding nuts (Figs A20, A21). Hafting wear on many of these implements (e.g., E025249, E031054, E044118, E052617a, E052617b, E052619, E054859f, E059849) was preserved from their previous use, probably as hafted woodworking tools.

Both hatchets and hammer/pounders were used for craft and food processing activities (e.g., making tools [27] and processing food [29]). Six GEAs were used for both craft and food-processing activities. It is significant that a large number of GEAs with multiple functions were associated with activities such as processing plant foods (e.g., seeds, nuts, rhizomes). In our study, nine tools were used in pounding and chopping/pounding non-woody plants. Grinding plants (e.g., seeds) with a GEA was relatively rare (only four tools: E031898, E032843, E054858A, E054882). In contrast, more GEAs were employed as anvils (10) and hammerstones (3) in cracking nuts; and as anvils (2) and pounders (5) in pounding kernels (Table 2). This use-wear/residue evidence for processing food plants expands the pre-1900 historical descriptions which make no mention of GEAs being used in processing food plants.

Suggestions that GEAs were used for non-woody plant processing were made by early 20th century collectors and museum curators, who referred to percussion pits on the faces of GEAs as 'husking holes' for cracking nuts and to the GEAs with battered ground edges as 'hammers' or 'pounders' for processing *Macrozamia* nuts/seeds (see Table A1). This study has confirmed that some hammer/pounders were used for non-woody plant processing. However, their use in pounding *Macrozamia* is not fully confirmed, as insufficient plant material was available for processing at this time, and further experimental studies are proposed. Many GEAs identified as hatchets also bear evidence of having been used for processing non-woody plant and other materials. The 'rocks' used for preparing food plants that were referred to in the historical literature (e.g., Bradley, 1969 [1786–92]: 134, 117; Hunter, 1968 [1793]: 63, 80; Tench, 1979: 284 [1793: 191]); Threlkeld, 1825–26 in Gunson, 1974: 55), may well have included unhafted GEAs.

Identifying the use of GEAs to process food plants is of interest as the early (pre-1900) historical literature of south-eastern Australia refers to the use of GEAs by men only and there are no references to the use of GEAs in gathering non-woody plant materials or processing food plants. In other parts of Australia, where such data has been recorded, gathering and processing foods plants were principally carried out by women (e.g., Jones & Meehan, 1989; Keen, 2006: 306–307, 318–319; Meehan & Jones, 1977). Our finding that many of the NSWCC ground-edged artefacts were used for processing food plants suggests that in the NSW Central Coast these tools were used by women as well as men.

An association between GEAs and women is seen in Arnhem Land rock art where women are depicted holding hatchets (Basedow, 2012[1925]: 337; Chaloupka, 1993: fig. 117). In The Kimberley, Arnhem Land and the Tiwi Islands, Aboriginal women were observed using stone hatchets to split open branches and tree trunks to access the honey of native bees (Akerman, 1979: 171; Basedow, 2012[1925]: 337). The involvement of women in their manufacture on the Tiwi Islands is described by Goodale (1971) and is alluded to by Roth (1904: 19) in the Boulia district of Queensland. These references (see also Bird, 1993; McKell, 1993) to the use of ground-edged artefacts by Aboriginal women in other parts of Australia (albeit post-1900) support the use of hammer/pounders and other ground-edged artefacts by women in the NSWCC.

The use-wear approach in this study has made important contributions to identifying and understanding the life history of ground-edged stone artefacts by documenting the different parts of the NSWCC GEAs that were used, the way in which they were used, and the materials they were used to process. We identified 17 wear-types which combine different activities with various raw materials and use of different parts of the GEAs. Evidence of hafting is counted as Wear-type 18. The types of wear identified on the ground-edged artefacts include not only those recorded historically, but also several activities and raw materials not documented in the early historical records. The activities and processed materials identified by analysis of the NSW Central Coast GEAs, especially those referred to as hammer/pounders, give new insights into understanding the diversity of forms and multiple functions of this class of Australian Aboriginal implement.

Acknowledgments. This research was funded by ARC Discovery Grant DP120103993. Thanks to Darkinjung Local Aboriginal Land Council for their long-term support of Attenbrow's research in the NSW Central Coast and for giving permission to reproduce images of GEAs. We also wish to thank Rebecca Bryant, Tessa Corkill, Gail Robertson, Robin Torrence and Hugh Watt for their advice and discussions over the period of this study and/or comments on drafts of this paper; Allison Dejanovic for facilitating access to GEAs in the Australian Museum Archaeology Collection; and Ross Pogson for identifying rock-types for hatchets that were unmatched in the pXRF analysis; Betty Meehan and Brit Asmussen for suggesting references; NPWS Gosford Office for granting approval to collect *Macrozamia* nuts from Bouddi National Park that were used in the use-wear experiments; as well as Marika Low and Rebecca Bryant who assisted in the experiments.

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Appendix

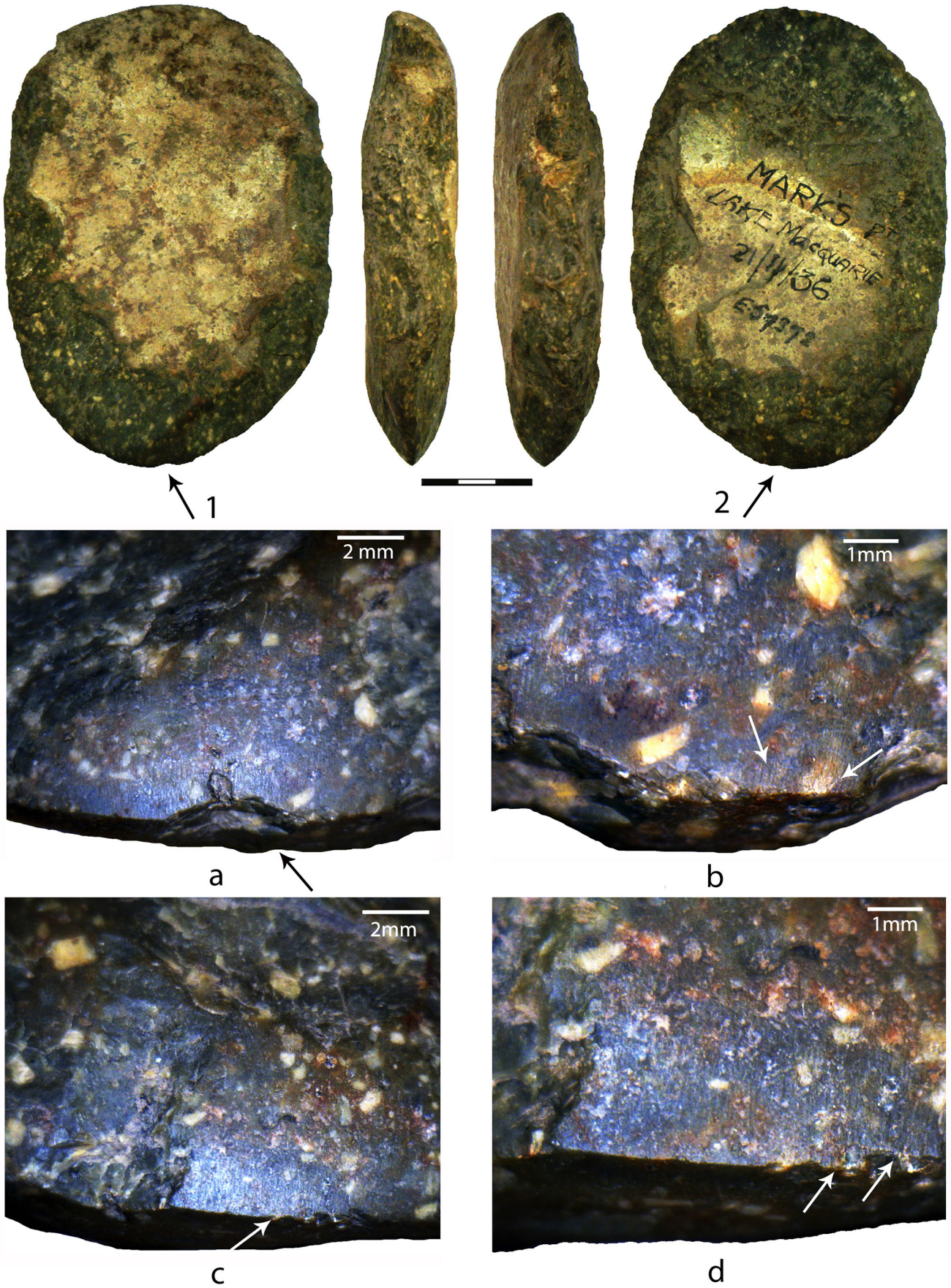


Figure A1. E057828. Hatchet. Chopping wood. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, blunted edge with step scars indicated by arrow (×30); *(b)* point 1, edge rounding and striations indicated by arrows (×50); *(c)* point 2, edge rounding and polish indicated by arrow (×30); *(d)* point 2, microscars and striations indicated by arrows (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

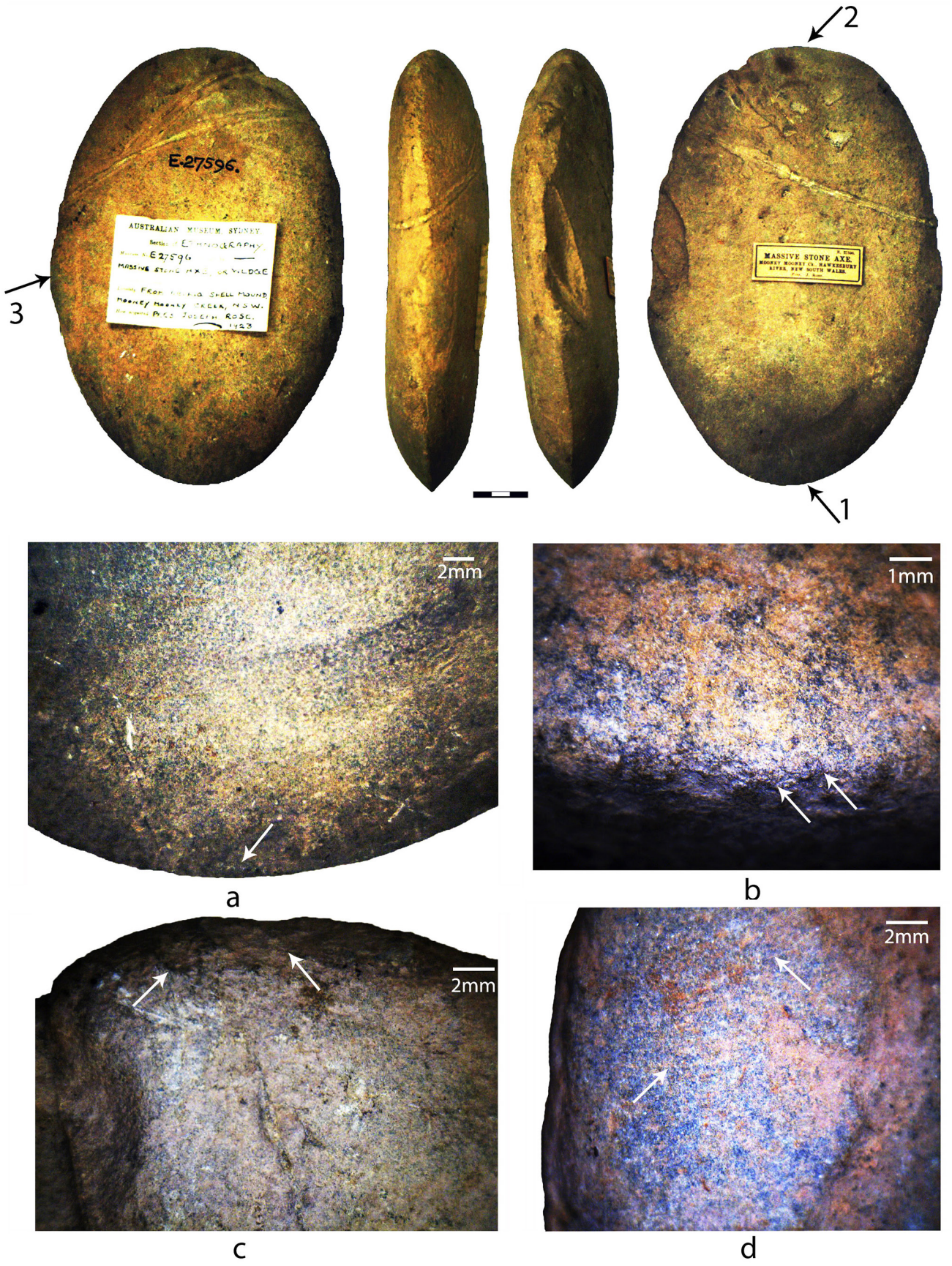


Figure A2. E027596. Hatchet, Wedge. Splitting wood. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, edge rounding and striations indicated by arrow (×15); *(b)* point 1, edge rounding, alignment and striations indicated by arrows (×40); *(c)* point 2, the butt damaged by flaking. The arrows indicate scars (×20); *(d)* point 3, hafting wear: smooth reflective gloss, alignment and striations indicated by arrows (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

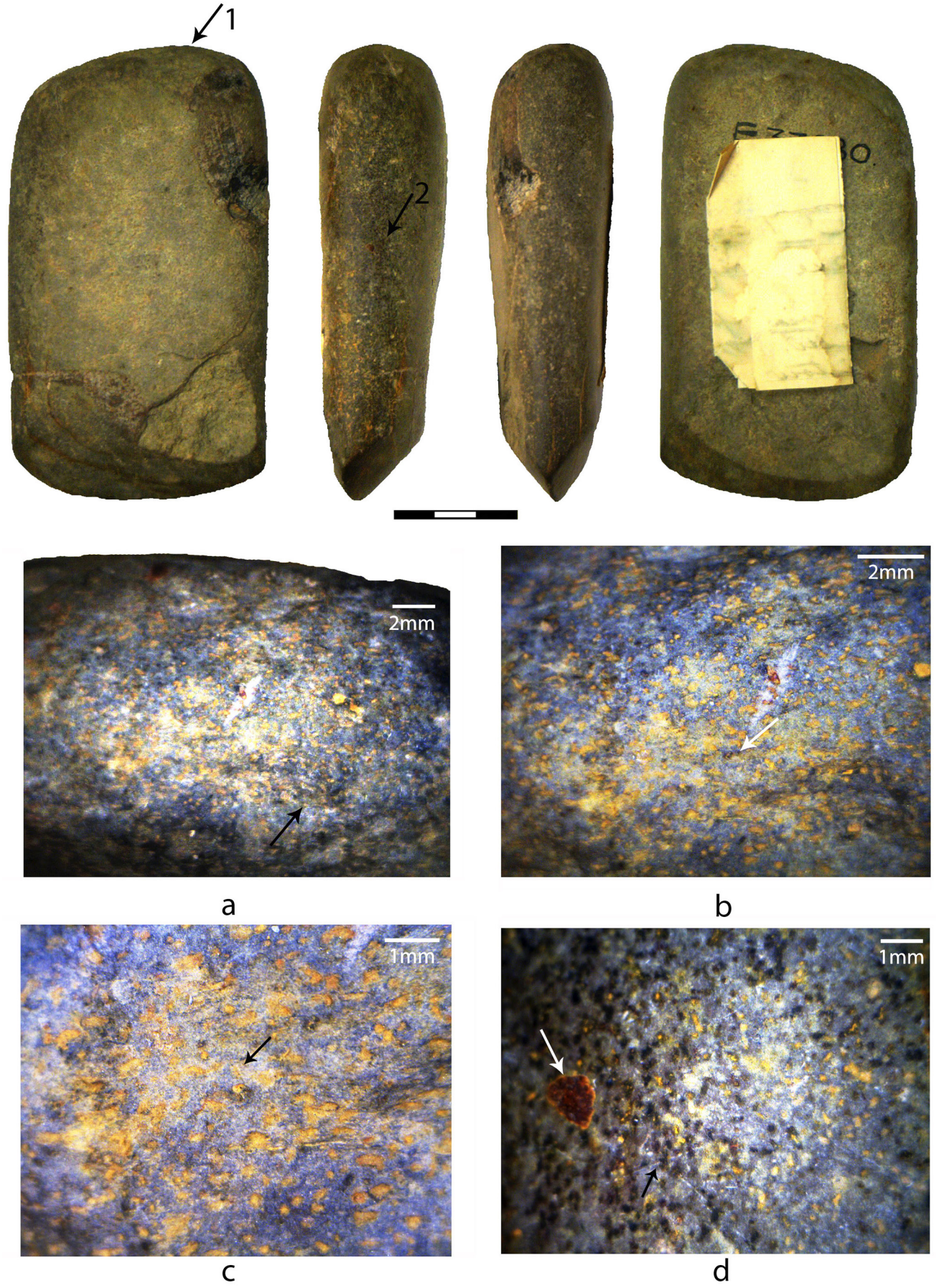


Figure A3. E033280. Hatchet. Chopping wood; pounding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks and striations indicated by arrow (×20); *(b)* point 1, levelled surface, alignment and peck marks indicated by arrow (×30); *(c)* point 1, flattened rock grains, smoothed sheen and isolated striations indicated by arrow (×50); *(d)* point 2, hafting wear and residues: gloss, alignment, long fine striations indicated by black arrow, and resin-like residues indicated by white arrow (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

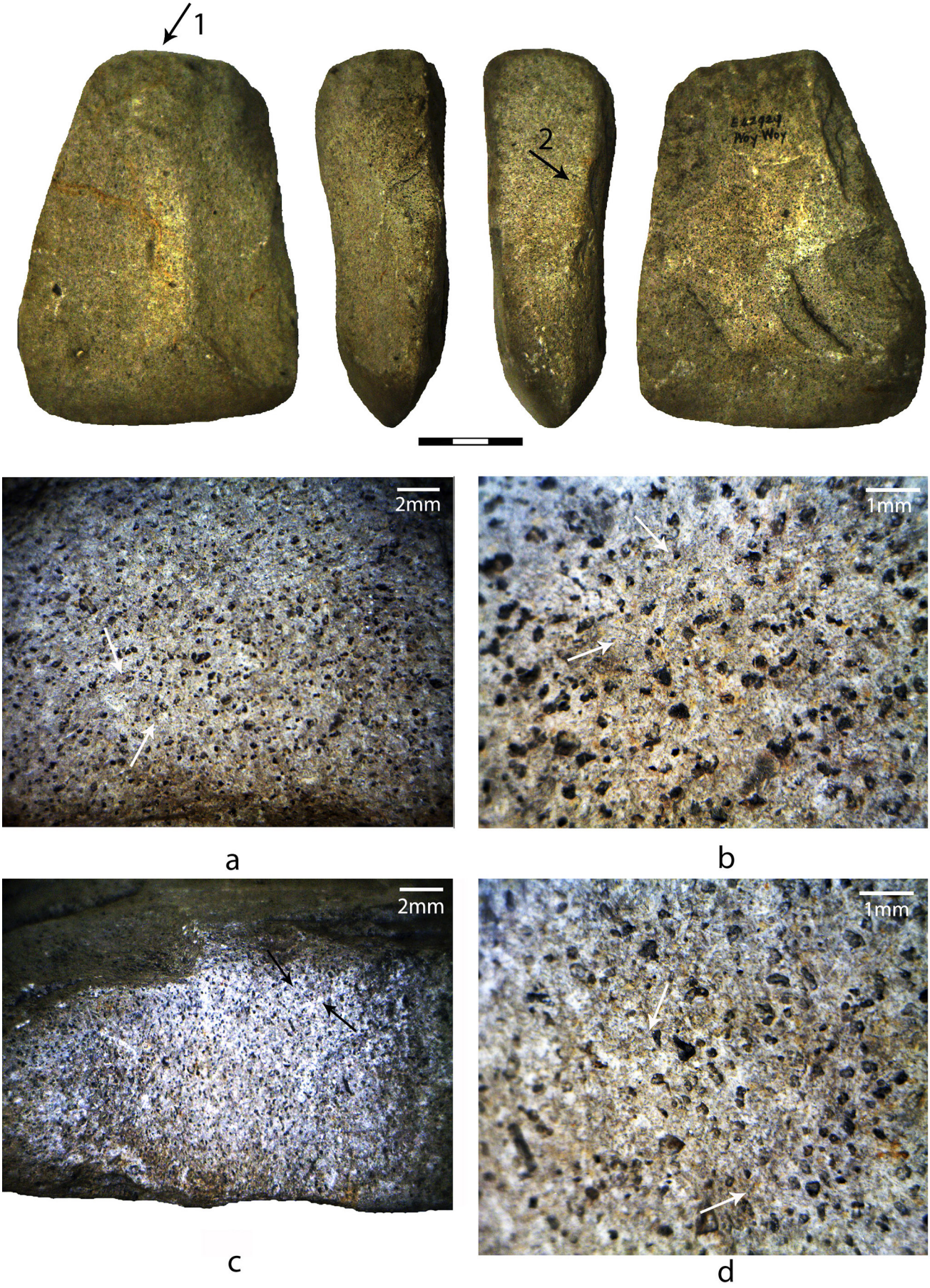


Figure A4. E042929. Hatchet. Chopping wood; pounding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, alignment and peck marks indicated by arrows (×20); *(b)* point 1, grain flattening and striations indicated by arrows (×50); *(c)* point 2, hafting wear: rounded edges of the lateral, smooth gloss, alignment and crossed striations indicated by arrows (×20), *(d)* point 2, hafting wear: smoothed surface, angular rock grains and striations indicated by arrows (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

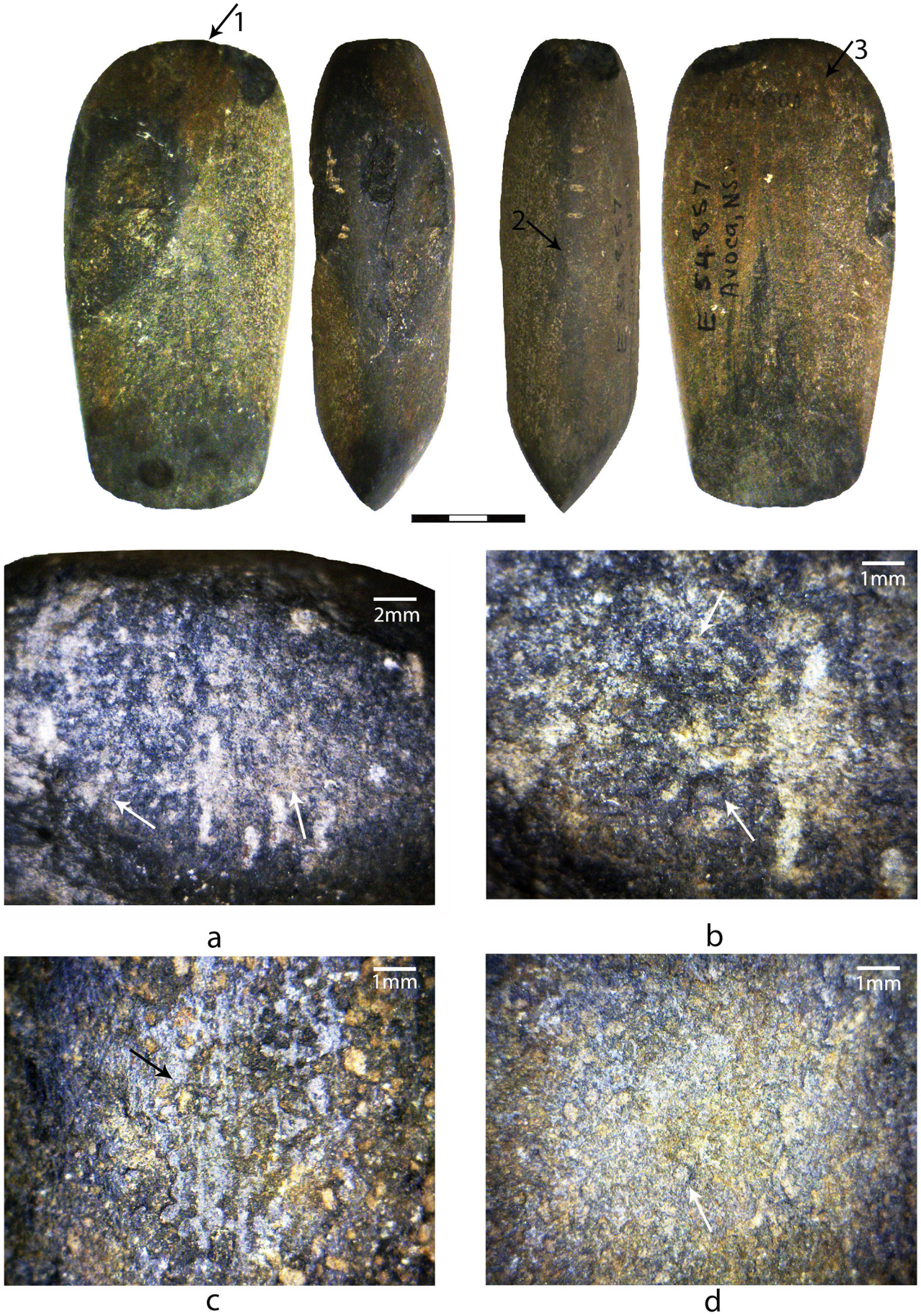


Figure A5. E054857. Hatchet. Chopping wood; pounding non-woody plant/seeds. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks and striations indicated by arrows (×20); *(b)* point 1, grain flattening, alignment and peck marks indicated by arrows (×40); *(c)* point 2, hafting wear: alignment and gloss indicated by arrow (×40); *(d)* point 3, unused surface with angular rock grain indicated by arrow (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

