Edge tool technologies in prehistoric Greece: A short overview of the published data

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Zusammenfassung

Schneidwerkzeugtechnologien im prähistorischen Griechenland: Ein kurzer Überblick über die veröffentlichten Daten

Bei »Technologie« handelt es sich in erster Linie um ein soziales Phänomen mit einer komplexen Dynamik. Die Untersuchung von Werkzeugen vergangener Gesellschaften hat daher das Potenzial, technische Traditionen und – durch sie – soziokulturelle Merkmale sichtbar zu machen. Da Schneidwerkzeuge gezielt und aufwändig ausgeformte Artefakte sind, eignen sie sich hervorragend als Gegenstand dieser Forschungsrichtung. Dieser Beitrag untersucht die verfügbaren publizierten Daten verschiedener griechischer Schneidwerkzeugassemblagen aus dem Neolithikum, um unterschiedliche technologische Entwicklungen aufzuzeigen. Anhand des Materialkorpus können gemeinsame Aspekte der Herstellung und Instandhaltung von Werkzeugen (z. B. Präferenzen bei den Rohmaterialien und Arten der Verwendung) auf einer Makroebene durch die Zeit hindurch nachverfolgt werden. Gleichzeitig sprechen signifikante Unterschiede, hauptsächlich in den Herstellungstechniken und der Typologie, jedoch für vielfältige Traditionen der Steinbearbeitung, die, geografisch betrachtet, eine grobe Nord-Süd-Verteilung wiedergeben. Einigen Indizien zufolge scheinen die neolithischen Gemeinschaften Nordgriechenlands im Vergleich zu denen des südlichen Festlandes und der Inseln vor allem balkanorientiert zu sein, was ihre eher komplexen Schneidewerkzeugtechnologien betrifft, die – in einigen Fällen – den Eindruck erwecken, technisch gesehen »einfacher« zu sein.

Schlagwörter Schneidwerkzeug, Neolithikum, Steinzeugtechnologie, Griechenland, technologische Traditionen

Summary

»Technology« constitutes, first and foremost, a social phenomenon with complex dynamics. Therefore, the study of the tools of past societies has the potential to reveal technical traditions and – through them – sociocultural characteristics. Being intentionally and extensively shaped artefacts, edge tools are a prime candidate to serve this line of research. The current paper analyses the available published data from various Greek Neolithic edge tool assemblages, seeking to identify different technological trajectories. Judging from the corpus of material, common aspects in tool manufacture and maintenance (such as raw material preferences and modes of exploitation) can be traced through time on a macro-scale. At the same time, however, significant differences, mainly in manufacturing techniques and typology, suggest the existence of diverse stone-working traditions that, in geographical terms, appear to roughly reflect a north-south divide. More specifically, by some indications, the Neolithic communities of Northern Greece seem more Balkan-oriented in terms of their rather complex edge tool technologies when compared to the communities from the southern mainland and the islands, which – in some cases – give the impression of being technically more »straightforward«.

Keywords edge tools, Neolithic, stone tool technology, Greece, technical traditions

Introduction

Polished edge tools (i.e., axes, adzes, and chisels), often referred to as celts or ground edge tools, form one of the most recognisable categories of ground stone tools (alternatively, macrolithic tools). Their main diagnostic feature is a sharp polished bit at one of their two ends. They were used with direct or indirect percussion or pressure, usually as composite tools attached to or inserted into a wooden, bone, or antler haft (Moundrea-Agrafioti 1981; Moundrea-Agrafioti 1992).

Although we now know that edge tools were manufactured and used by prehistoric people in various parts of the world before the establishment of true agricultural systems (Hiscock et al. 2016; Yerkes et al. 2012), their significance as a central element of the Neolithic economy, tied to key activities at the core of the new agrarian lifeway, was recognised early on by scholars. In Greece, the first edge tools appeared alongside the first agropastoral settlements of the 7th millennium BC and continued to be used long after the advent of