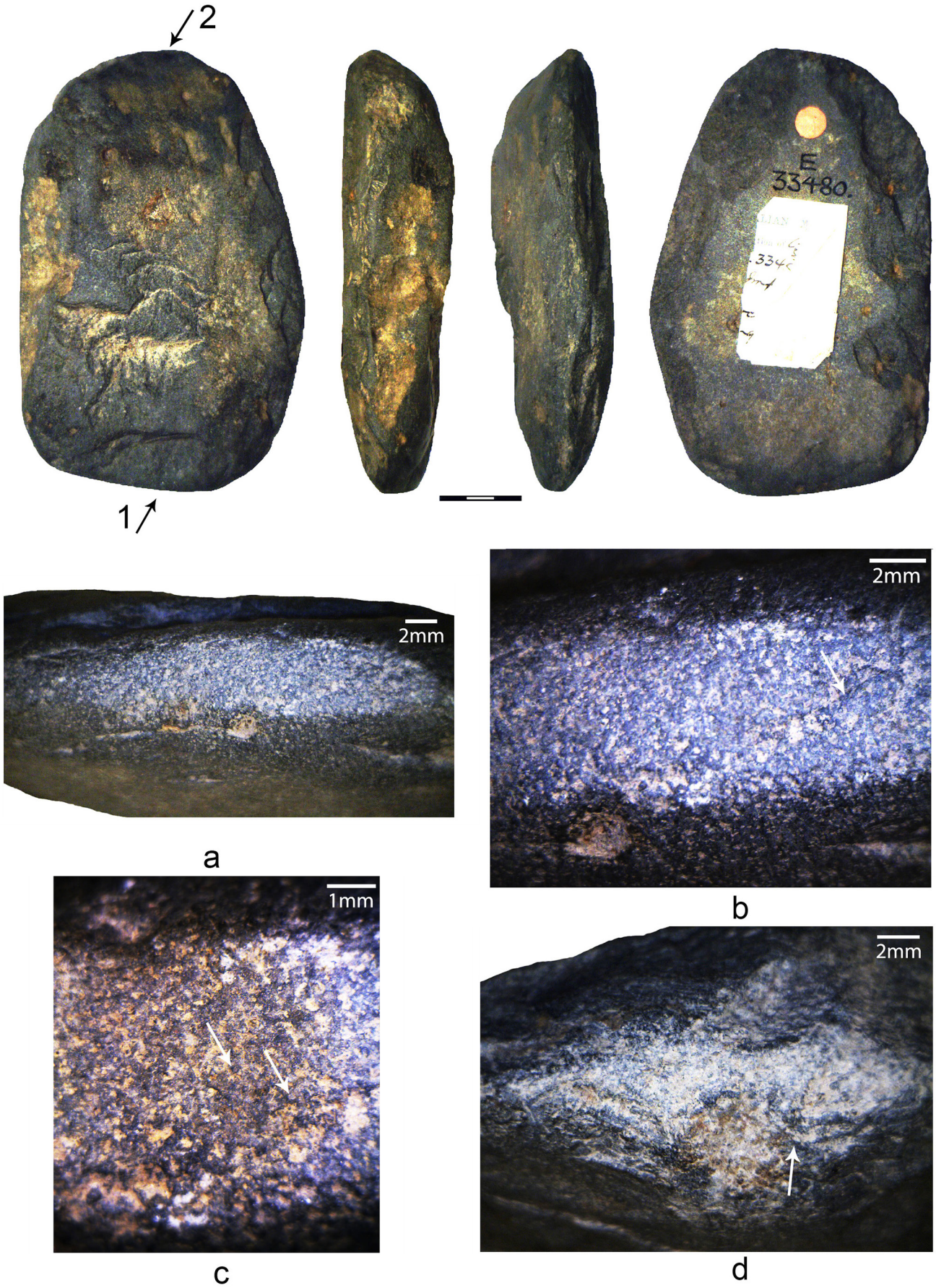


Figure A6. E033480. Hammer/pounder. Chopping/pounding non-woody plant. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks, sheen and alignment (×15); *(b)* point 1, levelled surface, peck marks, sheen, alignment and crack indicated by arrow (×25); *(c)* point 1, levelled surface, peck marks, alignment, sheen and grain rounding indicated by arrows (×45); *(d)* point 2, levelled surface, peck marks, step scars indicated by arrow (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

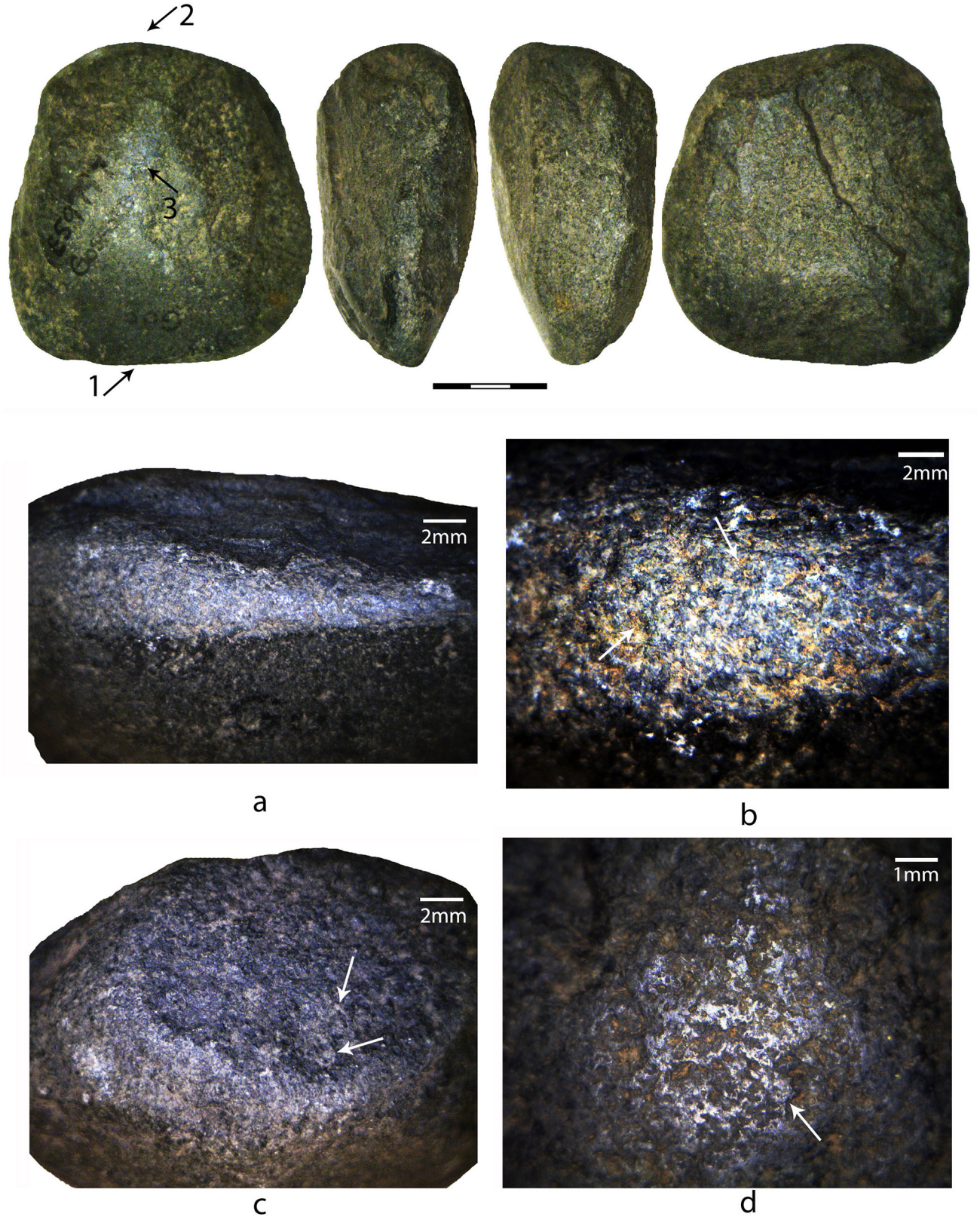


Figure A7. E059797. Hammer/pounder. Chopping/pounding non-woody plant; pounding non-woody plant/seeds. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks, smoothed sheen and alignment (×20); *(b)* point 1, levelled surface, alignment, sheen and peck marks indicated by arrows (×35); *(c)* point 2, damaged surface of the butt with peck marks and crushed rock grains indicated by arrows (×20); *(d)* point 3, hafting wear on the face: gloss indicated by arrow (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

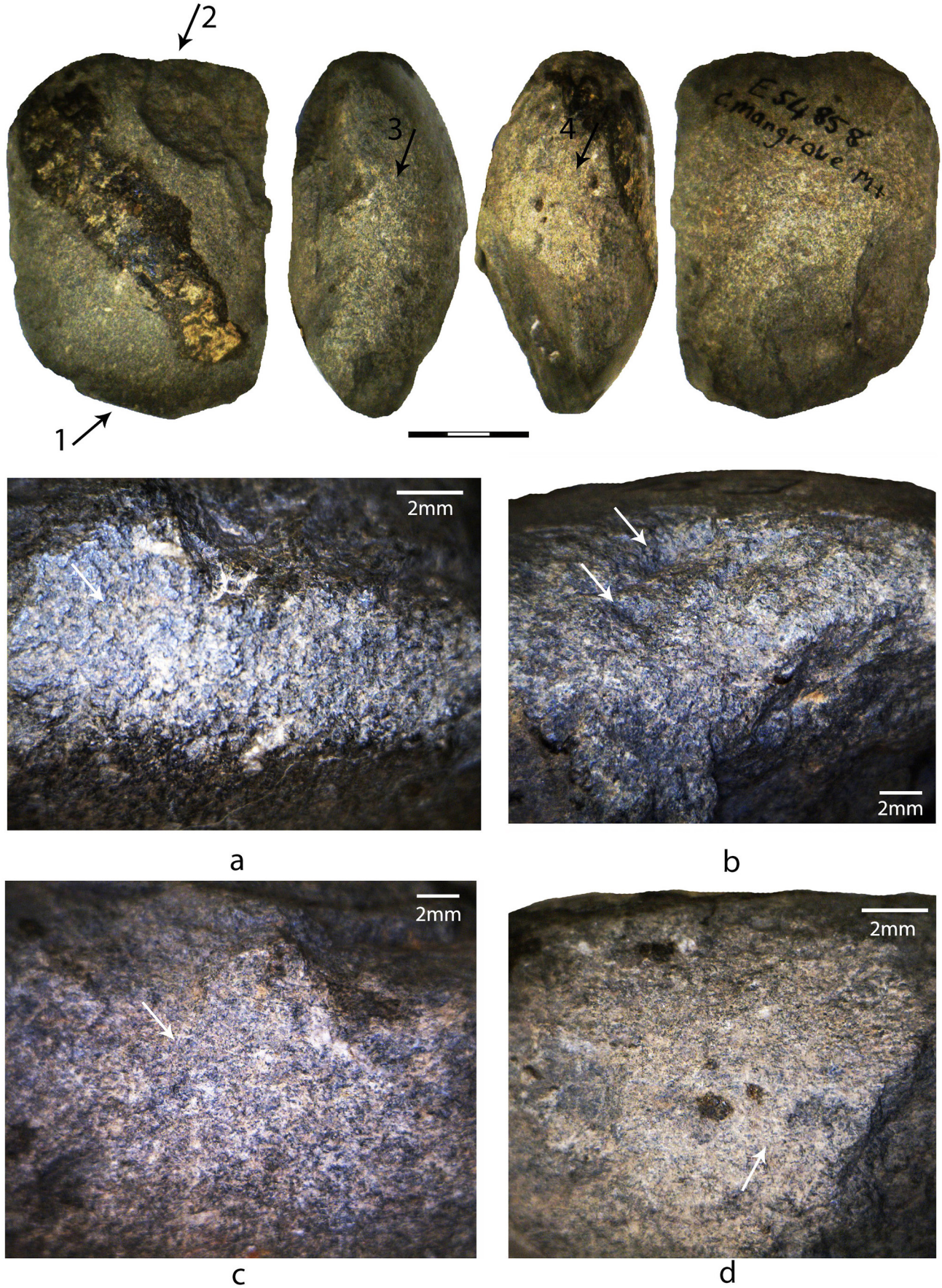


Figure A8. E054858a. Hammer/pounder. Pounding/grinding non-woody plant/seeds; chopping/pounding non-woody plant. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, rough levelled surface, alignment and peck marks indicated by arrow (×30); *(b)* point 2, the arrows indicate deep peck marks resulted from grain removal (×20); *(c)* point 3, smooth levelled surface, sheen and isolated striations indicated by arrow (×20); *(d)* point 4, smooth levelled surface, sheen and alignment indicated by arrow (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

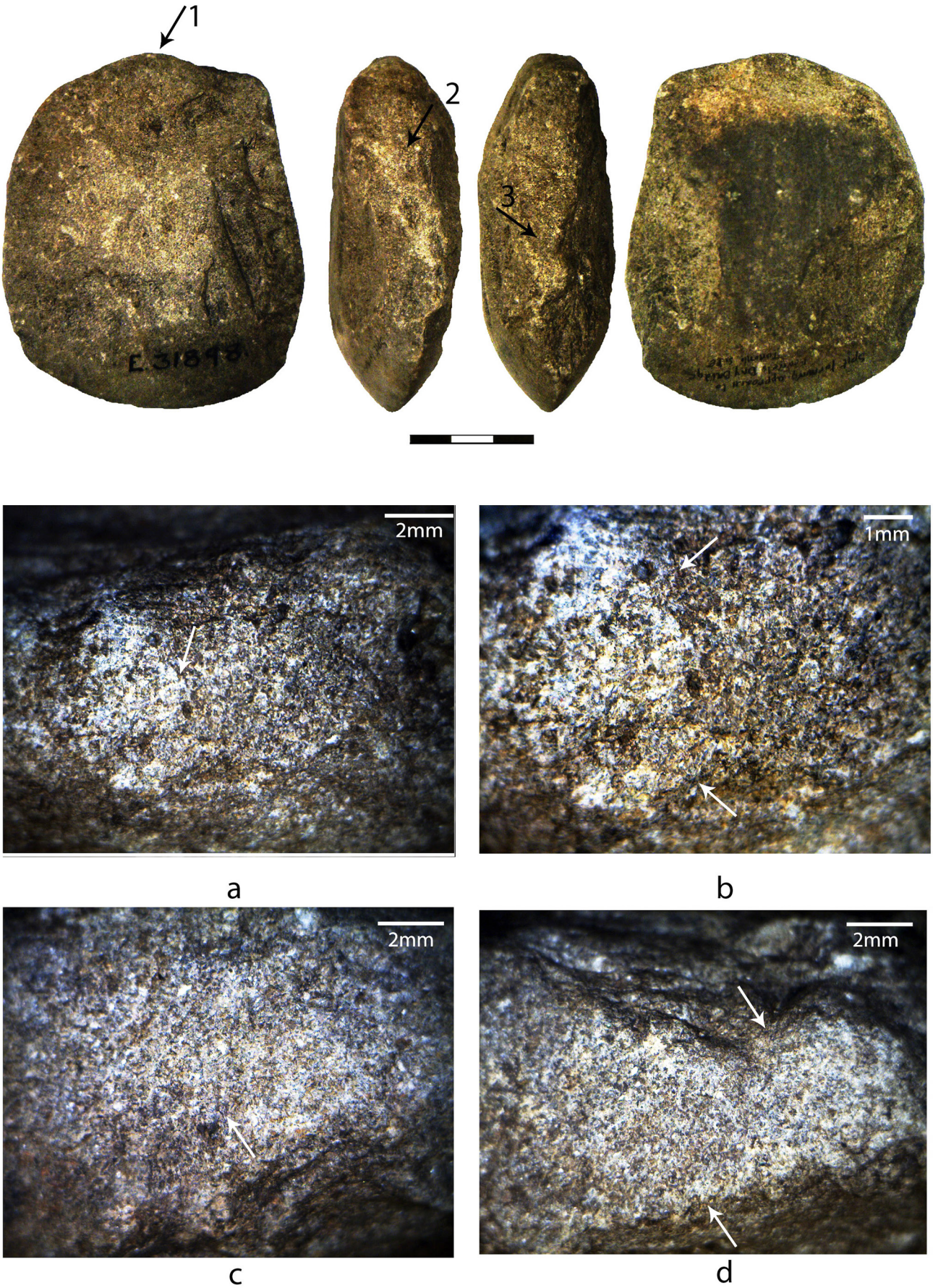


Figure A9. E031898. Hatchet. Chopping wood; grinding and pounding non-woody plant/seeds. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks, alignment and sheen indicated by arrow (×30); *(b)* point 1, peck marks, sheen and striations indicated by arrows (×45); *(c)* point 2, levelled surface, sheen and striations indicated by arrows (×30); *(d)* point 3, levelled surface sheen and striations indicated by arrows (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

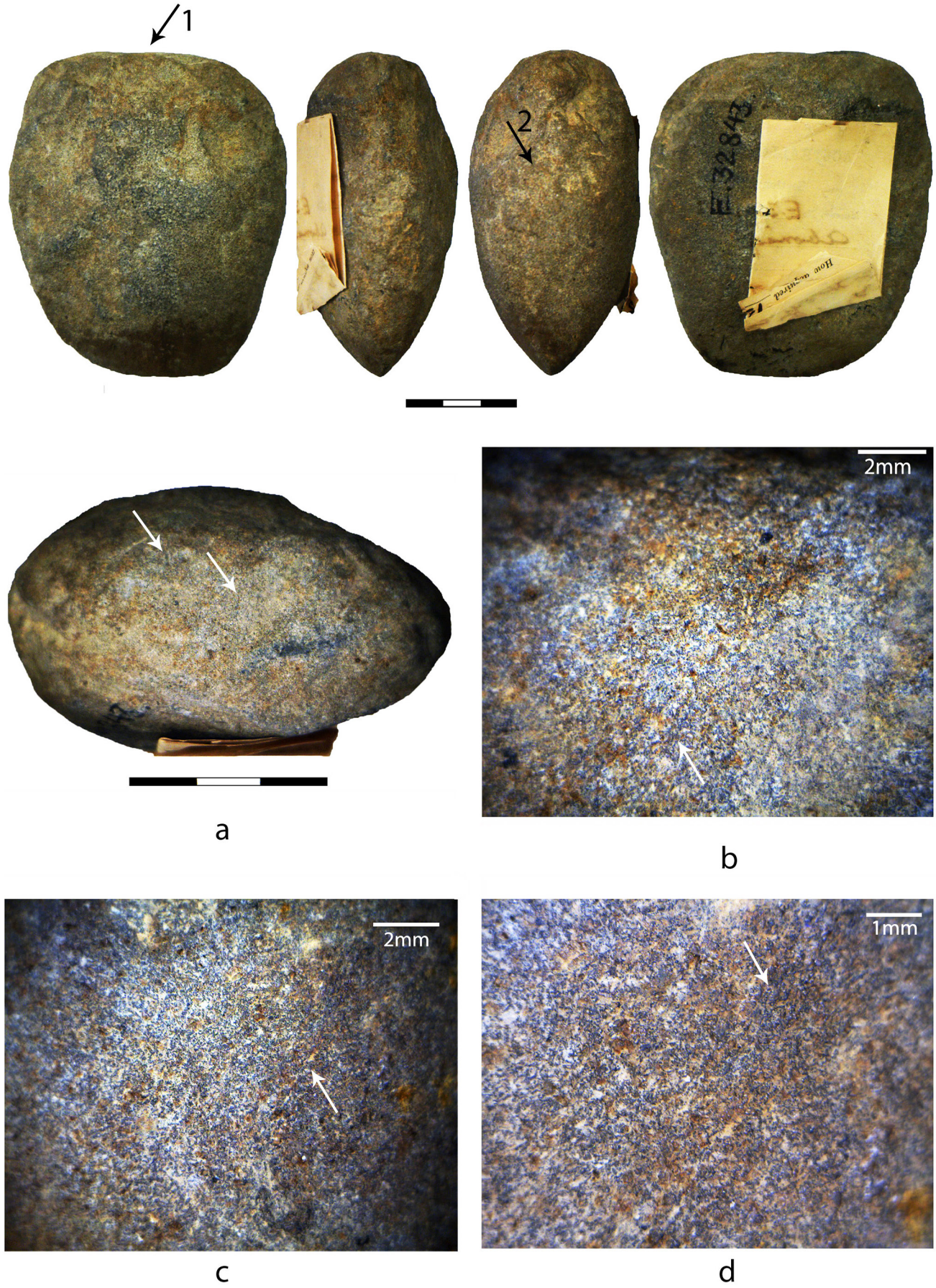


Figure A10. E032843. Hatchet. Chopping wood; grinding and pounding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen and striations indicated by arrows; *(b)* point 1, peck marks, sheen and striations indicated by arrow (×30); *(c)* point 2, smoothed sheen and alignment indicated by arrow (×30); *(d)* point 2, peck marks and grain flattening indicated by arrow (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

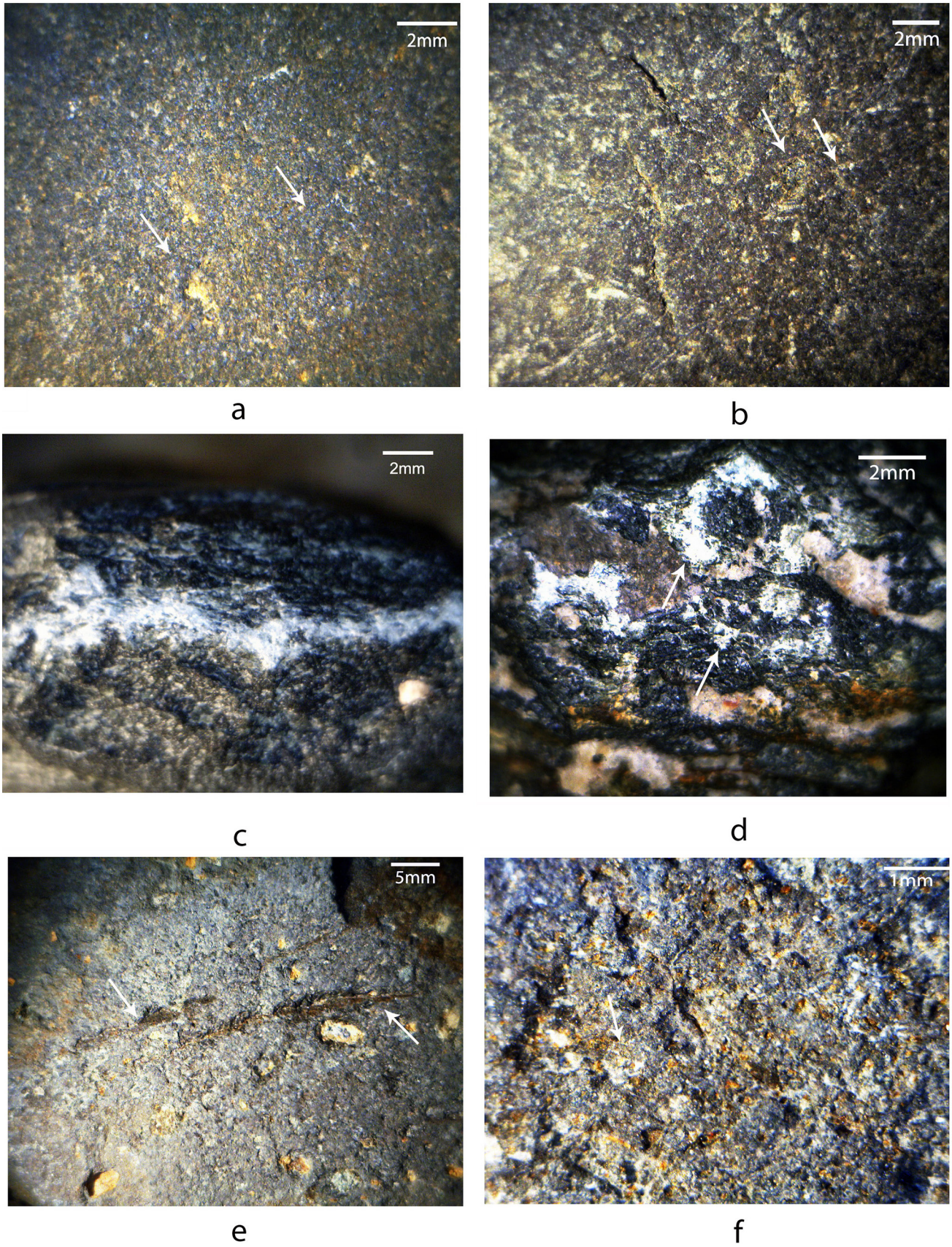


Figure A11. Wear resulted from the experimental replication of nut processing: *(a)* anvil for cracking nuts after two hours of use: peck marks, sheen and striations indicated by arrows (×30); *(b)* hammer for cracking nuts after two hours of use: peck marks, sheen and striations indicated by arrows (×20); *(c)* the edge of the hammer after five hours of use for pounding nuts: battered and levelled surface and step scars indicated by arrow (×20); *(d)* the butt of the hammer after five hours of use for pounding nuts: battered surface with crushed rock grains indicated by arrows (×30); *(e)* anvil for pounding nuts after two hours of use: smooth surface with flattened rock grains, peck marks and cracks indicated by arrows (×10); *(f)* anvil for pounding nuts after two hours of use: flattened rock grains, sheen, peck marks and striations indicated by arrow (×60). Photographs Nina Kononenko, scale in 1 cm divisions.

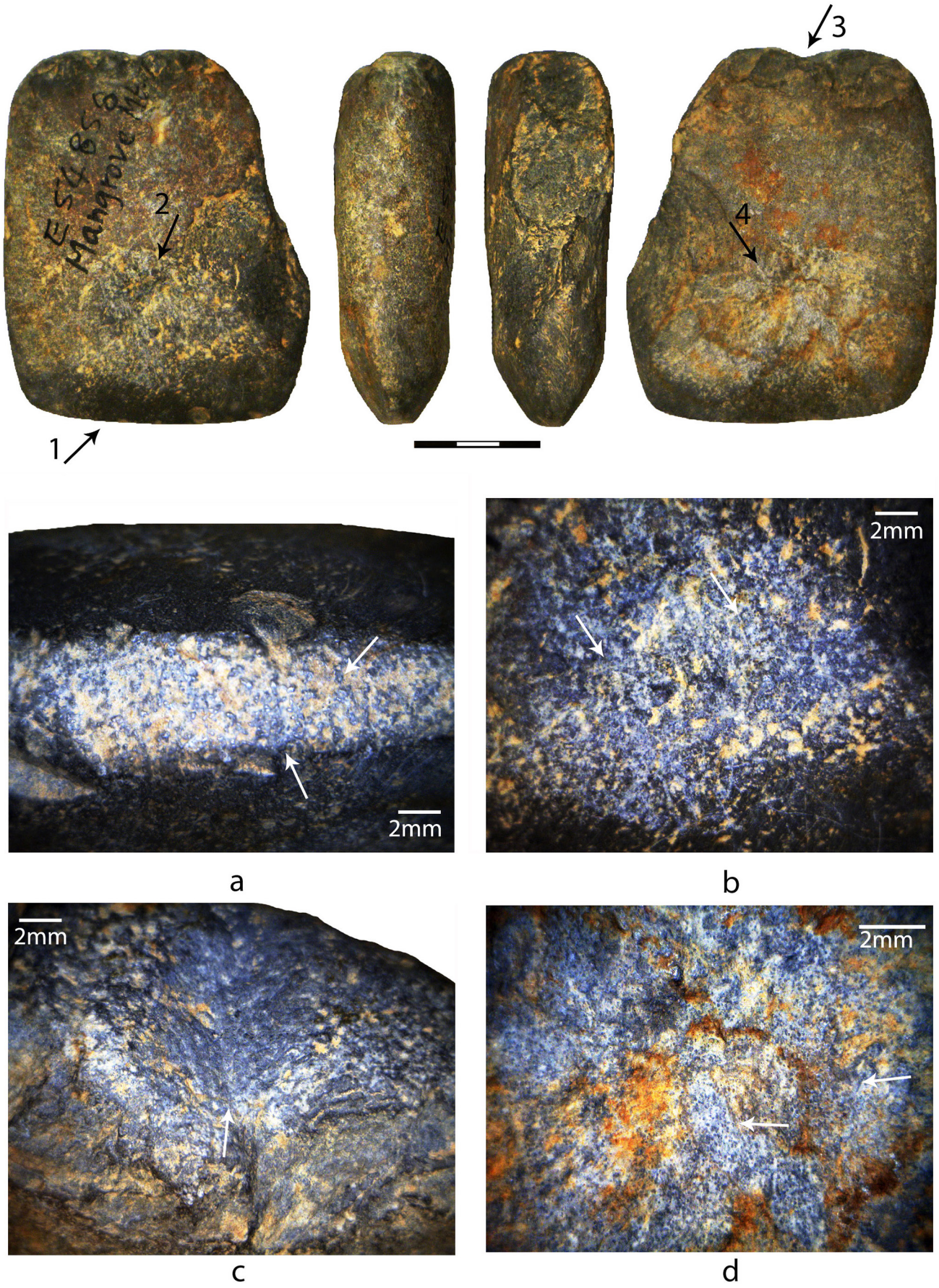


Figure A12. E054858c. Hammer/pounder. Pounding kernels as anvil and non-woody plant/seeds as pounder; polishing bone or shell. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, dense peck mark, sheen, levelled surface with rounded rock grain indicated by arrows (×20); *(b)* point 2, incipient pit: levelled surface, dense peck marks, sheen, alignment and striations indicated by arrows (×20); *(c)* point 3, levelled surface of the groove with sheen, alignment and striations indicated by arrow (×20); *(d)* point 4, incipient pit: levelled surface with peck marks, sheen and striations indicated by arrows (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

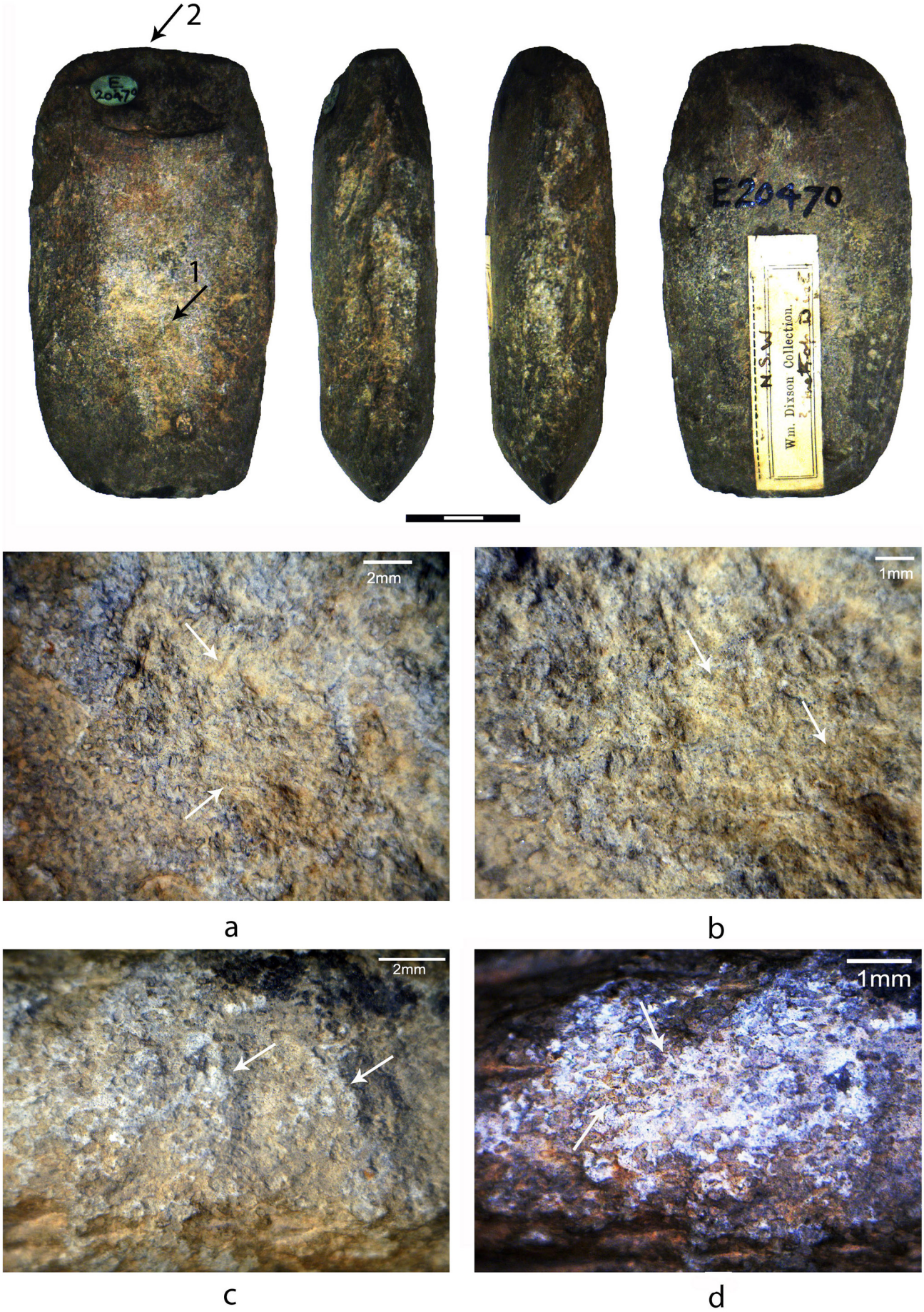


Figure A13. E020470. Hatchet. Chopping wood; cracking nuts (as anvil or possible hammerstone) and pounding kernels (as pounder). Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, incipient pit: overlapping fine and deep peck marks, alignment and scratches with rounded edges indicated by arrows (×25); *(b)* point 1, incipient pit: overlapping peck marks, levelled surface and isolated fine striations indicated by arrows (×40); *(c)* point 2, peck marks, alignment, sheen and flattened rock grains indicated by arrow (×30); *(d)* point 2, levelled surface, sheen and alignment and dense peck marks indicated by arrow (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

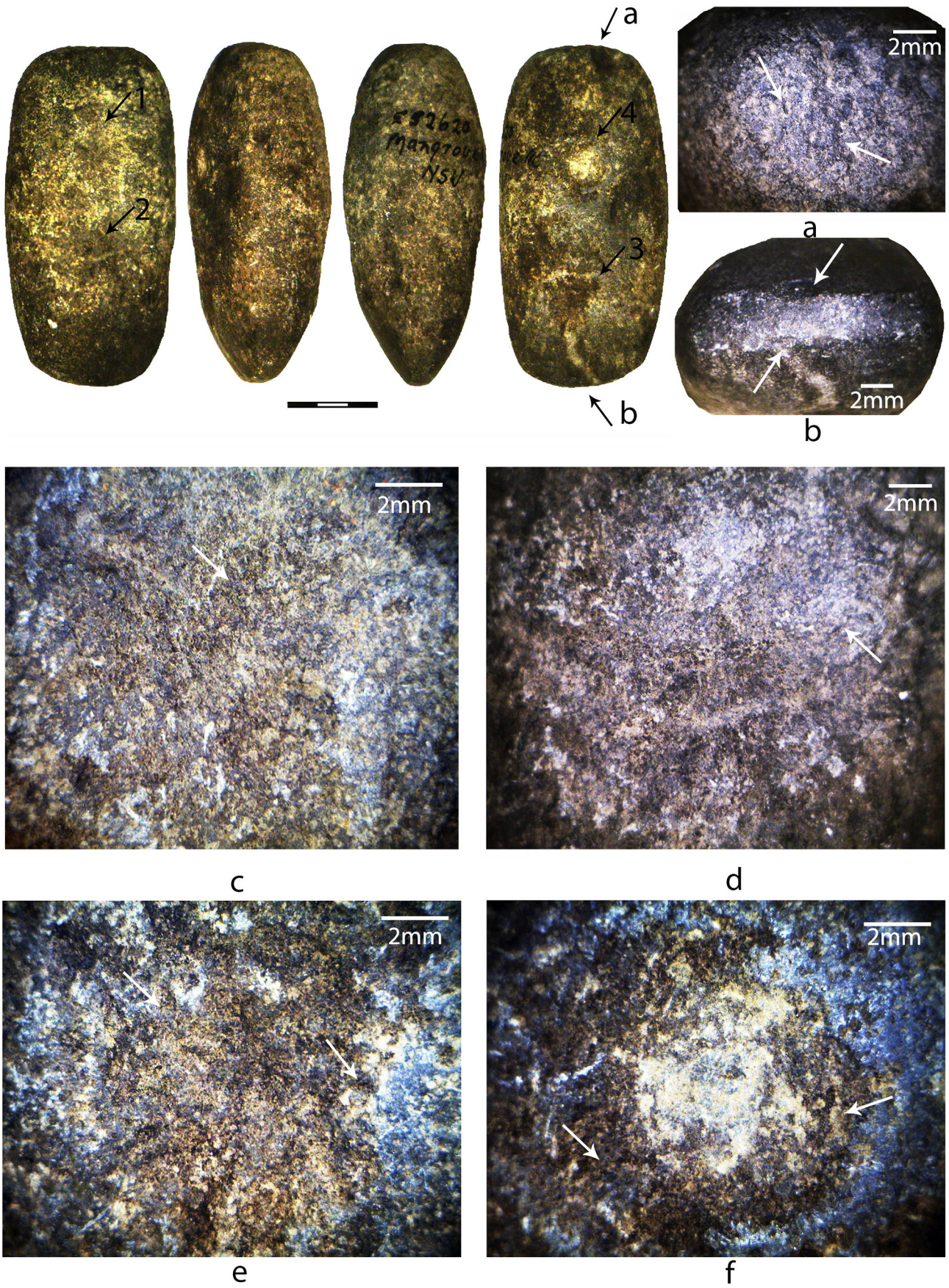


Figure A14. E052620. Hammer/pounder. Cracking nuts as anvil; pounding non-woody plant/seeds; chopping/pounding non-woody plant. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* the butt with wear from pounding non-woody plant. The arrows indicate peck marks (×20); *(b)* the edge with wear from pounding non-woody plants. The arrow indicates scars on the ridges of the edge (×15); *(c)* point 1, incipient pit: levelled surface, sheen and alignment indicated by arrow (×30); *(d)* point 2, incipient pit: peck marks, smooth sheen and flattened rock grains indicated by arrow (×20); *(e)* point 3, incipient pit: levelled surface, peck marks, sheen and striations indicated by arrows (×30); *(f)* point 4, deliberate pit: peck marks, smooth levelled surface, sheen and striations indicated by arrows (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

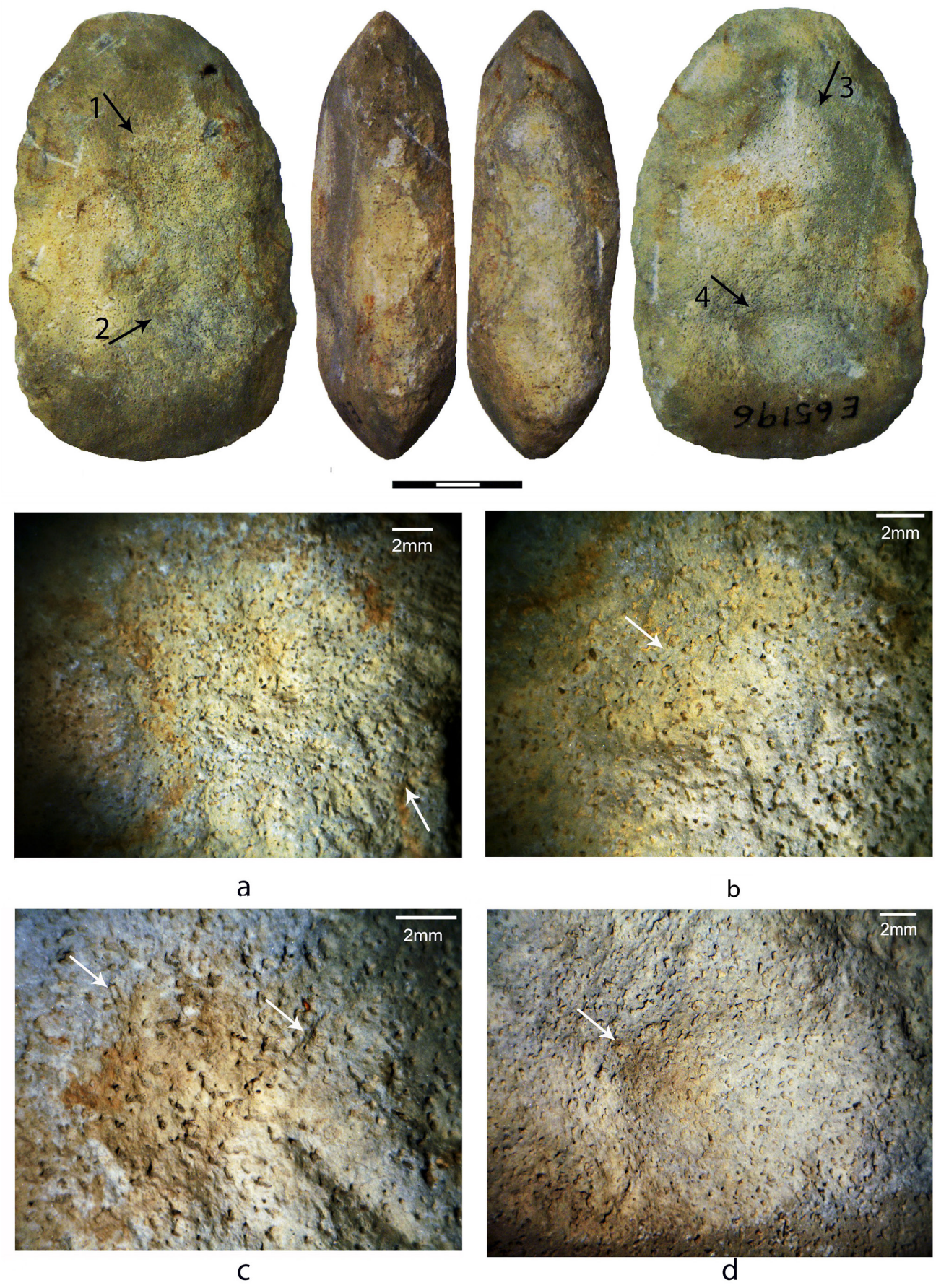


Figure A15. E065196q. Hatchet. Chopping wood; cracking nuts as anvil. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, incipient pit: levelled surface, alignment and striations indicated by arrow (×20); *(b)* point 2, incipient pit: smooth surface, alignment and flattened rock grains indicated by arrow (×25); *(c)* point 3, incipient pit: levelled surface, alignment, striations and scratches indicated by arrows (×30); *(d)* point 4, deliberately made pit: smooth surface, sheen, alignment peck marks with levelled edges indicated by arrow (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

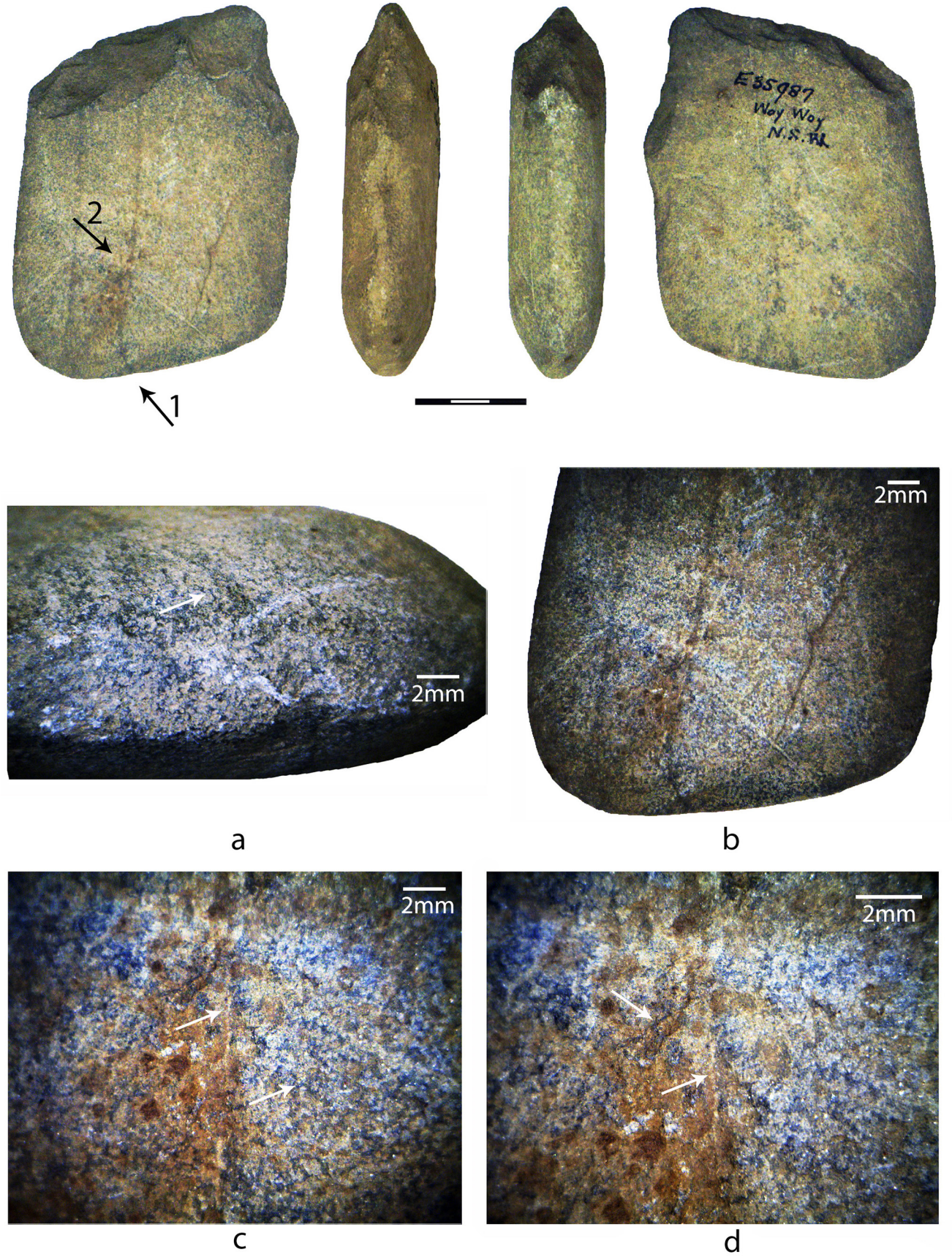


Figure A16. E035987. Hammer/pounder. Cracking nuts (as anvil or possible hammer) and pounding non-woody plant/seeds. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, dense fine peck marks, levelled surface, alignment and fine striations indicated by arrow (×20); *(b)* point 2, incipient pit with levelled surface (×15); *(c)* point 2, incipient pit: peck marks, levelled surface, scratches and striations indicated by arrows (×20); *(d)* point 2, incipient pit: peck marks, levelled surface, striations and scratches indicated by arrows (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

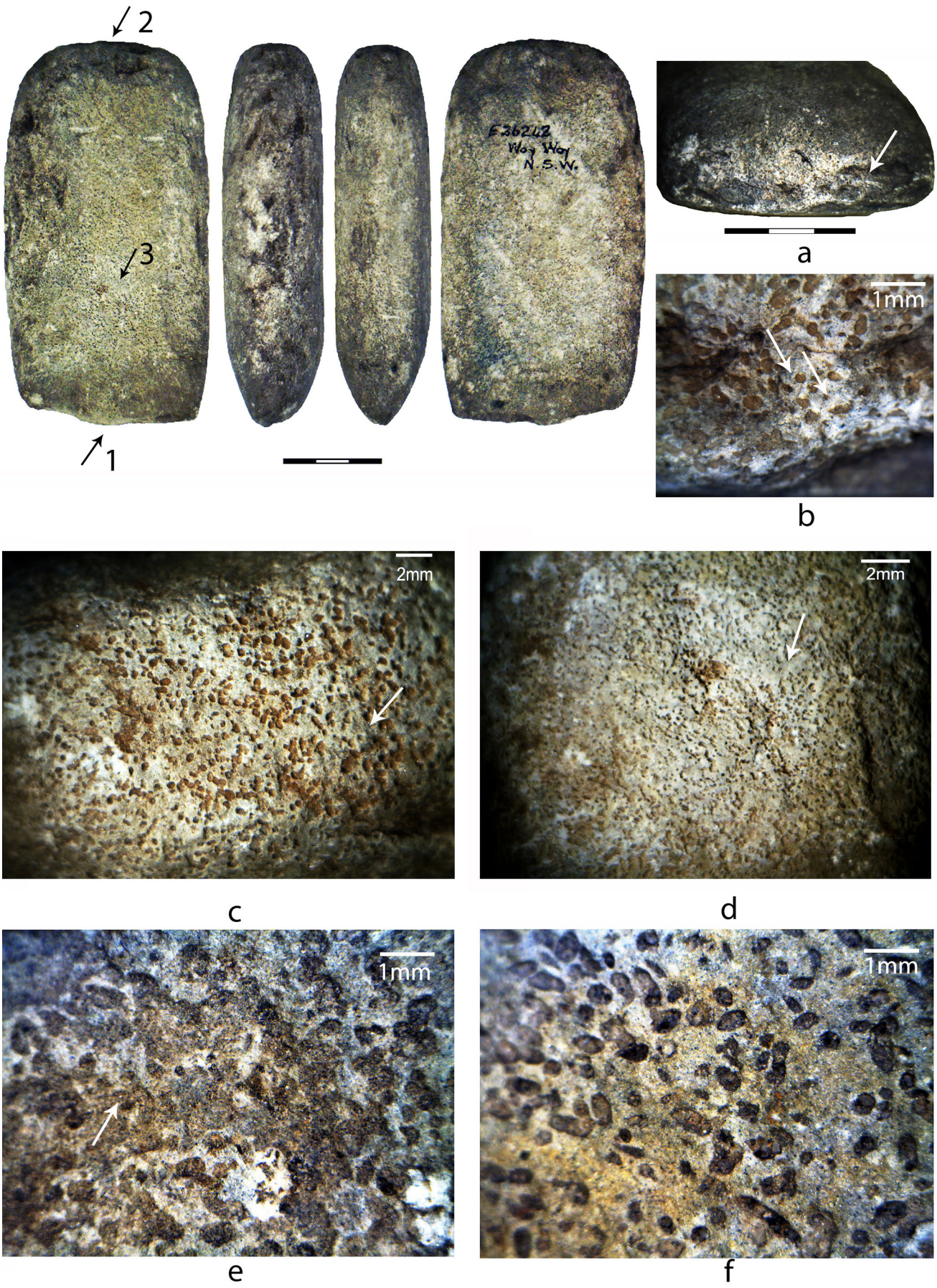


Figure A17. E036242. Hatchet. Cracking nuts (as anvil); pounding non-woody plant/seeds. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, blunted edge with scars indicated by arrow; *(b)* point 1, edge rounding and striations indicated by arrow (×50); *(c)* point 2, peck marks, levelled surface, sheen, alignment and fine striations indicated by arrow (×20); *(d)* point 3, incipient pit: smoothed surface, peck marks and flattened rock grain indicated by arrow (×25); *(e)* point 3, incipient pit: flattened rock grain, sheen and striations indicated by arrows (×50); *(f)* unused surface (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

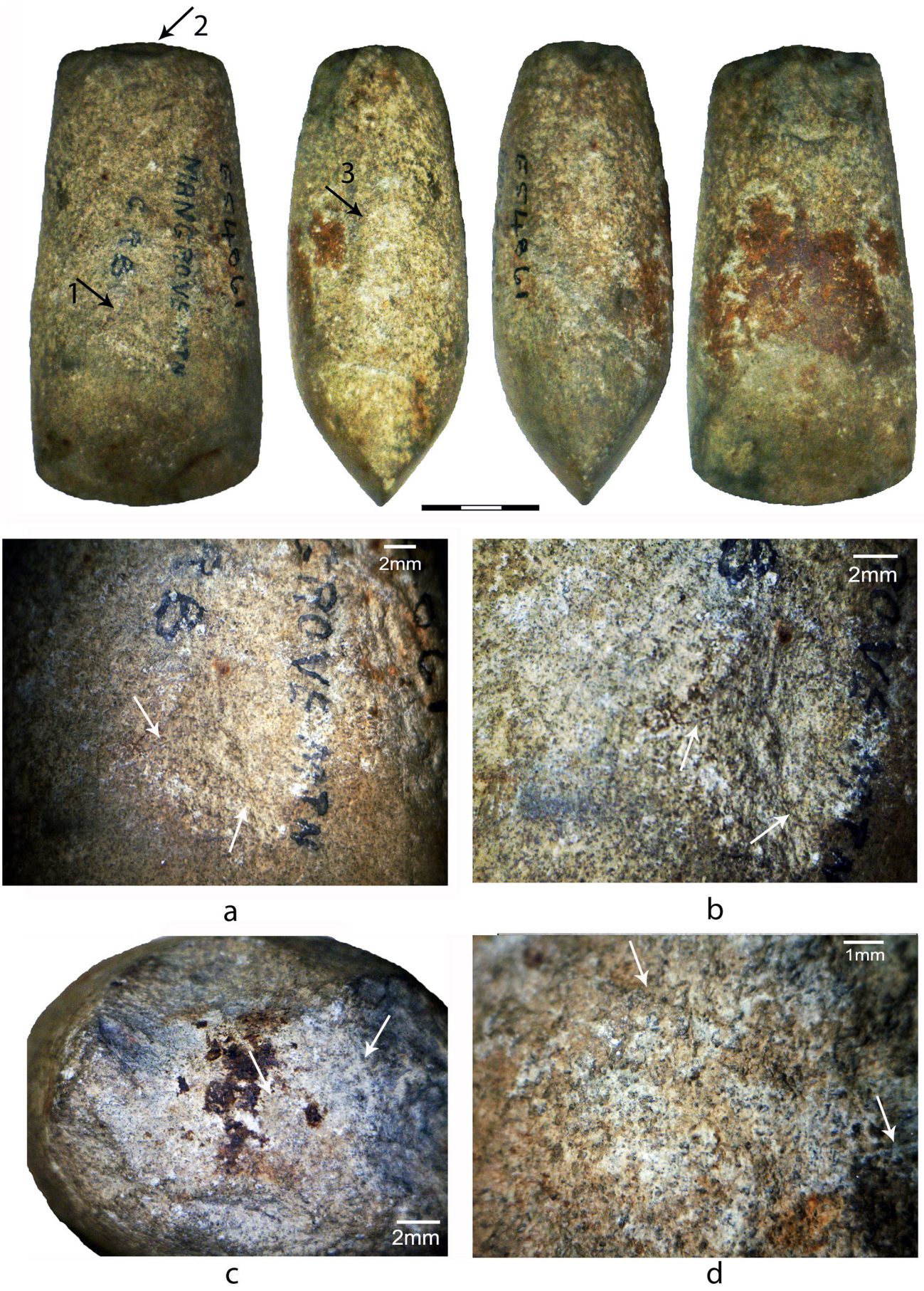


Figure A18. E054861a. Hatchet. Chopping wood; cracking nuts as anvil; pounding non-woody plant/seeds. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, incipient pit: smoothed levelled surface, peck marks and striations indicated by arrows, (×15); *(b)* point 1, the profile of incipient pit: peck marks with levelled edges and striations indicted by arrows (×20); *(c)* point 2, the butt damaged by scars: levelled surface, peck marks, sheen and striations indicated by arrows (×20); *(d)* point 3, hafting wear: gloss, alignment and striations indicated by arrows (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

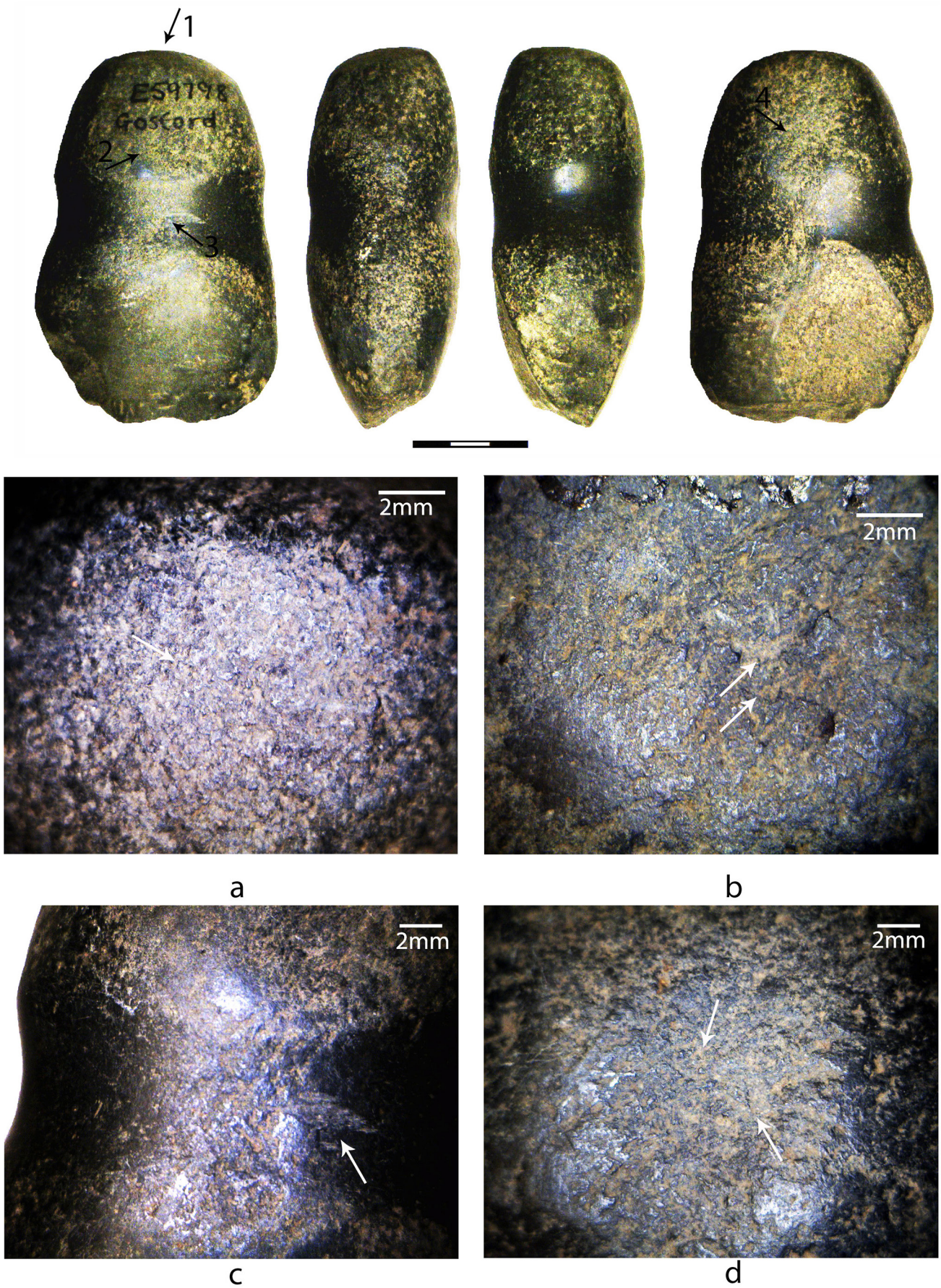


Figure A19. E059798. Hatchet. Chopping wood; cracking nuts as anvil; pounding non-woody plant/seeds. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen, peck marks and striations indicated by arrow (×30); *(b)* point 2, incipient pit: flattened rock grains, sheen, alignment and peck marks indicated by arrows (×30); *(c)* point 3, hafting wear: gloss and striations indicated by arrow (×20); *(d)* point 4, incipient pit: smoothed surface, sheen, striations and peck marks indicated by arrows (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

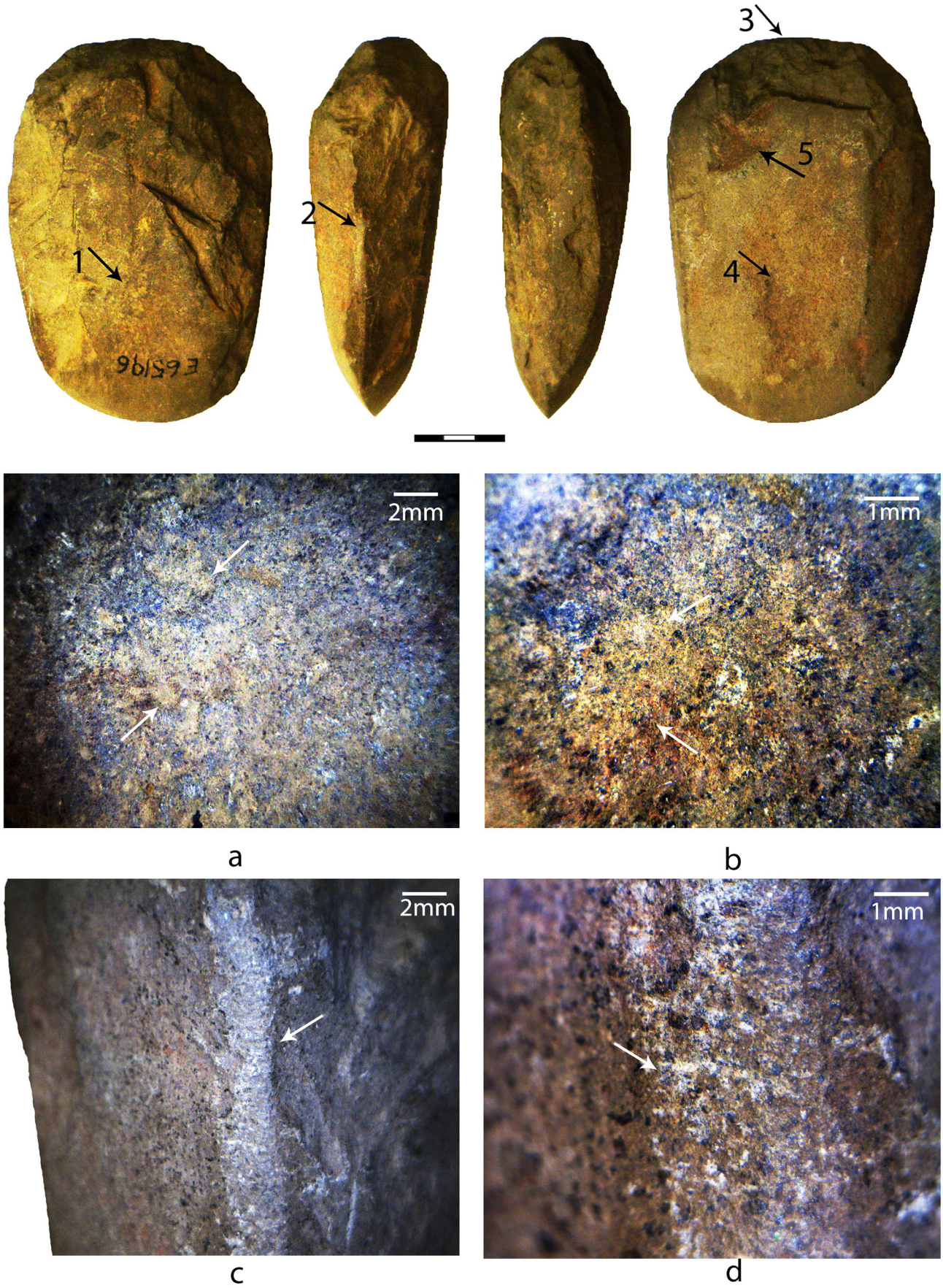


Figure A20. E065196a. Hatchet. Chopping wood; cracking nuts as anvil or possible hammer; pounding kernel as pounder; pounding ochre as anvil. Faces and laterals with points 1–5 where images of wear patterns were taken: *(a)* point 1, incipient pit: smoothed levelled surface, sheen and peck marks indicated by arrows, (×20); *(b)* point 1, incipient pit: levelled surface, alignment and striations indicated by arrows (×50); *(c)* point 2, hafting wear: levelled surface, gloss and striations indicated by arrow (×20); *(d)* point 2, hafting wear: levelled surface, rock grain rounding and gloss indicated by arrow (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

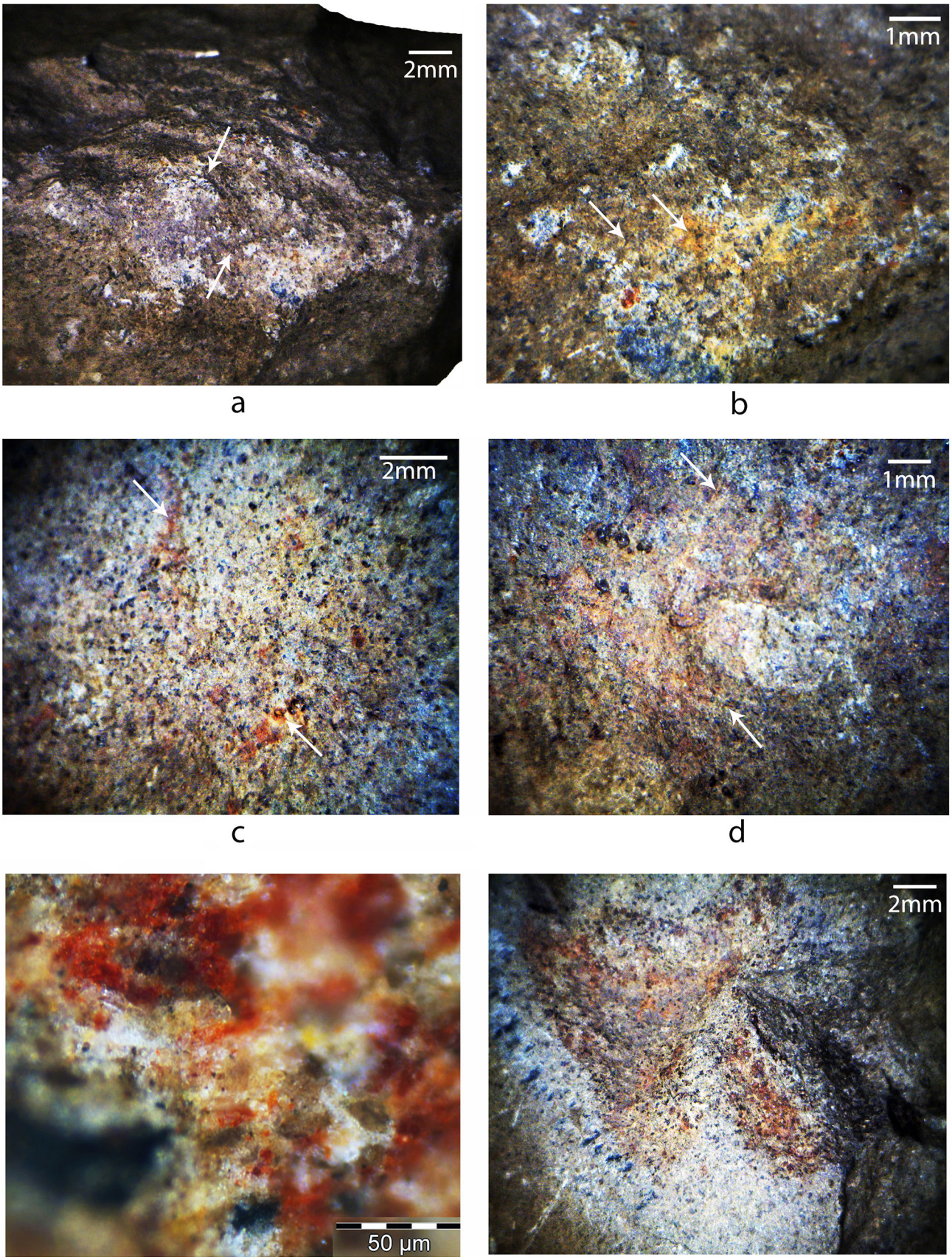


Figure A21. E065196a. Hatchet. Chopping wood; cracking nuts as anvil or possible hammer; pounding kernel as hammer; pounding ochre as anvil. Wear patterns at points 3–5: *(a)* point 3, levelled surface, peck marks and scratches indicated by arrow (×20); *(b)* point 3, levelled surface, alignment and striations indicated by arrows (×45); *(c)* point 4, incipient pit: abrasive smoothing of the surface, alignment, sheen and embedded ochre residues indicated by arrows (×30); *(d)* point 4, incipient pit: smoothed levelled surface, crushed rock grains, alignment and striations indicated by arrows (×40); *(e)* point 4, ochre residues within pit (×500, polarized light); *(f)* point 5, ochre deposits within scars (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

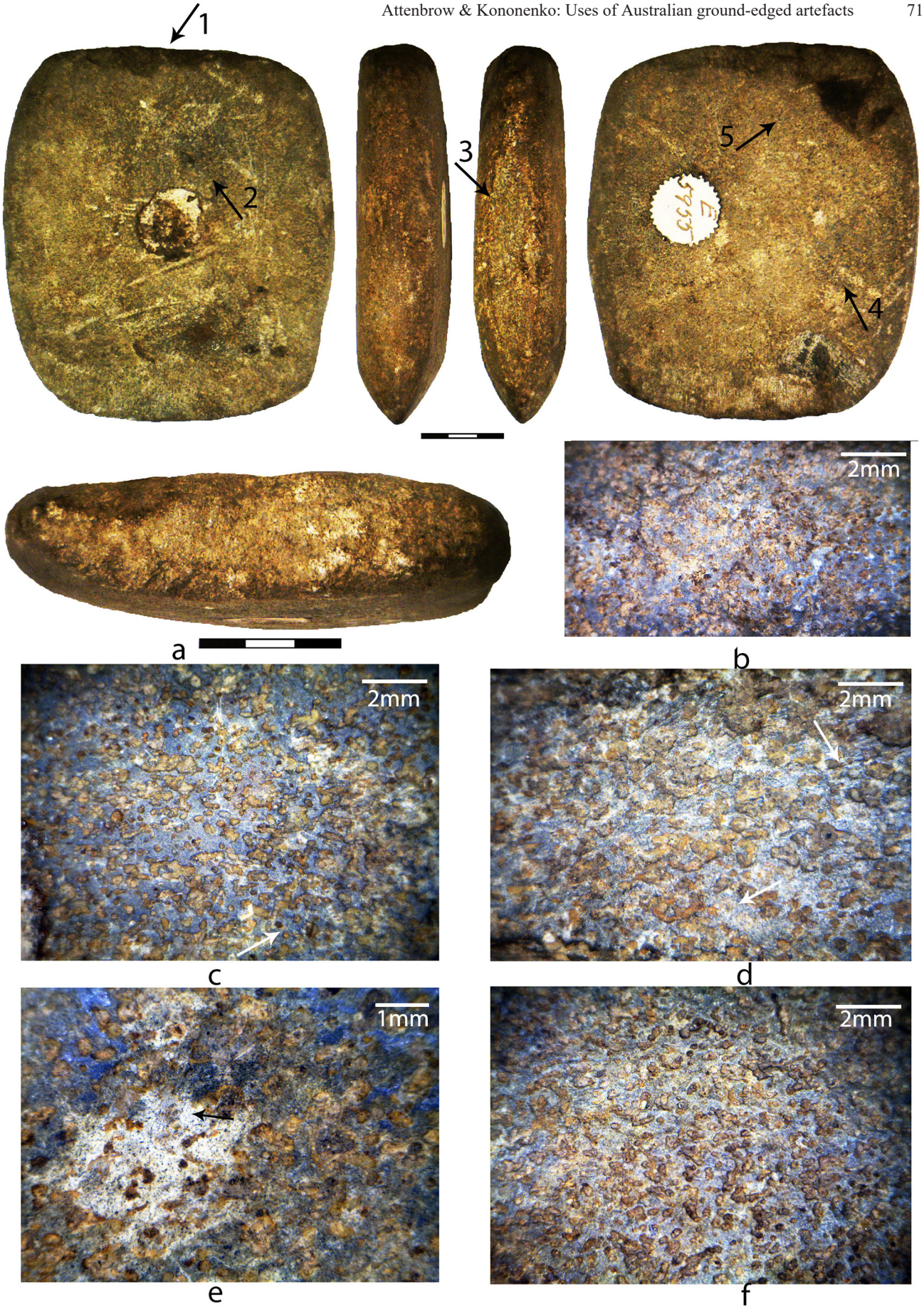


Figure A22. E005955. Hatchet. Chopping wood, polishing bone. Faces and laterals with points 1–5 where images of wear patterns were taken: *(a)* point 1, smooth levelled surface and alignment; *(b)* point 1, sheen and flattened rock grains indicated by arrow (×30); *(c)* point 2, levelled surface, sheen and alignment indicated by arrow (×30); *(d)* point 3, sheen, alignment and striations indicated by arrow (×30) *(e)* point 4, levelled surface, sheen, alignment and striations indicated by arrow (×50); *(f)* point 5, features of unused surface (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

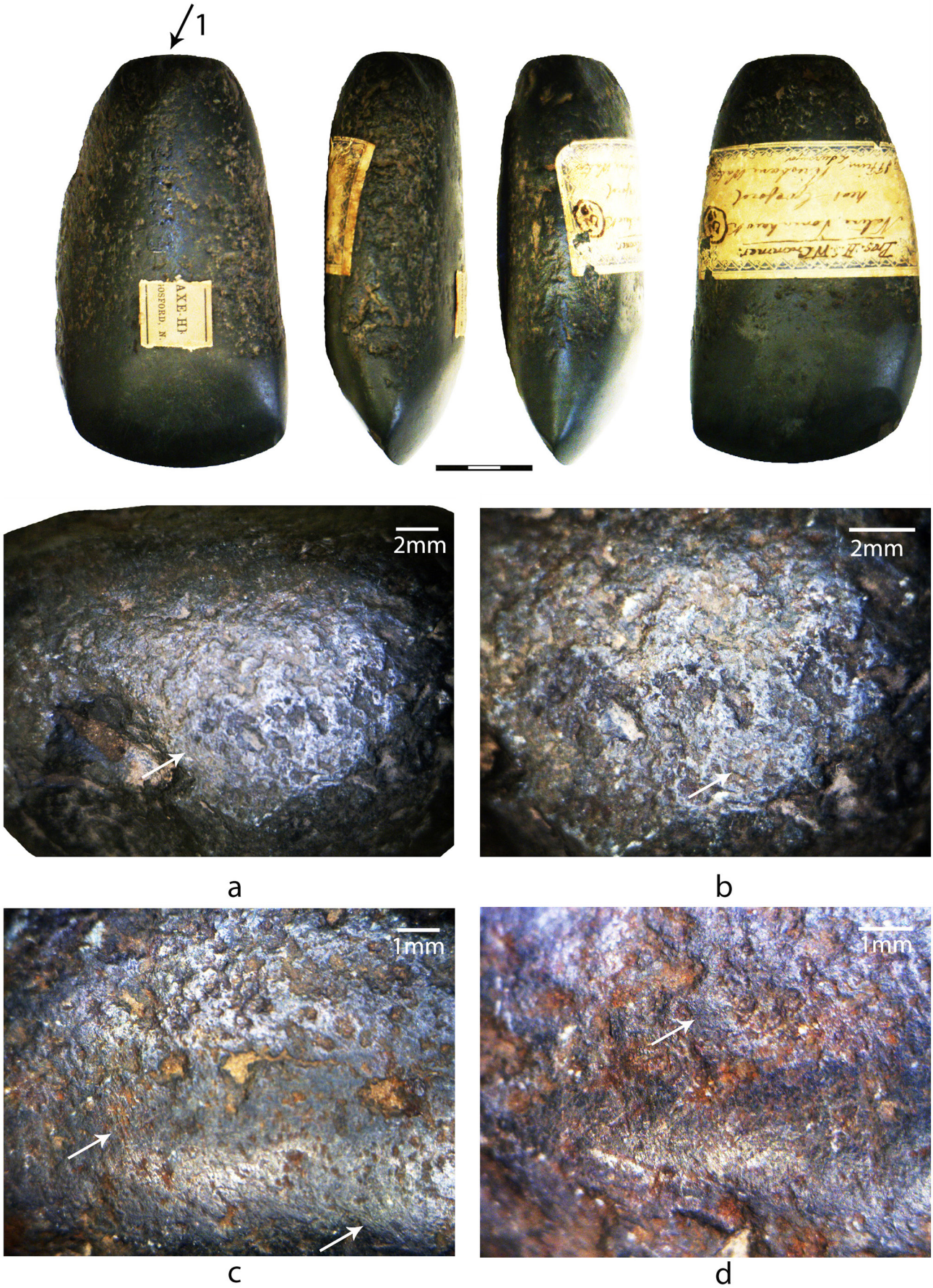


Figure A23. E012712. Hatchet. Chopping wood, polishing bone. Faces and laterals with point 1 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen and striations indicated by arrow (×20); *(b)* point 1, sheen, alignment and fine striations indicated by arrow (×30); *(c)* point 1, sheen and striations indicated by arrows (×40); *(d)* point 1, flattened rock grains, fine striations and sheen indicated by arrow (×50). Photographs Nina Kononenko, scale in 1 cm divisions.

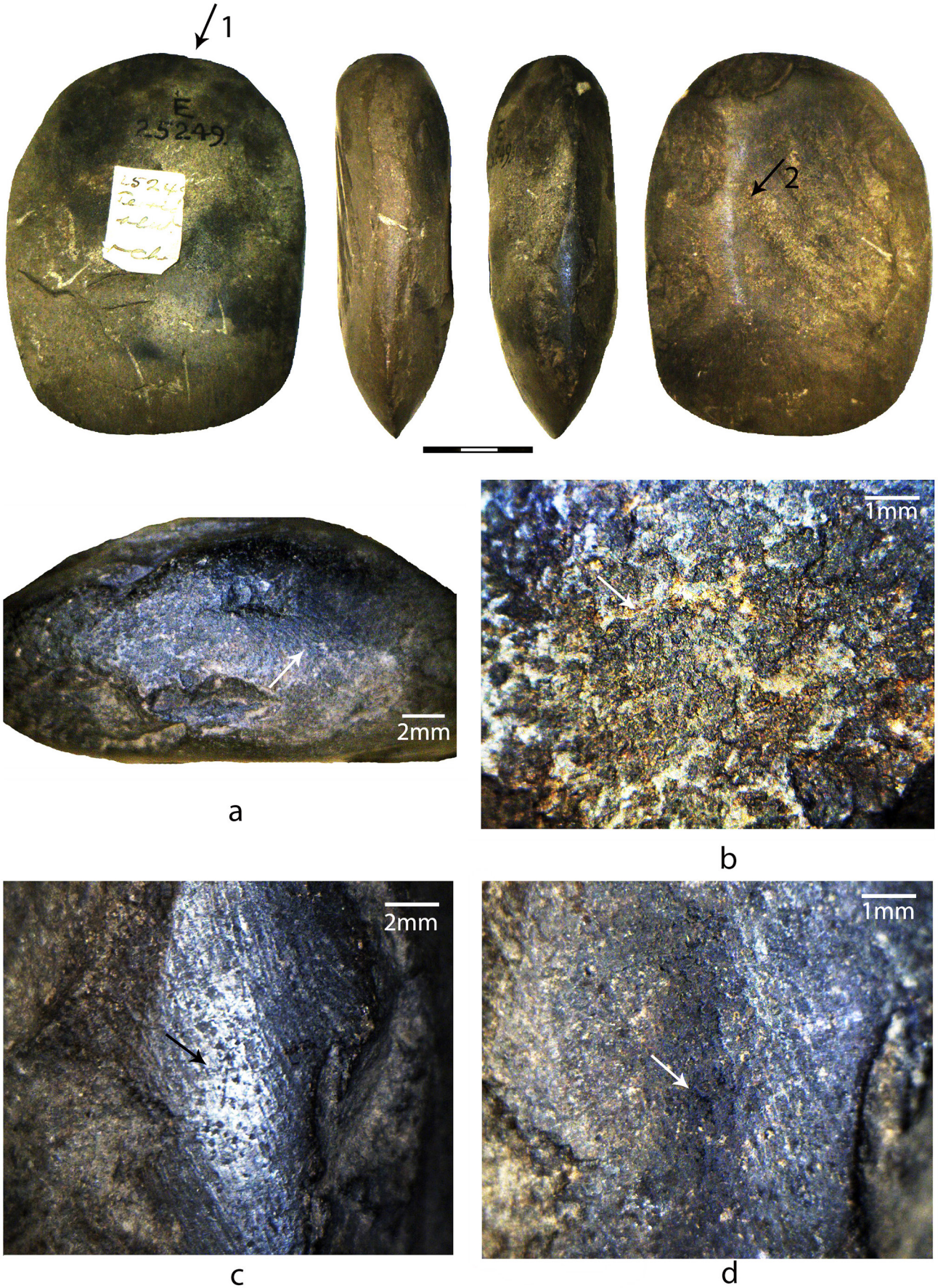
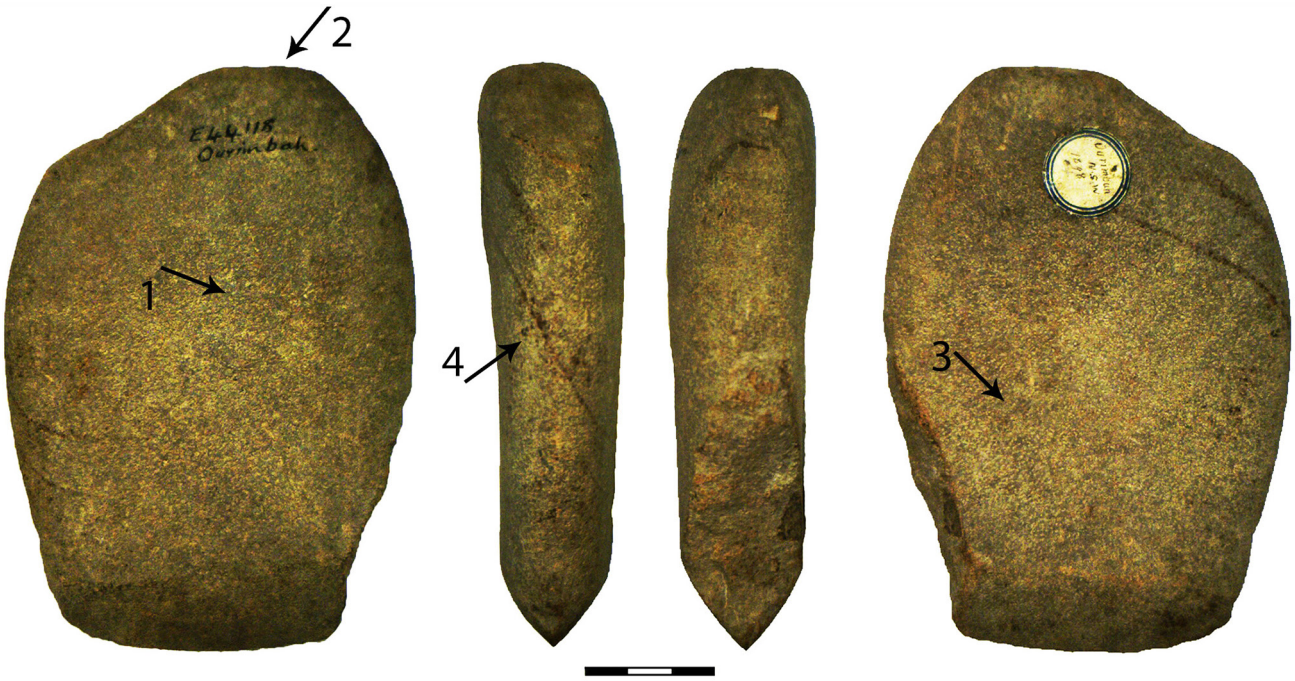
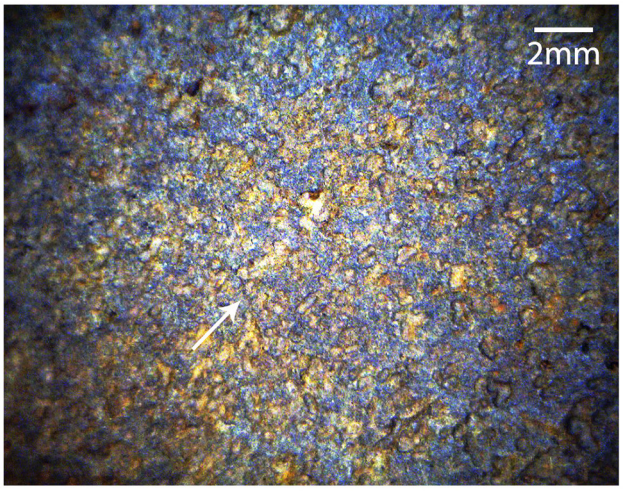


Figure A24. E025249. Hatchet. Chopping wood; polishing bone or shell. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen and alignment indicated by arrow (×20); *(b)* point 1, levelled surface, sheen, alignment and residues indicated by arrow (×50); *(c)* point 2, hafting wear: gloss, alignment and transverse striations indicated by arrow (×25); *(d)* point 2, gloss, alignment and charred non-woody plant residues indicated by arrow (×50, polarized light). Photographs Nina Kononenko, scale in 1 cm divisions.





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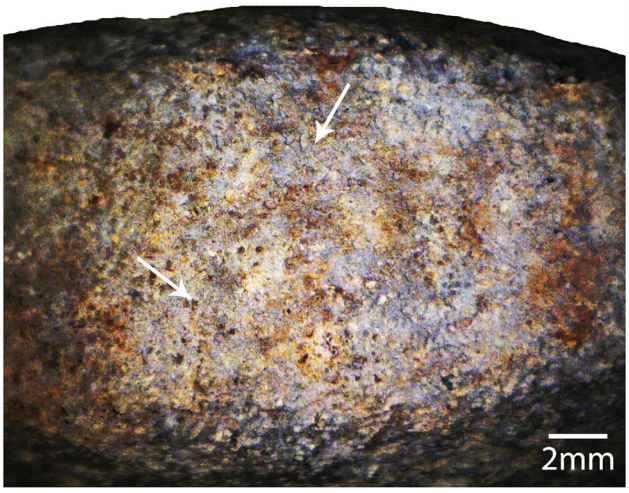

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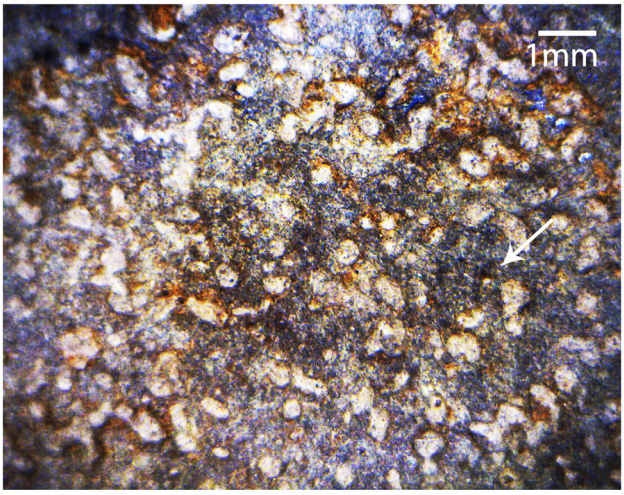

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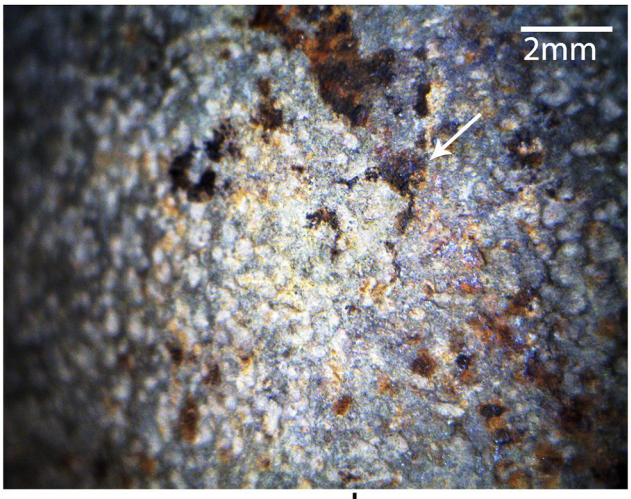

d

Figure A25. E044118. Hatchet. Chopping wood; polishing bone. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen, alignment and striations indicated by arrow (×20); *(b)* point 2, levelled surface, sheen, alignment and striations indicated by arrow (×20); *(c)* point 3, levelled surface, sheen and alignment indicated by arrow (×40); *(d)* point 4, hafting wear: gloss, striations and residues indicated by arrow (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

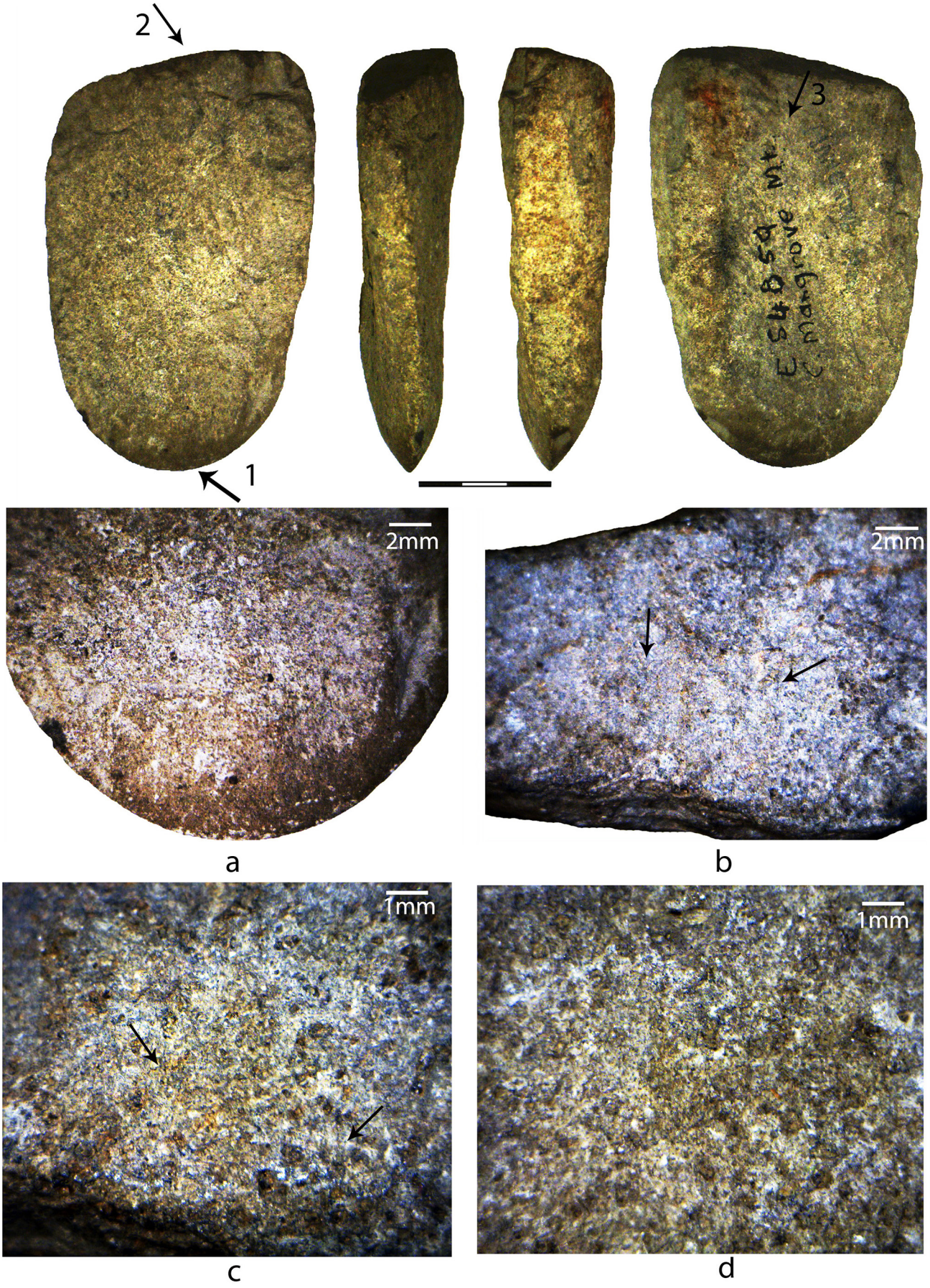

Figure A26. E054859c. Hatchet. Chopping wood; polishing bone. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, ground edge (×20); *(b)* point 2, levelled surface, sheen, alignment and striations indicated by arrows (×20); *(c)* point 2, levelled surface, sheen, alignment and striations indicated by arrows (×40); *(d)* rough unused surface (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

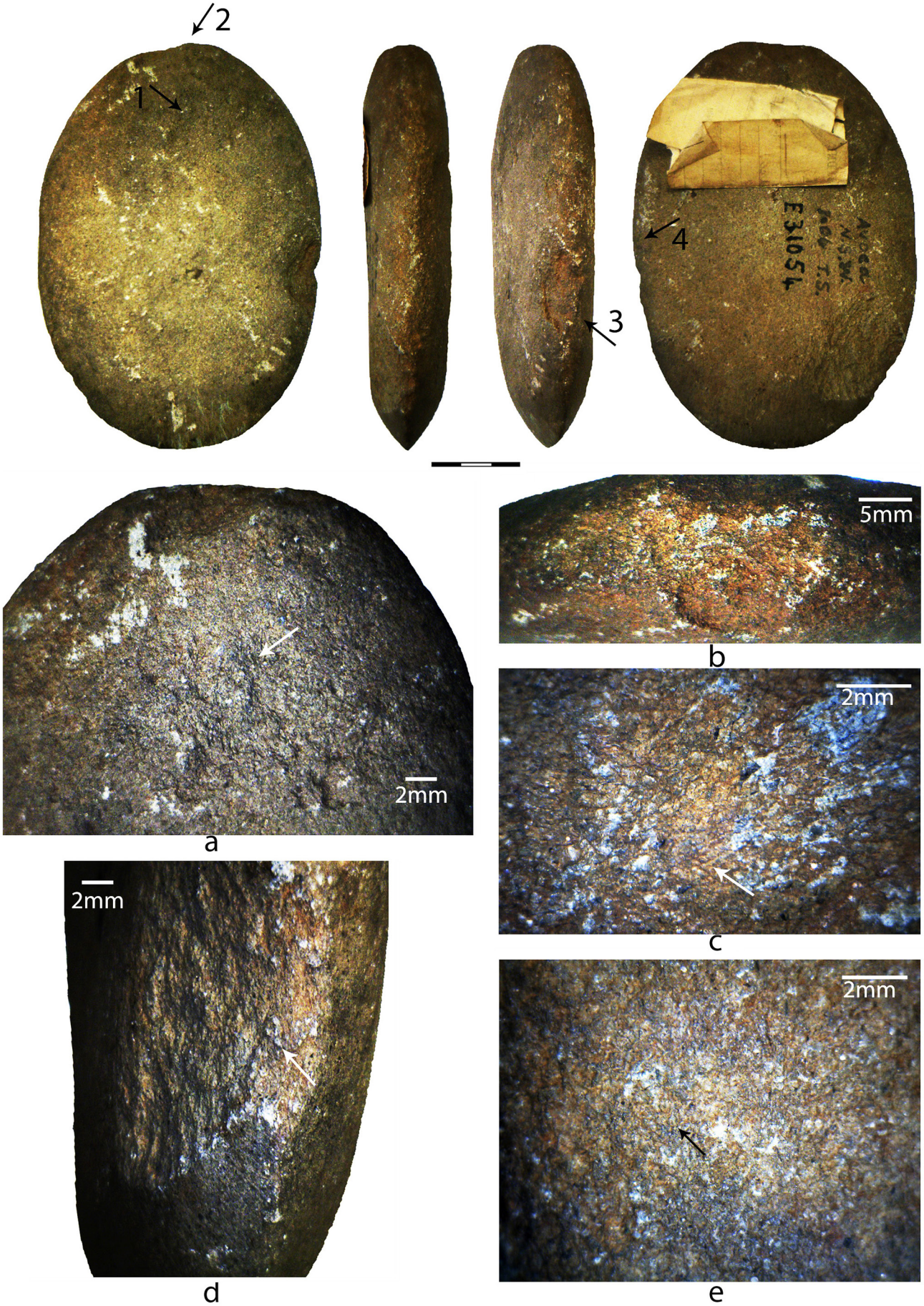

Figure A27. E031054. Hatchet. Chopping wood; breaking bone as hammerstone. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, rough impact marks and scratches indicated by arrow (×15); *(b)* point 2, scars and rough peck marks on the butt (×10); *(c)* point 2, rock grains with crushed edges and striations indicated by arrow (×35); *(d)* point 3, scars and peck marks with crushed rock grains indicated by arrow (×15); *(e)* point 4, hafting wear: gloss, alignment and striations. The arrow indicates striations (x30). Photographs Nina Kononenko, scale in 1 cm divisions.

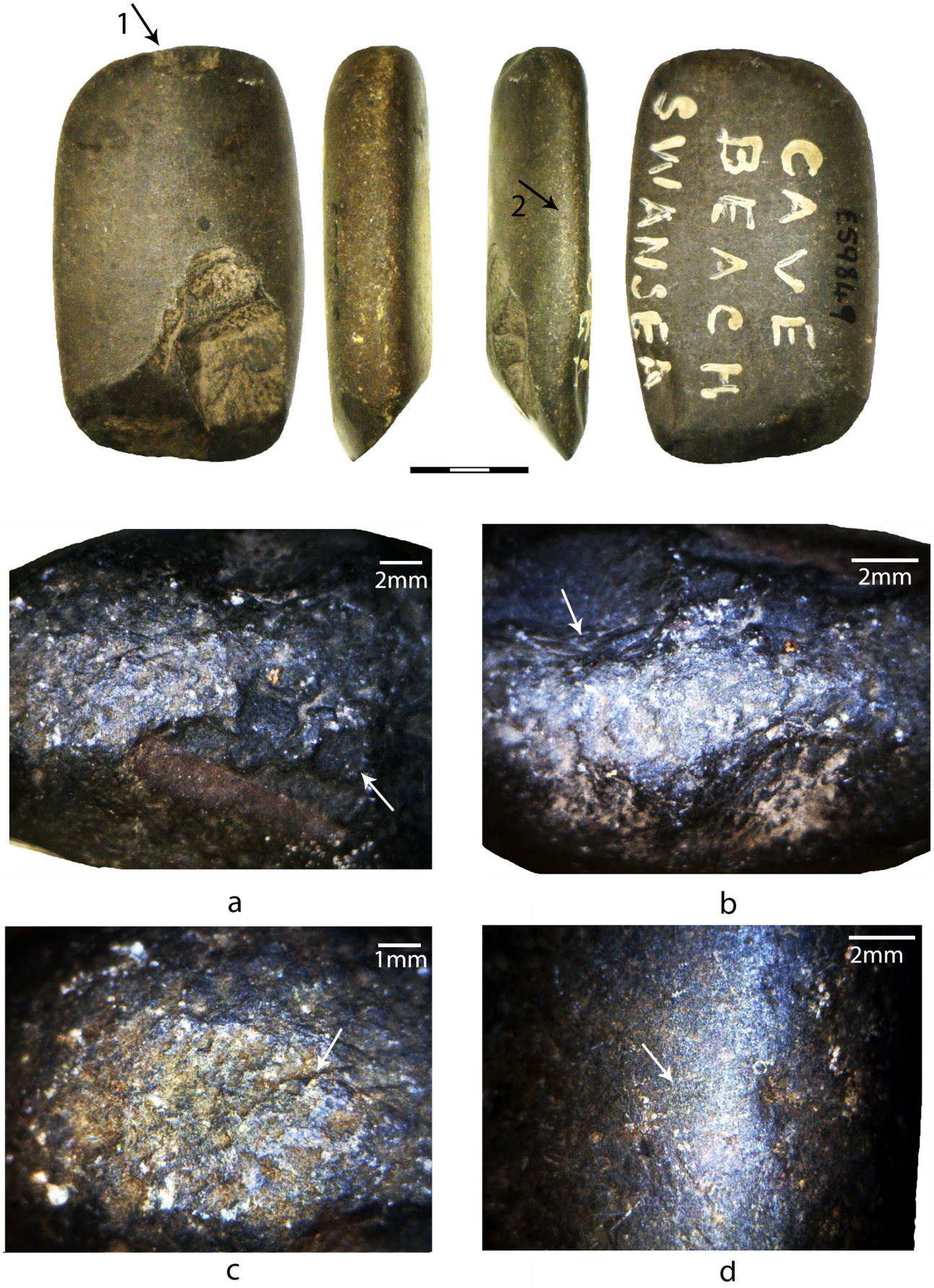

Figure A28. E059849. Hatchet. Chopping wood; breaking bone as hammerstone. Faces and laterals with points 1–2 where images of wear patterns were taken: *(a)* point 1, levelled surface, peck marks and scars indicated by arrow (×20); *(b)* point 1, levelled surface, alignment, superficial sheen and step scars indicated by arrow (×30); *(c)* point 1, rough peck marks and deep cracks indicated by arrow (×40); *(d)* point 2, hafting wear: gloss, alignment and fine striations indicated by arrow (×30). Photographs Nina Kononenko, scale in 1 cm divisions.

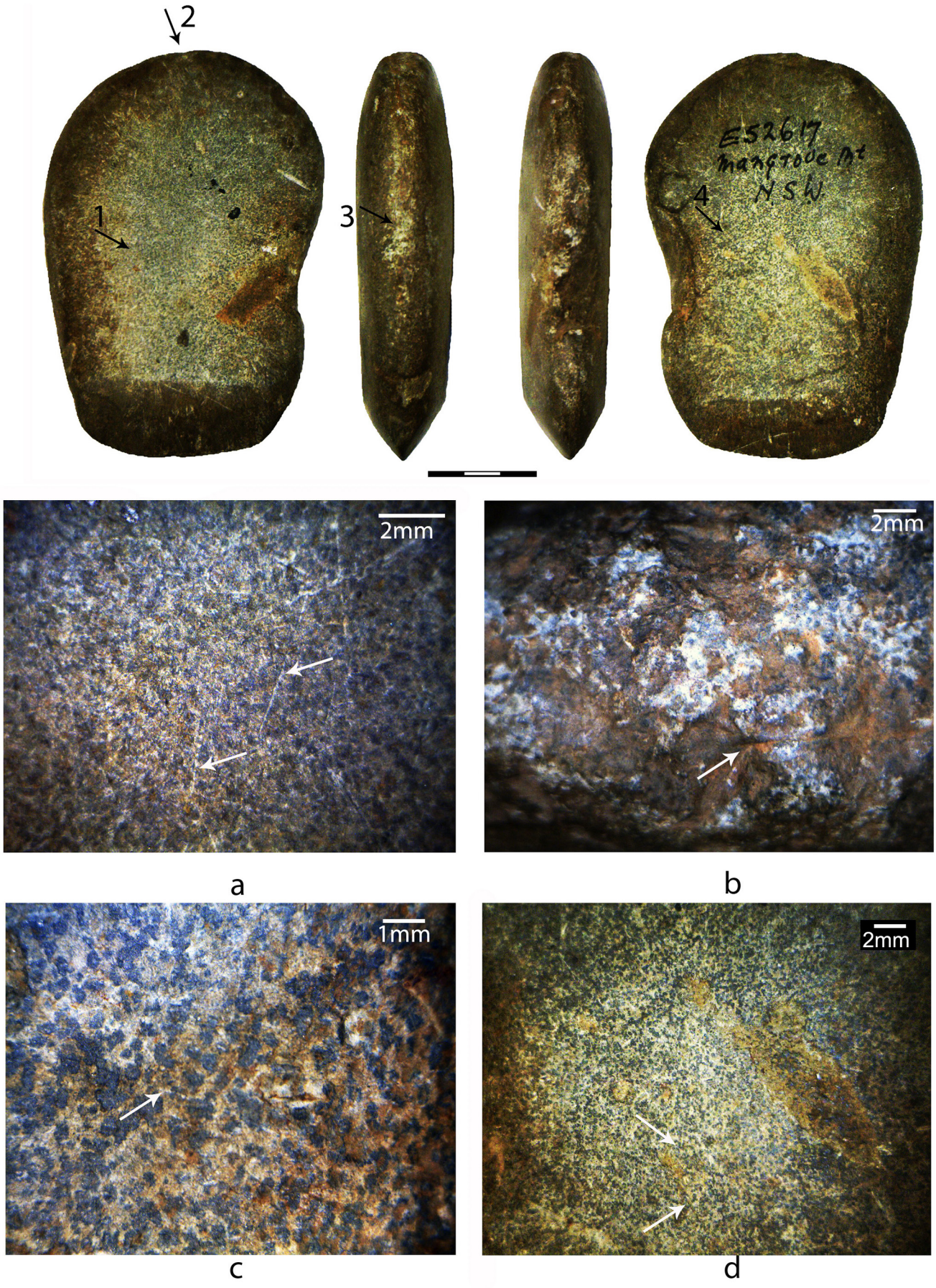

Figure A29. E052617b. Hatchet. Chopping wood; polisher for bone and breaking bone as a hammerstone. Faces and laterals with points 1–4 where images of wear patterns were taken: *(a)* point 1, levelled surface, sheen and striations indicated by arrows (×30); *(b)* point 2, scars, crushed rock grains and crakes indicated by arrow (×20); *(c)* point 3, hafting wear: gloss and fine isolated striations indicated by arrow (×40); *(d)* point 4, levelled surface, sheen, alignment and fine crossed striations indicated by arrows (×15). Photographs Nina Kononenko, scale in 1 cm divisions.

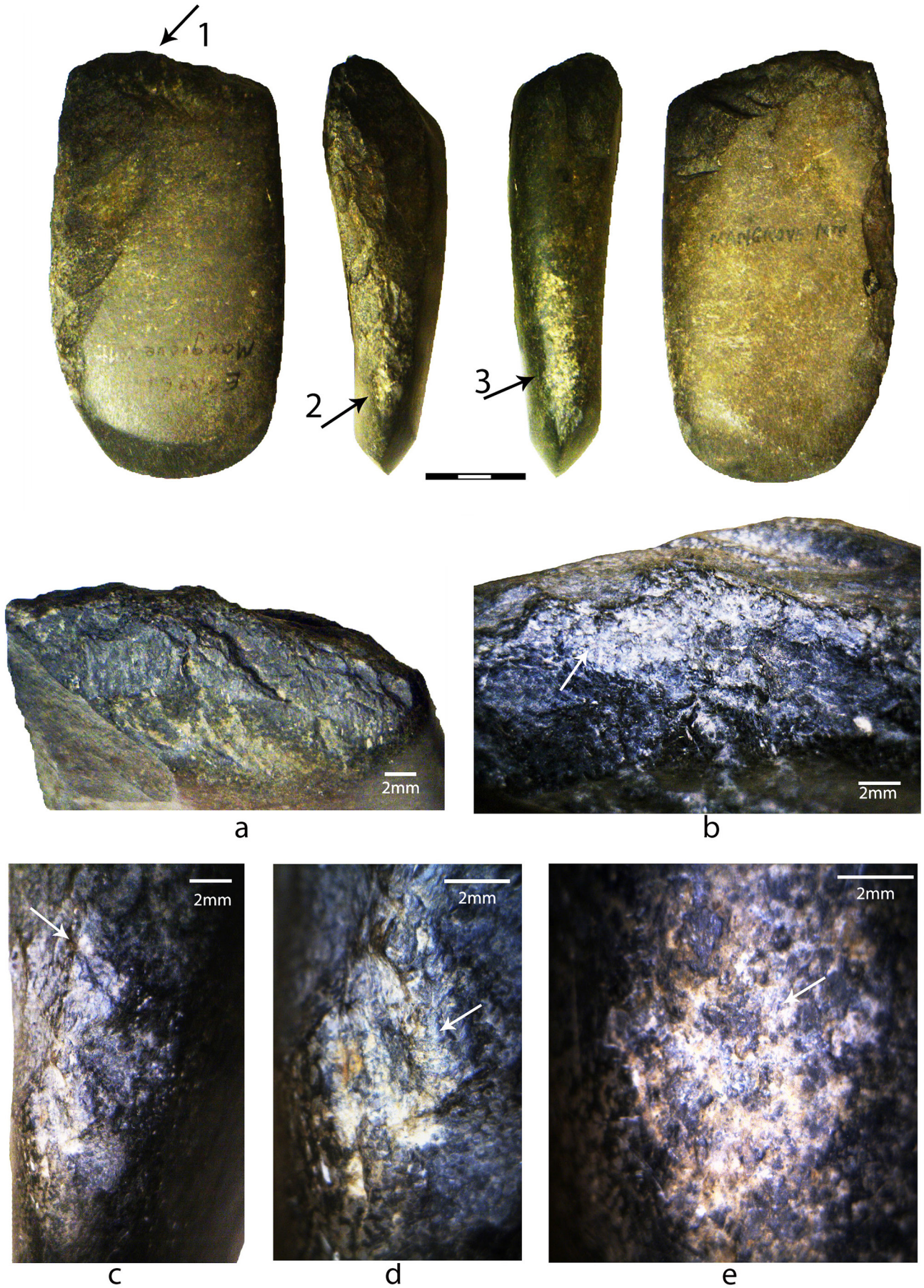

Figure A30. E060861b. Hatchet. Chopping wood; knapping stone as hammerstone. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, scars and partly flattened top (×15); *(b)* point 1, scars, crushed and flattened rock grains indicated by arrow (×20); *(c)* point 2, scars and cracks indicated by arrow (×20); *(d)* point 2, scars with levelled ridges indicated by arrow (×30); *(e)* point 3, abrasive smoothing of the surface, peck marks, crushed rock grains and alignment indicated by arrow (×35). Photographs Nina Kononenko, scale in 1 cm divisions.

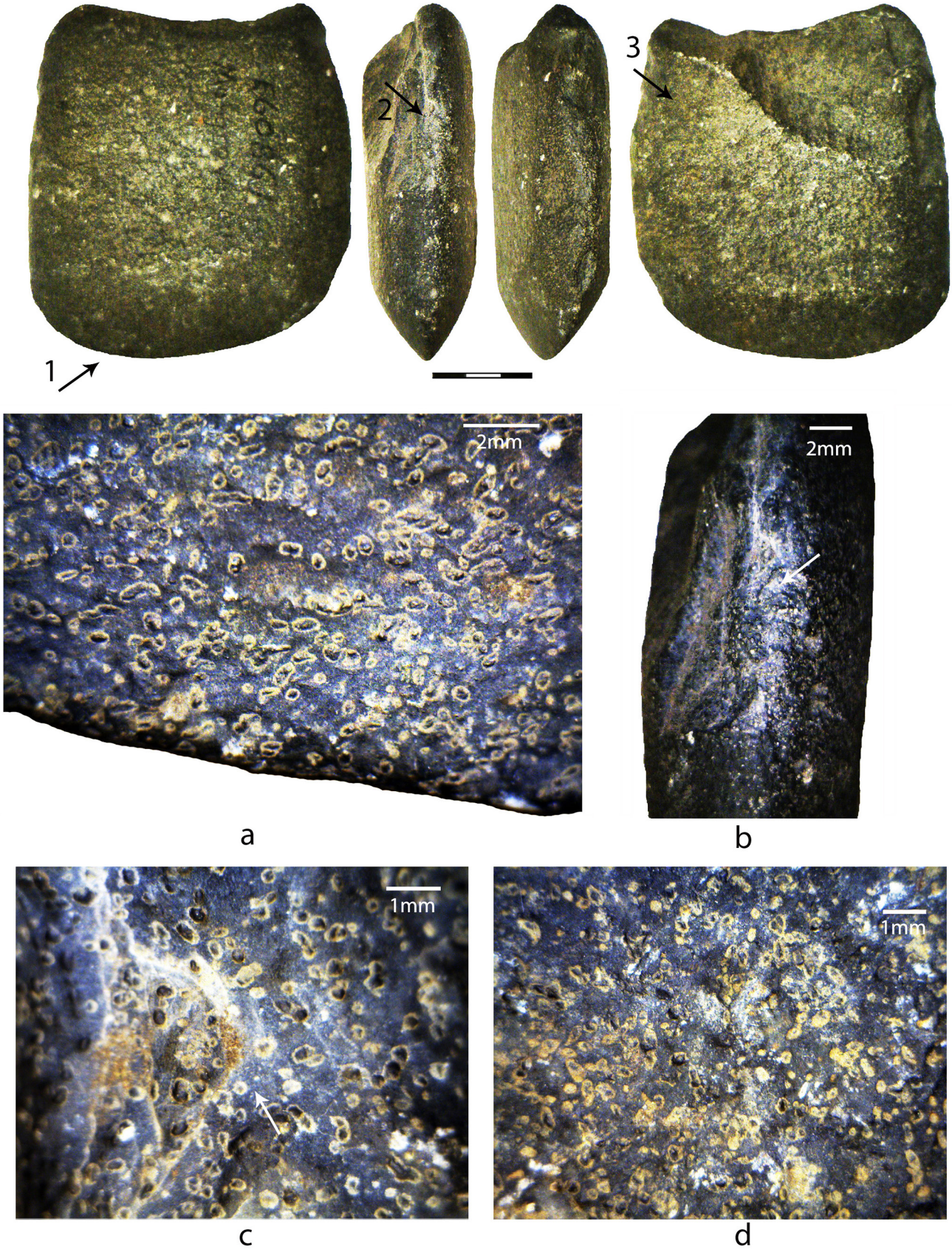

Figure A31. E060861d. Hatchet. Chopping wood; knapping stone as hammerstone. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, smooth levelled surface and alignment (×35); *(b)* point 2, scars and peck marks indicated by arrow (×20); *(c)* point 2, levelled surface and alignment indicated by arrow (×50); *(d)* point 3, unused surface (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

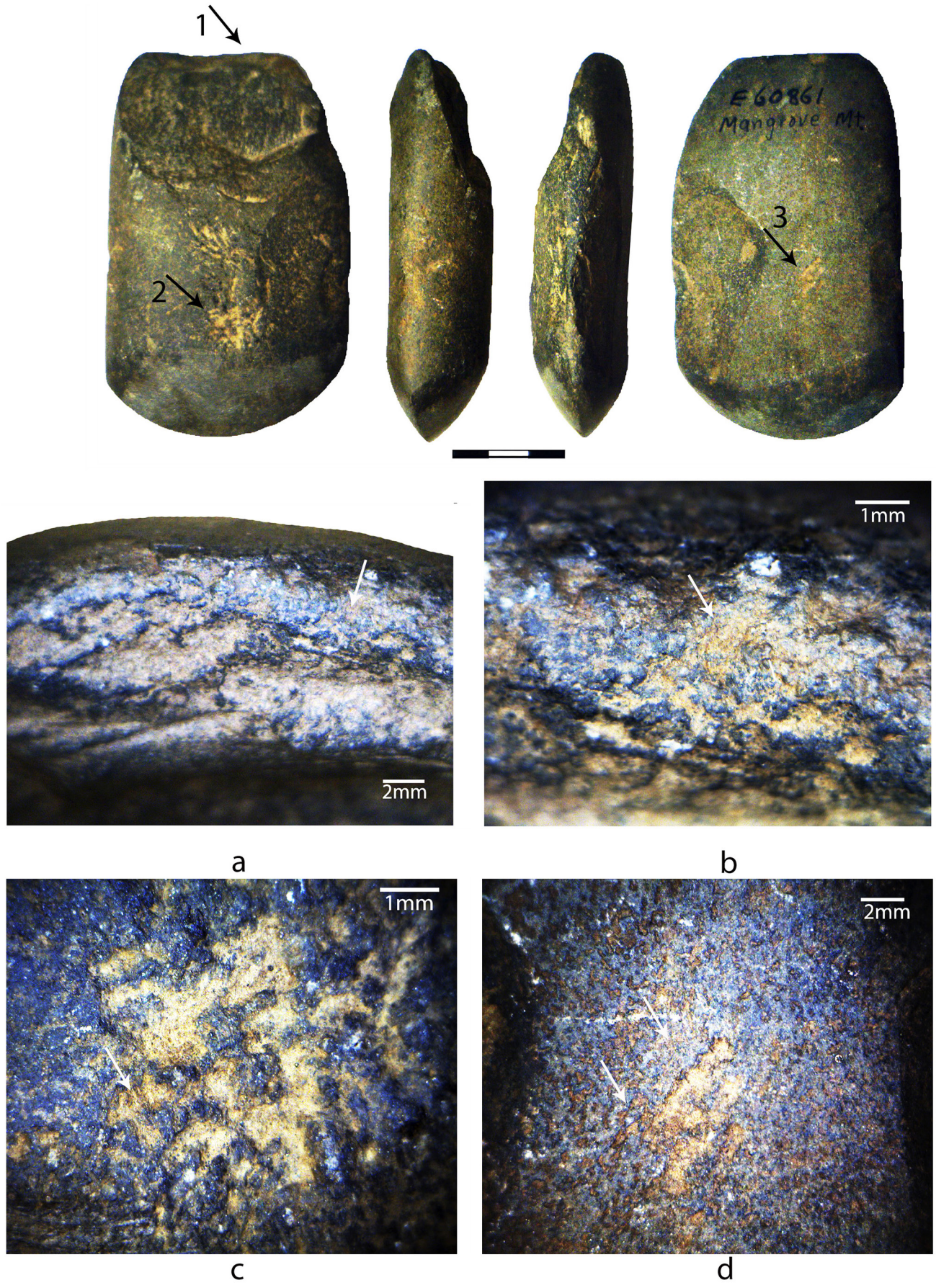

Figure A32. E060861a. Hatchet. Chopping wood; knapping stone as anvil and hammerstone; pounding non-woody plant/seeds. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, scars, levelled surface and peck marks indicated by arrow (×20); *(b)* point 1, smooth surface with flattened rock grains, peck marks and alignment indicated by arrow (×50); *(c)* point 2, deep rough peck marks with crushed rock grains and abrasive smoothing of the surface indicated by arrow (×50); *(d)* point 3, deep peck marks, abrasive smoothing of the surface, scratches and striations indicated by arrows (×20). Photographs Nina Kononenko, scale in 1 cm divisions.

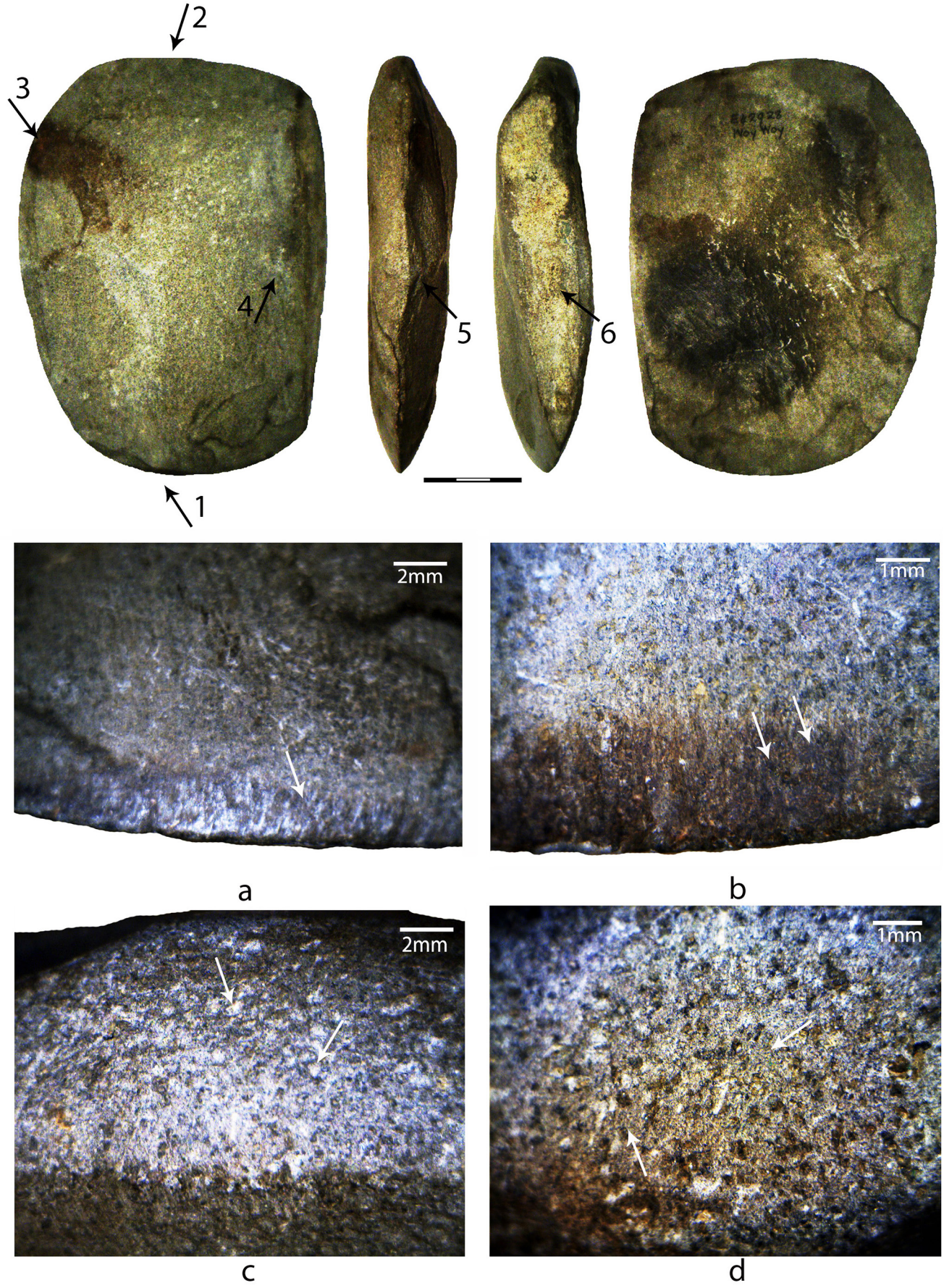

Figure A33. E042928. Hatchet. Skin-working; pounding non-woody plant/seeds. Faces and laterals with points 1–6 where images of wear patterns were taken: *(a)* point 1, edge rounding, sheen and striations indicated by arrow (×25); *(b)* point 1, edge rounding, sheen, striations and charred residues indicated by arrows (×50, polarized light); *(c)* point 2, levelled surface, sheen, alignment, fine striations and peck marks indicated by arrows (×25); *(d)* point 2, levelled surface, sheen and fine striations indicated by arrows (×45). Photographs Nina Kononenko, scale in 1 cm divisions..

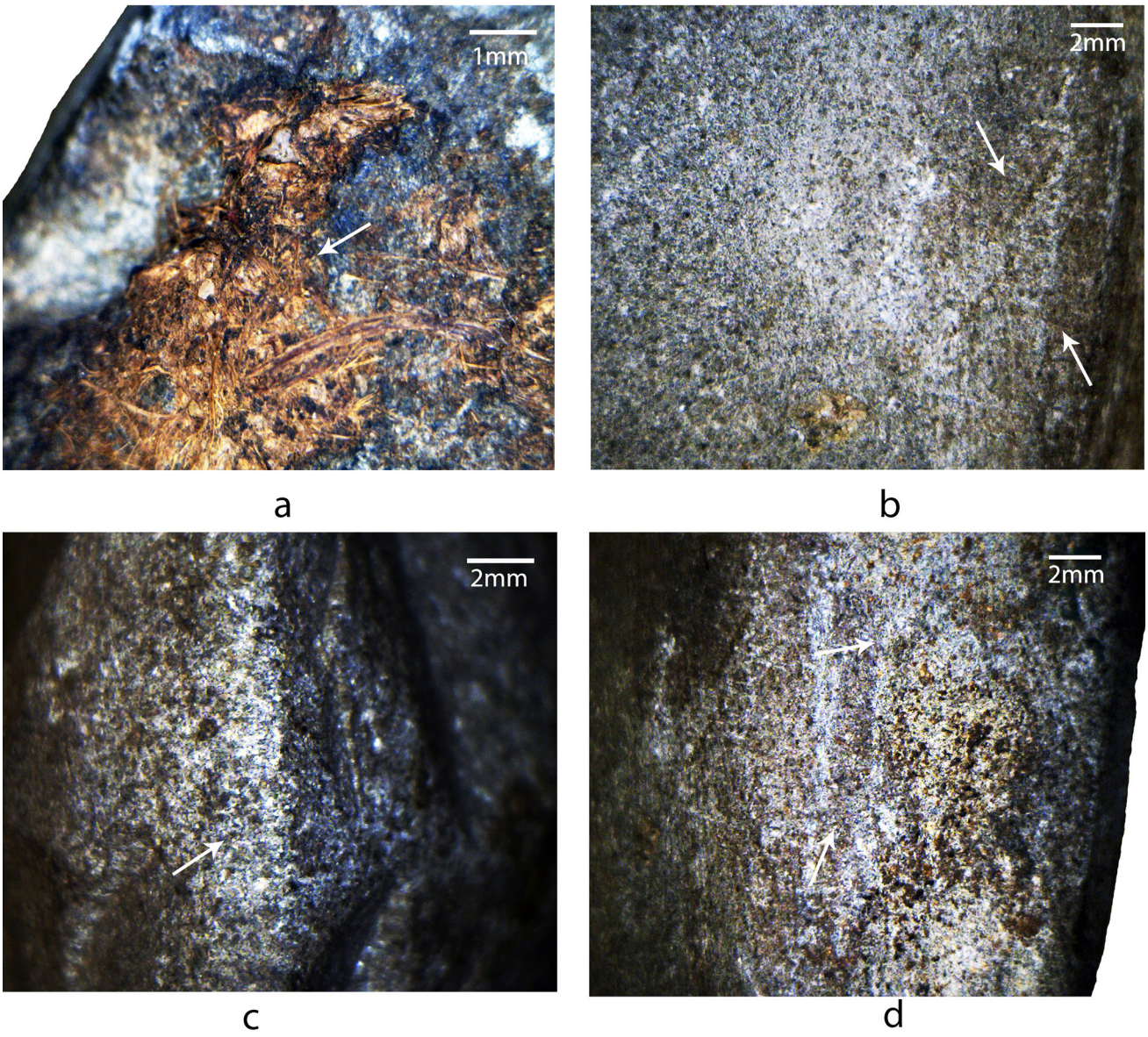

Figure A34. E042928. Hatchet. Hafting wear patterns and residues at points 3–6: *(a)* point 3, plant fibre indicated by arrow (×50); *(b)* point 4, smoothed surface, gloss and fine striations indicated by arrows (×20); *(c)* point 5, smoothed surface, gloss and alignment indicated by arrow (×25); *(d)* point 6, smoothed surface, gloss and fine striations indicated by arrows (×20). Photographs Nina Kononenko, scale in 1 cm divisions..

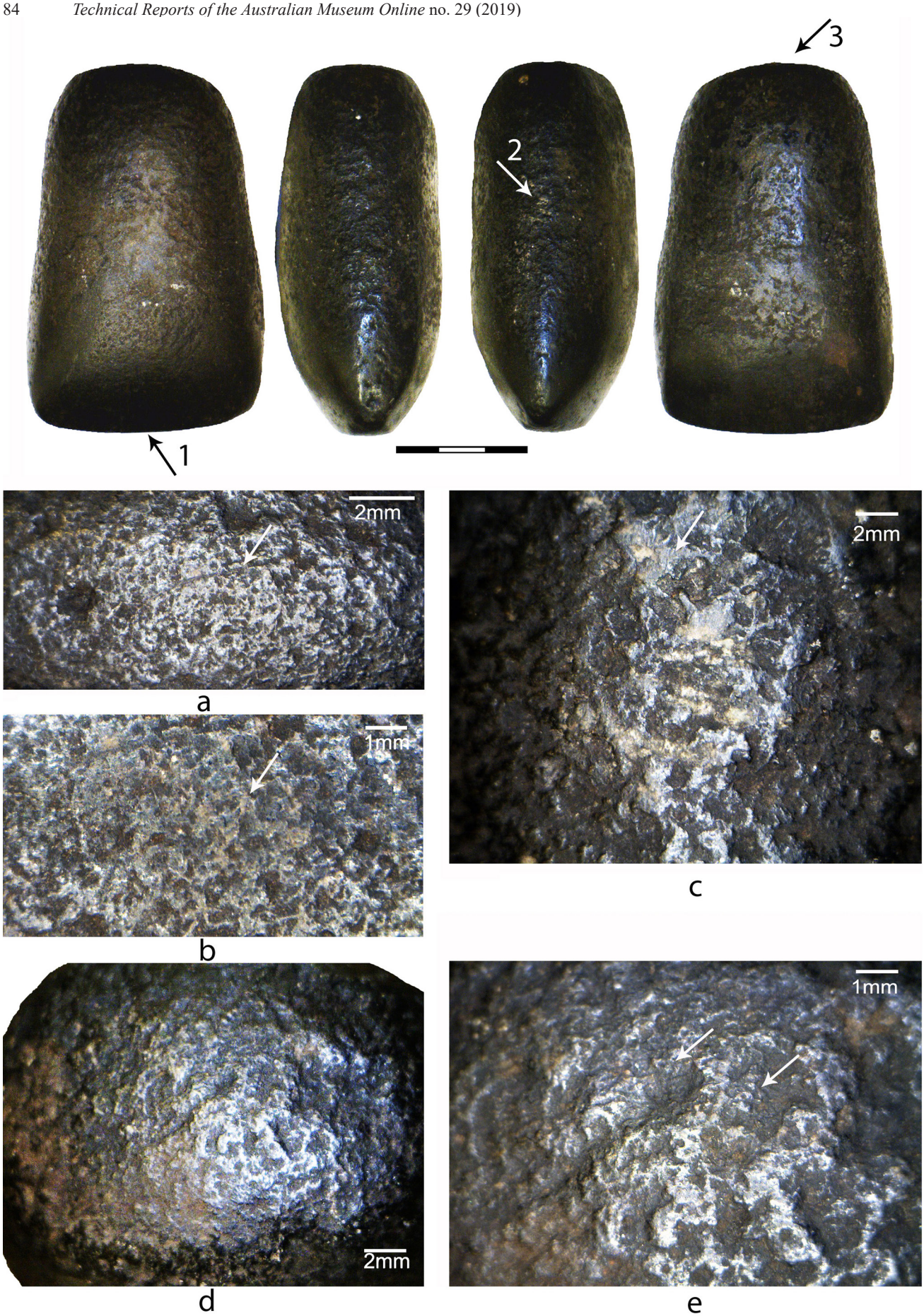

Figure A35. E052619. Hammer/pounder. Polishing bone. Faces and laterals with points 1–3 where images of wear patterns were taken: *(a)* point 1, levelled surface, alignment, sheen and striations indicated by arrow (×30); *(b)* point 1, smoothed surface, sheen and flattened rock grains indicated by arrow (×40); *(c)* point 2, hafting wear: smoothed surface, alignment and gloss indicated by arrow (×20); *(d)* point 3, levelled surface, sheen and alignment (×20); *(e)* point 3, levelled surface, sheen and striations indicated by arrows (×40). Photographs Nina Kononenko, scale in 1 cm divisions.

Table A1. Descriptions of ground-edged artefacts from the New South Wales Central Coast included in the use-wear analysis and other ground-edged artefacts referred to in text. All localities are in NSW.

AM Register Number	Artefact type	AM RegDate	Description (AM Register)	Locality (AM Register)	Remarks (AM Register)	Completeness	Length (mm)	Width (mm)	Thickness (mm)	Mass (g)	Rocktype [pXRF, Ross Pogson]	Region	NinaK UWstudy	PXRF ID no.
E005955	GE hatchet head	06-12-1897	Tomahawk	Coolambong [sic, Cooranbong] nr Morrisett	Northumberland, NSW	Complete	121	107	28	719	Hornfels	Central Coast	Y	301
E011247	GE hammer/pounder	06-12-1902	Stone Hammer (used for crushing Zamia nuts. See E033479	Sandstone Caves Wyong Creek	No. 21—see E20/1902	Complete	88	67	27	309	Hornfels	Central Coast	Y	302
E012712	GE hatchet head	27-07-1904	Stone Axe-Head	near Gosford		Complete	122	64	38	542	Basalt	Central Coast	Y	97
E017183	GE hatchet head	04-09-1907	Axe-Head, found in drift 30 ft below surface	Tuggerah	Transferred to Palaeontology Dept, AM	Broken; very large	212	114	[38]	[1391]	Hornfels/Quartzite	Central Coast	Y	99
E020467	GE hatchet head	09-08-1912	Stone Axe—with husking holes	Metropolitan district	No. 308	Complete	131	88	39	694	Hornfels	Sydney	Y	1525
E020469	GE hatchet head	09-08-1912	Stone Axe—with husking holes	Metropolitan district		Complete	106	85	33	517	Hornfels	Sydney	Y	1526
E020470	GE hatchet head	09-08-1912	Stone Axe—with husking holes	Metropolitan district		Complete	110	60	29	332	Hornfels	Sydney	Y	1527
E025249	GE hatchet head	19-08-1918	Aborig. Stone Axe	Wamberal, near Terrigal		Complete	100	76	32	385	Basalt	Central Coast	Y	101
E027596	GE hatchet head	19-04-1923	Massive Stone Axe, or Wedge	Portion 110, PA Mooney Mooney Ck, Hawkesbury Rv. Later anontated in pencil with "Erina" [ref reg]		Complete; very large	212	151	44	2400	Fine-grained sedimentary	Central Coast	Y	103
E031054	GE hatchet head	30-05-1927	Aboriginal Stone Axe	Avoca	See E28935 and other numbers	Complete	132	88	27	509	Fine-grained sedimentary	Central coast	Y	104
E031898	GE hatchet head	10-09-1928	Aborig. Stone Axe	near Fennell's Bay Bridge, Lake Macquarie		Complete	80	65	28	240	Igneous	Central coast/Hunter Valley	Y	249
E032843	GE hatchet head	05-11-1929	Aborig. Stone Axe	Yarramalong, W of Wyong		Complete	82	71	41	384	Basalt	Central Coast	Y	105
E033280	GE hatchet head	12-05-1930	Aborig. Stone Axe	near Palmer's Wharf, Empire Bay via Woy Woy		Complete	104	60	27	322	Metamorphosed sedimentary	Central Coast	Y	107
E033473 [exchanged]	GE hammer/pounder	15-07-1930	Stone Hammer	Rock Shelters, Mangrove Mountain, W of Gosford	see E25660-6. Anotated by Thorpe—see below which refers to annotation against 33479-81—"?Used for crushing Zamia nuts preparatory to maceration of kernel"	Exchanged; not seen					Exchanged; not analysed	Central Coast	N	311
E033479	GE hammer/pounder	15-07-1930	Stone Implement, ?Hammer	Rock Shelters on slopes of Mangrove Mountain, W of Gosford	Figured by Thorpe (1932: pl.XXVII, fig.3). 1ft 6 in in ashes and debris. See E.25660–66	Complete	155	97	31	837	Basalt	Central Coast	Y	108
E033480	GE hammer/pounder	15-07-1930	Stone Implement, ?Hammer	Rock Shelters on slopes of Mangrove Mountain, W of Gosford	Figured by Thorpe (1932: pl.XXVII, fig.3). 1ft 6 in in ashes and debris. See E.25660–66. WWT anotation: "?Used for crushing Zamia nuts preparatory to maceration of kernel	Complete	151	100	39	909	Basalt	Central coast	Y	137
E033481	GE hammer/pounder	15-07-1930	Stone Implement, ?Hammer (with traces of hafting)	Rock Shelters on slopes of Mangrove Mountain, W of Gosford	Figured by Thorpe (1932: pl.XXVII, fig.3). 1ft 6 in in ashes and debris. See E.25660–66. WWT anotation "?Used for crushing Zamia nuts preparatory to maceration of kernel"	Complete	710	590	65	262	Basalt	Central Coast	N	307
E033647	GE hatchet head	16-10-1930	Stone Axe	From Rock Shelter, Parish Kooree, Mangrove Mountain	At shallow depth in sand, ashes and charcoal . Crown Lands N of portion 91 Glennies property	Complete	116	75	23	324	Hornfels/Quartzite	Central coast	Y	135

Table A1 (continued). Descriptions of ground-edged artefacts from the New South Wales Central Coast included in the use-wear analysis and other ground-edged artefacts referred to in text. All localities are in NSW.

AM Register Number	Artefact type	AM RegDate	Description (AM Register)	Locality (AM Register)	Remarks (AM Register)	Completeness	Length (mm)	Width (mm)	Thickness (mm)	Mass (g)	Rocktype [pXRF, Ross Pogson]	Region	NinaK UWstudy	PXRF ID no.
E033655	GE hammer/pounder	23-10-1930	Basaltic Hammer or "Pounder"	From rock shelter, Parish of Popran, Mangrove Mountain	Thorpe anotation: See remarks under E33479. Figured by Thorpe (1932: pl XVIII, fig. 6, pl XXVII fig. 7)	Complete	113	85	44	720	Basalt	Central Coast	N	306
E035987	GE hammer/pounder	09-08-1933	Stone Axe	Woy Woy		Broken	[84.20]	66	23	[237]	Hornfels	Central Coast	Y	123
E036242	GE hatchet head	27-10-1933	Ground-edge axe	Empire Bay, Woy Woy		Complete	114	60	30	376	Unknown metamorphic	Central Coast	Y	124
E042883	GE hatchet head	24-07-1936	Ground-edge axe	Little Mooney Mooney Ck Reserve	Sch 323/1936	Complete	132	88	46	798	Basalt	Central coast	Y	110
E042926	GE hatchet head	03-09-1936	Ground-edge axe—pebble type	Koolewong, Woy Woy	Murphys Bay	Complete	131	69	28	420	Hornfels	Central coast	Y	187
E042928	GE hatchet head	03-09-1936	Ground-edge axe—flaked	Koolewong, Woy Woy		Complete	126	93	23	508	Basalt	Central coast	Y	189
E042929	GE hatchet head	03-09-1936	Ground-edge axe—flaked	Koolewong, Woy Woy		Complete	99	74	35	373	Basalt	Central coast	Y	190
E042997	GE hatchet head	29-10-1936	Ground edge flaked axe	Point Clare, Woy Woy, Hawksberry River	Found by Andrew Murphy. Anvil holes in each surface.	Complete	105	87	32	519	Hornfels	Central coast	Y	372
E044118	GE hatchet head	04-11-1937	Ground edge axe—pebble type	Ourimbah	Collected 1898 [ref reg]	Complete	132	91	30	607	Hornfels	Central Coast	Y	191
E052617a	GE hatchet head	13-12-1948	Edge-ground axes—pebble	Mangrove Mountain		Complete	105	78	30	398	Hornfels	Central Coast	Y	193
E052617b	GE hatchet head	13-12-1948	Edge-ground axes—pebble	Mangrove Mountain		Complete	111	71	26	360	Hornfels	Central Coast	Y	194
E052618	GE hatchet head	13-12-1948	Edge-ground axes—pecked	Mangrove Mountain		Complete	109	85	35	452	Hornfels	Central Coast	Y	195
E052619	GE hammer/pounder	13-12-1948	Edge-ground hammer-axe—pecked	Mangrove Mountain		Complete	79	52	36	250	Meta-basalt	Central Coast	Y	196
E052620	GE hammer/pounder	13-12-1948	Edge-ground hammer-axe—pecked	Mangrove Mountain		Complete	109	55	45	428	Hornfels	Central coast	Y	138
E053281	GE hammer/pounder	13-12-1948	Edge-ground axe—pebble	Mangrove Mountain		Complete	85	57	39	353	Basalt	Central coast	Y	141
E054640	GE hatched head	17-01-1952	Edge-ground axe—pebble	Fox's Bay, Mooney Mooney Creek		Complete	103	54	32	227	Basalt	Central Coast	Y	199
E054857	GE hatchet head	09-09-1952	Edge-ground axe—Pebble-type	Avoca		Complete	118	59	35	379	FG Volcanic	Central Coast	Y	206
E054858a	GE hammer/pounder	09-09-1952	Edge-ground axe—Pebble-type.	Central Mangrove Mountain	Ground-edge battered to flat percussion surface	Complete	87	62	41	329	Basalt	Central Coast	Y	207
E054858c	GE hammer/pounder	09-09-1952	Edge-ground axe—Pebble-type	Mangrove Mountain	Ground-edge battered to flat percussion surface	Broken	86	[71]	28	[300]	Hornfels	Central Coast	Y	280
E054858d	GE hammer/pounder	09-09-1952	Edge-ground axe—Pebble-type	Mangrove Mountain	Ground-edge battered to flat percussion surface	Complete	94	94	31	444	Hornfels	Central Coast	Y	281
E054859c	GE hatchet head	09-09-1952	Edge-ground axe—Biface coroid-type	Central Mangrove Mountain		Complete	90	59	23	185	Basalt	Central coast	Y	132
E054859d	GE hatchet head	09-09-1952	Edge-ground axe—Biface coroid-type	Central Mangrove Mountain		Complete	137	73	30	376	Basalt	Central coast	Y	133
E054859f	GE hatchet head	09-09-1952	Edge-ground axe—Biface coroid-type	Central Mangrove Mountain		Complete	140	96	43	859	Basalt	Central coast	Y	209
E054861a	GE hatchet head	09-09-1952	Edge-ground axe—Pecked	Central Mangrove Mountain		Complete	112	56	45	484	Basalt	Central coast	Y	143

Table A1 (continued). Descriptions of ground-edged artefacts from the New South Wales Central Coast included in the use-wear analysis and other ground-edged artefacts referred to in text. All localities are in NSW.

AM Register Number	Artefact type	AM RegDate	Description (AM Register)	Locality (AM Register)	Remarks (AM Register)	Completeness	Length (mm)	Width (mm)	Thickness (mm)	Mass (g)	Rocktype [pXRF, Ross Pogson]	Region	NinaK UWstudy	PXRF ID no.
E054862a	GE hammer/pounder [assumed]	09-09-1952	Edge-ground axe—Biface coroid-type	Central Mangrove Mountain	Sch.181. Ground-edge battered to flat percussion surface	Exchanged; not seen					Exchanged; not analysed	Central Coast	N	373
E054862b	GE hammer/pounder [assumed]	09-09-1952	Edge-ground axe—Biface coroid-type	Central Mangrove Mountain	Sch.181. Ground-edge battered to flat percussion surface	Exchanged; not seen					Exchanged; not analysed	Central Coast	N	304
E054862c	GE hammer/pounder [assumed]	09-09-1952	Edge-ground axe—Biface coroid-type	Central Mangrove Mountain	Sch.181. Ground-edge battered to flat percussion surface	Exchanged; not seen					Exchanged; not analysed	Central Coast	N	305
E054882	GE hatchet head	09-09-1952	Edge-ground axe—Pebble-type	Toukley		Complete	122	92	41	760	Basalt	Central Coast	Y	224
E057828[Reg]; E057372[GEA]	GE hatchet head	30-08-1955	Edge-ground axe—flaked pebble type	Lake Macquarie		Complete	128	84	25	419	Ignimbrite, welded rhyolitic tuff	Central coast/Hunter Valley	Y	225
E059797	GE hammer/pounder	01-12-1960	Ground-edge axe: biface-coroid	Gosford		Complete	76	72	34	281	Dolerite	Central Coast	Y	226
E059798	GE hatchet head	12-01-1960	Ground-edge axe: pecked & grooved	Gosford		Broken	[91.49]	60	36	[351]	Meta-basalt	Central Coast	Y	227
E059849	GE hatchet head	13-01-1960	Edge-ground axe	Cave Beach, Swansea		Complete	96	59	25	234	Hornfels	Central coast/Hunter Valley	Y	229
E060861a	GE hatchet head	23-10-1962	Edge-ground axe—flaked pebble type	Mangrove Mountain		Complete—though large flake removed from one surface	102	63	26	[255]	Quartzite	Central coast	Y	139
E060861b	GE hatchet head	23-10-1962	Edge-ground axe—flaked pebble type	Mangrove Mountain		Complete	127	70	29	412	Hornfels/quartzite	Central coast	Y	140
E060861c	GE hatchet head	23-10-1962	Edge-ground axe—flaked pebble type	Mangrove Mountain		Complete	97	69	28	304	Ignimbrite, rhyodacite, FGVolcanic	Central coast	Y	231
E060861d	GE hatchet head	23-10-1962	Edge-ground axe—flaked pebble type	Mangrove Mountain		Broken	[98.68]	94	31	[489]	Hornfels	Central coast	Y	232
E065196a	GE hatchet head	17-10-1971	Collection of stone implements	Mangrove Mountain and Newcastle	Coll. in farming between Mangrove Mountain and Shakeshaft	Complete	124	84	41	659	Basalt	Central Coast	Y	314
E065196e	GE hatchet head	17-10-1971	Collection of stone implements	Mangrove Mountain and Newcastle	Coll. in farming between Mangrove Mountain and Shakeshaft	Complete	110	51	27	199	Basalt	Central Coast	Y	318
E065196q	GE hatchet head	17-10-1971	Collection of stone implements	Mangrove Mountain and Newcastle	Coll. in farming between Mangrove Mountain and Shakeshaft	Complete	101	66	31	314	Hornfels/quartzite	Central Coast	Y	331

Table A2. Historically recorded (pre-1900) uses of southeast Australian ground-edged hatchets.

uses of hatchets	references
Woodworking	
Shaping wood into shields, containers, clubs or spears	Brough Smyth (1878: vol 1, p 379)
	Tench (1979: 284 [1793: 191])
Cutting off sheets of bark for bark shelters, shields and canoes	Brough Smyth (1878: vol 1, p 379)
	Mathews (1895: 303)
	Tench (1979: 284 [1793: 191])
Cutting footholds in the trunks of trees so as to climb trees to gain access to possums and 'flying squirrels' (grey headed bats)	Bradley (1969:129 [1786–1792]:129)
	Brough Smyth (1878: vol 1, p 379)
	Collins (1975: 456 [1798])
	Dawson (1830: 202)
	Mathews (1895: 303)
	Phillip (1892: 135 [15 May 1788])
	Stockdale (1789 [1950]: 103–104)
	White (1962 [1790]: 201)
Cutting open tree limbs/trunks to gain access to possums, honey, grubs and insect eggs	Barrallier (1802 [1975: 6, no. 9])
	Brough Smyth (1878: vol 1, p 379)
	Grant (1803:158) in Brayshaw (1986: 66)
	Hunter (1968 [1793]: 61)
Cutting down trees	Brough Smyth (1878: vol 1, p 379)
Preparing bark for canoe manufacture	Beveridge (1889: 69)
	Spencer (1914: 387)
Used as wedges in removing timber/bark from trees for shields and containers	Bradley (1969 [1786–1792]: 129–130)
Non-woodworking	
Butchering large animals	Brough Smyth (1878: 379)
	Dawson (1830: 202)
Cleaning skins	Brough Smyth (1898: vol 1, p 379)
Communal hunting	Barrallier (1975 [1802: 2–3 no. 5])
Skinning animals	Brough Smyth (1878: vol 1, p 379)
Striking off flakes of stone for inserting into spear heads	Brough Smyth (1878: vol 1, p 379)
Using an old 'tomahawk' to shape a new one from a rough block of stone	Brough Smyth (1878: vol 1, p 378–279)
As a weapon 'when no other offers to their necessities'	Collins (1975 [1798]: 487)

Table A3. New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR: Modification to edge, butt, laterals: Scars	Rounding, Battering	Surface modification: Surface levelling	Grain modification	Peck marks, Pits	Linear traces: Alignment, high or low topography	Striations	Cracks	Sheen: Texture, reflectivity	Extent of sheen	WEAR TYPE: Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	MATERIAL WORKED: WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE	HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
E005955—hatchet																																								A22
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high to low	dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial										•												•							
face 1				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial										•												•							
face 2				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial										•												•							
lateral 2				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial										•												•							
E011247—hammer/pounder																																								27
edge	1		battered	flat, smooth	intensively flattened		smooth, high	dense, fine, parallel, some crossed		smooth, very reflective	superficial, slightly invasive														•										•					
butt				flat, smooth	intensively flattened		smooth, high	dense, fine, parallel, some crossed		smooth, very reflective	superficial, slightly invasive														•										•					
E012712—hatchet																																								2, A23
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high to low	dense, short, diagonal and perpendicular		smooth,very reflective	superficial, slightly invasive	•																	•											
butt				rounded, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel		smooth,very reflective	superficial										•												•							
E017183—hatchet																																								6, 31
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial		•																•											
butt		continuous, large, bifacial	slight	undulating	crushed, flattened		slight, high	none		slight smoothing	superficial		•																•											
face 1																																						•		
face 2																																						•		
lateral 1																																						•		
lateral 2																																						•		
E020467—hatchet																																								18
edge	1	continuous, small and microscars	intensive	flat, relatively rough	flattened		high to low	dense, short, diagonal and perpendicular		smooth, very reflective	superficial	•																	•											
butt				undulating	flattened, crushed, rounded	dense, wide, deep and shallow	high	fine, few, isolated	numerous, irregular, deep	smooth, very reflective	superficial									•												•								
face 1				deliberate pit with smooth, flat walls	flattened, rounded	overlapped, shallow	high to low	few, isolated, concentric and crossed		smooth, very reflective	superficial, slightly invasive						•														•									
face 2				deliberate pit with smooth, flat walls	flattened, rounded	overlapped, shallow	high to low	few, isolated, concentric and crossed		smooth, very reflective	superficial, slightly invasive						•														•									

continued ...

Table A3 (continued). New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR										WEAR TYPE																	MATERIAL WORKED									HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification			Linear traces			Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E020469—hatchet																																								25
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		high to low	poorly visible, short, diagonal and perpendicular		smooth, very reflective	superficial	•																	•											
butt				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial												•											•						
face 1				undulating, rough, incipient pits	flattened, crushed, some rounded	overlapped, deep and shallow	rough, high	rough, isolated, deep, crossed	numerous, rough, deep, irregular	rough, slightly reflective	superficial													•											•					
face 2				undulating, rough, incipient pits	flattened, crushed, some rounded	overlapped, deep and shallow	rough, high	rough, isolated, deep, crossed	numerous, rough, deep, irregular	rough, slightly reflective	superficial													•											•					
E020470—hatchet																																								A13
edge	1	continuous, small and microscars	intensive	flat, relatively rough	flattened		high to low	poorly visible, short, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				undulating, smooth	flattened, rounded	overlapped, deep and shallow	high	fine, few, isolated	few, irregular, deep	smooth, very reflective	superficial, slightly invasive									•												•								
face 1				incipient pit with undulating relatively rough base	flattened, some crushed	overlapped, deep and shallow	high	few isolated, crossed	few, irregular, deep	smooth, very reflective	superficial						•	•													•									
face 2				incipient pit with undulating relatively rough base	flattened, some crushed	overlapped, deep and shallow	high	few isolated, crossed	few, irregular, deep	smooth, very reflective	superficial						•	•													•									
E025249—hatchet																																								2, A24
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high to low	dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial, slightly invasive	•																	•											
butt				rounded, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel		smooth, very reflective	superficial										•													•						
lateral 1																																						•		
lateral 2																																						•		
E027596—hatchet																																								A2
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt		continuous, shallow, small, bifacial	slight	undulating	flattened, rounded		slight, high	none		slight smoothing	superficial		•																•											
lateral 1																																						•		
lateral 2																																						•		

continued ...

Table A3 (continued). NSW Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR											WEAR TYPE																		MATERIAL WORKED										HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification				Linear traces			Sheen		Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen																															
E031054—hatchet																																								A27
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high to low	dense, short, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive		•																•											
butt				undulating, rough	flattened, crushed and slightly rounded	dense, overlapped, deep, wide	rough, high	relatively dense, rough, oblique	few, irregular, deep	slightly smooth, moderately reflective	superficial										•											•									
face 1				undulating, rough	flattened, crushed	overlapped, deep, wide	slight, rough, high	relatively dense, rough, oblique	few, irregular, deep	slightly reflective	superficial										•											•									
lateral 2																																								
E031898—hatchet																																								A9
edge	1	continuous, small and microscars	intensive	flat	flattened		high	relatively dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial		•																•											
butt				flat	flattened, rounded	fine, overlapped, shallow	high to low	fine, relatively dense, crossed	few, irregular, deep	smooth, very reflective	superficial				•																									
lateral 1				flat	flattened, rounded		high to low	fine, relatively dense, sub-parallel		smooth, very reflective	superficial, slightly invasive					•														•									
lateral 2				flat	flattened, rounded	scattered, shallow	high to low	fine, relatively dense, sub-parallel		smooth, very reflective	superficial, slightly invasive					•														•									
E032843—hatchet																																								A10
edge	1	continuous, small and microscars	intensive	flat	flattened		high	relatively dense, short, diagonal and perpendicular		smooth, slightly reflective	superficial		•																•											
butt				flat	flattened, rounded	fine, overlapped, shallow	high to low	fine, relatively dense, crossed		smooth, very reflective	superficial					•														•									
lateral 2				flat	flattened, rounded	scattered, shallow	high to low	fine, relatively dense, sub-parallel, some crossed		smooth, very reflective	superficial, slightly invasive																			•									
E033280—hatchet																																								A3
edge	1	continuous, small and microscars	moderate to intensive	flat	flattened	none	high	dense, shallow, diagonal and perpendicular		smooth, moderately reflective	superficial		•																•											
butt				flat	flattened, rounded	fine, overlapped, shallow	high	isolated, crossed, rough, shallow	few, irregular, deep	smooth, moderately reflective	superficial				•																									
lateral 1																																						r		
lateral 2																																						•	•	

continued ...

Table A3 (continued). New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR																WEAR TYPE																	MATERIAL WORKED								HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification				Linear traces			Sheen		Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen																																	
E033479—hammer/pounder																																										2, 11
edge	1		battered	flat	flattened, crushed	overlapped, shallow	high to low	fine, isolated, sub-parallel	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive					•													•	•											
butt	1			flat	flattened, crushed	overlapped, shallow	high to low	fine, isolated, sub-parallel	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive																															
lateral 2																																										
E033480—hammer/pounder																																										A6
edge	1		battered	flat	flattened, crushed	overlapped, shallow	high to low	fine, isolated, sub-parallel	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive					•													•											
butt	1			flat	flattened, crushed	overlapped, shallow	high to low	fine, isolated, sub-parallel	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive					•													•											
lateral 1																																										
lateral 2																																										
E033647—hatchet																																										24
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		high to low	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive		•																													
lateral 1				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial												•																		
lateral 2				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial												•																		
E035987—hammer/pounder																																										A16
edge	1		battered	flat	flattened, rounded	fine, overlapped, shallow	high	isolated, crossed, rough, shallow	few, irregular, deep	smooth, moderately reflective	superficial							•												•											
face 1				incipient pit with smooth, flat base	flattened, rounded	dense, shallow	high	few isolated, crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive							•	•												•										
E036242—hatchet																																										A17
edge	1		blunted	undulating smooth	flattened, rounded	fine, overlapped, shallow	high	isolated, crossed, shallow	few, irregular, deep	smooth, moderately reflective	superficial																			•											
butt				flat, smooth	flattened, rounded	fine, overlapped, shallow	high	fine, isolated, crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive																			•											
face 1				incipient pit with smooth, flat base	flattened, rounded	dense, shallow	high	few isolated, crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive								•												•										

continued ...

Table A3 (cont.). NSW Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR									WEAR TYPE																						MATERIAL WORKED								HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification				Linear traces		Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E042883—hatchet																																								10
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	dense, shallow, diagonal and perpendicular		smooth, moderately reflective	superficial	•																•												
butt				flat	flattened, rounded	fine, overlapped, deep and shallow	high	few, crossed, isolated, shallow	few, irregular, deep	smooth, very reflective	superficial			•															•										
face 1																																						•	
E042926—hatchet																																								23
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial	•																•												
face 1				flat, smooth	intensively flattened		smooth, high	fine, isolated, parallel, some crossed		smooth, very reflective	superficial										•											•							
lateral 1				rounded, rough	flattened, crushed and slightly rounded	overlapped, wide, deep and shallow	rough, high	few, shallow, oblique	few, irregular, deep	smooth, moderately reflective	superficial											•							•				•						
lateral 2				rounded, rough	flattened, crushed and slightly rounded	overlapped, wide, deep and shallow	rough, high	few, shallow, oblique	few, irregular, deep	smooth, moderately reflective	superficial											•							•										
E042928—hatchet																																								A33, A34
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened, intensively rounded		high to low	fine, dense, parallel		smooth, very reflective	invasive															•												
butt				flat	flattened, rounded	fine, overlapped, shallow	high	relatively dense, parallel and some crossed, shallow	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive			•															•										
face 1																																						•	c	
lateral 1																																						•		
lateral 2																																						•		
E042929—hatchet																																								A4
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial	•																•												
butt		continuous, deep and shallow	intensive	flat	flattened, crushed	overlapped, wide and deep	high	few, crossed, isolated, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•															•										
lateral 2																																						•		

continued ...

Table A3 (continued). New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR												WEAR TYPE																		MATERIAL WORKED										HAFTING EVIDENCE		RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification				Linear traces			Sheen			Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE				
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen																																	
E042297—hatchet																																										19
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial			•																•											
face 1				deliberate pits with smooth, flat walls	flattened, rounded	overlapped, shallow	high to low	few, isolated, concentric and crossed	few, irregular, deep	smooth, very reflective	superficial								•												•										
face 2				deliberate pits with smooth, flat walls	flattened, rounded	overlapped, shallow	high to low	few, isolated, concentric and crossed	few, irregular, deep	smooth, very reflective	superficial							•													•										
E044118—hatchet																																										A25
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive			•																•											
butt				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial																				•										
face 1				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial												•								•										
face 2				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel		smooth, very reflective	superficial												•								•										
lateral 1																																								•	r	
E052617a—hatchet																																										22
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive			•																•											
butt				flat, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel, some crossed	few, deep, irregular	smooth, very reflective	superficial, slightly invasive												•								•										
face 1				flat, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel, some crossed		smooth, very reflective	superficial, slightly invasive												•								•										
face 2				flat, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel, some crossed		smooth, very reflective	superficial, slightly invasive												•								•										
lateral 1																																								•	•	
lateral 2																																								•	•	
E052617b—hatchet																																										A29
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive			•																•											
butt				rounded, smooth	intensively flattened		smooth, high	fine, few, parallel, some crossed	few, deep, irregular	smooth, very reflective	superficial												•								•										
face 1				flat, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel, some crossed		smooth, very reflective	superficial, slightly invasive												•								•										
face 2				flat, smooth	intensively flattened		smooth, high	fine, relatively dense, parallel, some crossed		smooth, very reflective	superficial, slightly invasive												•								•										
lateral 1																																								•	•	
lateral 2																																								•	•	

continued ...

Table A3 (continued). New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR										WEAR TYPE																	MATERIAL WORKED									HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification			Linear traces			Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E052618—hatchet																																								8
edge	1	continuous, small and microscars	intensive	flat	flattened		high	dense, shallow, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				flat	flattened, crushed	overlapped, wide and shallow	high	few, parallel and crossed, isolated, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
E052619—hammer/pounder																																								2, A35
edge	1		battered	slightly rounded, smooth	intensively flattened		smooth, high	fine, few, parallel		smooth, very reflective	superficial										•												•							
butt				rounded, smooth	intensively flattened		smooth, high	fine, few, parallel		smooth, very reflective	superficial										•												•							
lateral 2																																						•		
E052620—hammer/pounder																																								A14
edge	1		battered	flat, smooth	flattened, rounded, some crushed	overlapped, shallow	high to low	fine, isolated, crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive					•														•										
butt				flat	flattened, crushed	fine, overlapped, shallow	high	isolated, crossed, rough, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
face 1				incipient pits with smooth, flat base	flattened, rounded, some crushed	overlapped, shallow	high to low	few, isolated, crossed	few, irregular, deep	smooth, moderately reflective	superficial						•														•									
face 2				deliberate and incipient pits with smooth, flat base	flattened, rounded	overlapped, shallow	high to low	few, isolated, concentric and crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive						•														•									
E053281—hammer/pounder																																								20
edge	1		battered	flat, smooth	intensively flattened		smooth, high	fine, few, parallel		smooth, very reflective	superficial										•												•							
butt				slightly rounded, smooth	intensively flattened		smooth, high	fine, few, parallel		smooth, very reflective	superficial										•												•							
E054640—hatchet																																								29, 30
edge	1		levelled	flat, smooth	flattened, crushed	overlapped, shallow and deep	high to low	fine, isolated, sub-parallel	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive					•														•										
butt				flat, smooth	flattened, crushed, some rounded	fine, overlapped, shallow	high	isolated, crossed, rough, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
face 1				flat, smooth	flattened, intensively rounded		high to low	fine, dense, parallel		smooth, very reflective	invasive																•									•			o	
lateral 1				rounded, smooth	flattened, intensively rounded		high to low	fine, dense, parallel		smooth, very reflective	invasive																•									•			o	
lateral 2				rounded, smooth	flattened, intensively rounded		high to low	fine, dense, parallel		smooth, very reflective	invasive																•									•			o	

continued ...

Table A3 (cont.). NSW Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR										WEAR TYPE																	MATERIAL WORKED									HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification			Linear traces			Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E054857—hatchet																																								A5
edge	1	continuous, small scars and microscars	intensive	flat	flattened		high	dense, shallow, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				flat	flattened, crushed	overlapped, wide and shallow	high	few, parallel and crossed, isolated, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
lateral 2																																						•		
E054858a—hammer/pounder																																								A8
edge	1		battered	flat, rough	flattened, rounded	dense, some overlapped, shallow and deep	high	few, rough, crossed		slightly smooth, moderately reflective	superficial					•														•										
butt				flat, smooth	flattened, rounded, some crushed	fine, overlapped, shallow	high to low	isolated, crossed, shallow	few, irregular, deep	smooth, moderately reflective	superficial, slightly invasive			•																•										
lateral 1				flat	flattened, rounded	scattered, shallow	high to low	fine, sub-parallel		smooth, very reflective	superficial, slightly invasive				•															•										
lateral 2				flat	flattened, rounded	scattered, shallow	high to low	fine, sub-parallel		smooth, very reflective	superficial, slightly invasive				•															•										
E054858c—hammer/pounder																																								A12
edge	1		battered	flat, rough	flattened, crushed	overlapped, wide, deep and shallow	high	few, isolated, rough, sub-parallel	few, irregular, deep	smooth, very reflective	superficial									•												•								
butt (a)				flat	flattened, rounded	fine, overlapped, shallow	high	isolated, crossed, rough, shallow	few, irregular, deep	smooth, smooth, very reflective highly reflective	superficial			•																•										
butt (b)				flat, very smooth	flattened, rounded		high to low	fine, isolated, sub parallel		very smooth, very reflective	invasive										•													•						
face 1				incipient pits with smooth, flat base	flattened, rounded, some crushed	overlapped, shallow	high to low	relatively dense, shallow, sub-parallel and crossed	numerous, irregular, deep	smooth, highly reflective	superficial, slightly invasive								•													•								
face 2				incipient pits with smooth, flat base	flattened, rounded, some crushed	overlapped, shallow	high to low	few, isolated, crossed	few, irregular, deep	smooth, moderately reflective	superficial								•													•								

continued ...

Table A3 (cont.). NSW Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR: Modification to edge, butt, laterals: Scars	USE WEAR: Modification to edge, butt, laterals: Rounding, Battering	USE WEAR: Surface modification: Surface levelling	USE WEAR: Surface modification: Grain modification	USE WEAR: Surface modification: Peck marks, Pits	USE WEAR: Linear traces: Alignment, high or low topography	USE WEAR: Linear traces: Striations	USE WEAR: Linear traces: Cracks	USE WEAR: Sheen: Texture, reflectivity	USE WEAR: Sheen: Extent of sheen	WEAR TYPE: Hatchet:chopping	WEAR TYPE: Wedge:wedging/splitting	WEAR TYPE: Pounder: pounding plant, incl seeds, roots	WEAR TYPE: Grinder:grinding	WEAR TYPE: Chopping/pounding	WEAR TYPE: Cracking nut shells: anvil	WEAR TYPE: Cracking nut shells: hammer	WEAR TYPE: Pounding kernel:anvil	WEAR TYPE: Pounding kernel:pounder	WEAR TYPE: Polisher/abrader:bone	WEAR TYPE: Breaking bone:hammer	WEAR TYPE: Knapping stone:hammer	WEAR TYPE: Knapping stone:anvil	WEAR TYPE: Polishing stone	WEAR TYPE: Scraping:scraper	WEAR TYPE: Scraping/softening	WEAR TYPE: Pounding ochre: anvil	MATERIAL WORKED: WOOD (hardwood)	MATERIAL WORKED: N-WP SEEDS (soft), ROOTS	MATERIAL WORKED: N-WP, NUTS (shells)	MATERIAL WORKED: N-WP (kernel)	MATERIAL WORKED: BONE	MATERIAL WORKED: BONE/SHELL	MATERIAL WORKED: STONE	MATERIAL WORKED: SKIN	MATERIAL WORKED: OCHRE	HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
E054858d—hammer/pounder																																								17
edge	1		battered	flat, smooth	flattened, rounded, some crushed	overlapped, wide, deep and shallow	high to low	few, isolated, sub-parallel	few, irregular, deep	smooth, very reflective	superficial, slightly invasive									•												•								
butt	1		battered	flat, smooth	flattened, rounded, some crushed	overlapped, wide, deep and shallow	high to low	few, isolated, fine, sub-parallel	few, irregular, deep	smooth, very reflective	superficial									•												•								
face 1				incipient pits with rough, flat base	flattened, crushed	overlapped, deep and shallow	high	dense, rough, sub-parallel and crossed	numerous, irregular, deep	smooth, very reflective	superficial, slightly invasive								•													•								
face 2				incipient pits with rough, flatbase	flattened, crushed, some rounded	overlapped, shallow and deep	high to low	relatively dense, fine, sub-parallel and crossed	numerous, irregular, deep	smooth, very reflective	superficial, slightly invasive								•													•								
lateral 2/ ground edge	1																																							
E054859c—hatchet																																								A26
edge	1	continuous, small and microscars	moderate	flat, smooth	flattened		smooth, high	poorly visible, short, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				flat, smooth	intensively flattened		smooth, high	fine, few, isolated, parallel, some crossed		smooth, very reflective	superficial, slightly invasive										•												•							
E054859d—hatchet																																								12, 31
edge	1	continuous, small and microscars	intensive	flat	flattened		high	dense, shallow, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt/edge	1		battered	flat	flattened, crushed	overlapped, wide, shallow, some deep	high	few, parallel, isolated, shallow	few, irregular, deep	smooth, moderately reflective	superficial					•														•										
face 1																																						•		
face 2																																						•		
lateral 1																																						•		
lateral 2																																						•		
E054859f—hatchet																																								21
edge	1		battered	undulating, rough	flattened, crushed and slightly rounded	overlapped, wide, deep and shallow	rough, high	few, shallow, oblique	few, irregular, deep	smooth, very reflective	superficial											•											•							
butt/edge	1		battered	flat, smooth	flattened, rounded	fine, overlapped, shallow	smooth, high	fine, isolated, crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive			•																•										
lateral 1																																						•		
lateral 2																																						•		

continued ...

Table A3 (continued). New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR										WEAR TYPE																	MATERIAL WORKED									HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification			Linear traces			Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E054861a—hatchet																																								31, A18
edge	1	continuous, small and microscars	intensive	flat	flattened		high	dense, shallow, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				undulating, rough	flattened, rounded, some crushed	overlapped, deep and shallow	high	isolated, crossed, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
face 1				incipient pits with smooth, flat base	flattened, some crushed	overlapped, shallow and deep	high	few, isolated, crossed, rough	few, irregular, deep	smooth, moderately reflective	superficial						•														•									
lateral 1																																						•		
E054882—hatchet																																								13
edge	1	continuous, small and microscars	intensive	flat	flattened		high	relatively dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				flat	flattened, rounded	fine, overlapped, shallow	high to low	fine, isolated, crossed	rare, irregular, shallow	smooth, very reflective	superficial, slightly invasive			•																•										
lateral 2				flat	flattened, rounded	scattered, shallow	high to low	fine, sub-parallel, relatively dense		smooth, very reflective	superficial, slightly invasive				•															•										
E057828—hatchet																																								A1
edge	1	continuous, small and microscars	intensive	flat	flattened	none	high to low	dense, short, diagonal and perpendicular	none	smooth, moderately reflective	superficial	•																	•											
E059797—hammer pounder																																								31, A7
edge	1		battered	flat	flattened, rounded	fine, overlapped, shallow	high to low	few fine, isolated, sub-parallel	few, irregular, deep	smooth, very reflective	superficial, slightly invasive					•														•										
butt				undulating, rough	flattened, crushed	overlapped, deep and shallow	high	isolated, sub-parallel	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
face 1																																						•		
face 2																																						•		
E059798—hatchet																																								31, A19
edge	1	continuous, large and small	intensive, patchy	flat, rough	flattened		high to low	relatively dense, short, diagonal and perpendicular		smooth, very reflective	superficial	•																	•											
butt				flat	flattened, rounded	fine, overlapped, shallow	high	isolated, crossed, rough, shallow	few, irregular, deep	smooth, moderately reflective	superficial			•																•										
face 1				incipient pit with smooth, flat base	flattened, rounded	overlapped, deep and shallow	high	few isolated, sub-parallel and crossed	irregular, deep	smooth, very reflective	superficial						•														•							•		
face 2				incipient pit with smooth, flat base	flattened, rounded	overlapped, deep and shallow	high	few isolated, sub-parallel and crossed	irregular, deep	smooth, very reflective	superficial						•														•							•		
lateral 1																																						•		
lateral 2																																						•		

continued ...

Table A3 (cont.). NSW Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR												WEAR TYPE																		MATERIAL WORKED									HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification				Linear traces			Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E059849—hatchet																																								31, A28
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive	•																	•										
butt				flat, rough	flattened, crushed and slightly rounded	overlapped, wide, deep and shallow	smooth, high	few, fine, oblique	few, irregular, deep	smooth, very reflective	superficial											•																	
lateral 2																																						•	
E060861a—hatchet																																							A32
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		smooth, high	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive	•																•										
butt (a)				flat	flattened, rounded	fine, overlapped, shallow	high	fine, isolated, crossed and sub-parallel	few, irregular, deep	smooth, very reflective	superficial			•															•									
butt (b)				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial											•								•							
face 1				incipient pits, rough, undulating	flattened, crushed, some rounded	overlapped, deep and shallow	rough, high	rough, isolated, deep, crossed	numerous, rough, deep, irregular	rough, slightly reflective	superficial												•							•							
face 2				incipient pits, rough, undulating	flattened, crushed	overlapped, deep and shallow	rough, high	rough, isolated, deep, crossed	numerous, rough, deep, irregular	rough, slightly reflective	superficial												•							•							
E060861b—hatchet																																							A30
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		high to low	dense, shallow, diagonal and perpendicular		smooth, very reflective	superficial, slightly invasive	•																•										
butt				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial																			•							
lateral 1				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial																			•							
lateral 2				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial																			•							

continued ...

Table A3 (continued). New South Wales Central Coast ground-edged artefacts. Use-wear observations and materials worked. Residues: *(c)* charcoal, *(r)* resins, and *(o)* ochre. Material worked: *(N-WP)* non-woody plant.

AM registration number and working surfaces	Number of ground edges	USE WEAR										WEAR TYPE																	MATERIAL WORKED									HAFTING EVIDENCE	RESIDUES	References to Figures in text and appendix
		Modification to edge, butt, laterals		Surface modification			Linear traces			Sheen																														
		Scars	Rounding, Battering	Surface levelling	Grain modification	Peck marks, Pits	Alignment, high or low topography	Striations	Cracks	Texture, reflectivity	Extent of sheen	Hatchet:chopping	Wedge:wedging/splitting	Pounder: pounding plant, incl seeds, roots	Grinder:grinding	Chopping/pounding	Cracking nut shells: anvil	Cracking nut shells: hammer	Pounding kernel:anvil	Pounding kernel:pounder	Polisher/abrader:bone	Breaking bone:hammer	Knapping stone:hammer	Knapping stone:anvil	Polishing stone	Scraping:scraper	Scraping/softening	Pounding ochre: anvil	WOOD (hardwood)	N-WP SEEDS (soft), ROOTS	N-WP, NUTS (shells)	N-WP (kernel)	BONE	BONE/SHELL	STONE	SKIN	OCHRE			
E060861c—hatchet																																								26
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		high, smooth	dense, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial												•												•					
face 1				incipient pits, undulating, rough	flattened, crushed, some rounded	overlapped, deep and shallow	rough, high	rough, isolated, deep, crossed	numerous, rough, deep, irregular	rough, slightly reflective	superficial													•											•					
face 2				incipient pits, undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	rough, isolated, deep, crossed	numerous, rough, deep, irregular	rough, slightly reflective	superficial													•											•					
lateral 1				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial												•												•					
E060861d—hatchet																																								A31
edge	1	continuous, small and microscars	intensive	flat, smooth	flattened		high	poorly visible, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
lateral 1				undulating, rough	flattened, crushed	overlapped, deep and shallow	rough, high	few, rough, parallel and oblique	few, irregular, deep	rough, moderately reflective	superficial												•												•					
E065196a—hatchet																																								A20, A21
edge	1	continuous, small and microscars	intensive	flat	flattened		high	relatively dense, short, diagonal and perpendicular		smooth, moderately reflective	superficial	•																	•											
butt				undulating, smooth	flattened, crushed, rounded	dense, wide, deep and shallow	high	fine, few, isolated	few, irregular, deep	smooth, highly reflective	superficial, slightly invasive									•												•								
face 1				incipient pit with smooth, flatbase	flattened, crushed	dense, shallow	high to low	dense, fine, crossed	few, irregular, deep	smooth, low reflective	superficial, slightly invasive						•	•													•									
face 2				incipient pit with irregular boundaries	flattened, crushed	dense,deep and shallow	high to low	some,multidiractional	thin, shallow	rough, low reflective	superficial																	•									•		o	
lateral 1																																						•		
lateral 2																																						•		
E065196e—hatchet																																								4
edge	1	continuous, small and microscars	intensive	flat	flattened	none	high to low	dense, short, diagonal and perpendicular	none	smooth, moderately reflective	superficial	•																	•											
lateral 1																																						•		
E065196q—hatchet																																								A15
edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	poorly visible, short, diagonal and perpendicular		smooth, slightly reflective	superficial	•																	•											
butt/edge	1	continuous, small and microscars	intensive	flat	flattened		high to low	poorly visible, short, diagonal and perpendicular		smooth, slightly reflective	superficial	•																	•											
face 1				incipient pits with smooth, flat base	flattened, rounded some crushed	overlapped, shallow	high to low	few, isolated, crossed	few, irregular, deep	smooth, moderately reflective	superficial						•														•									
face 2				deliberate and incipient pits with smooth, flat base	flattened, rounded	overlapped, shallow	high to low	few, isolated, concentric and crossed	few, irregular, deep	smooth, very reflective	superficial, slightly invasive						•														•									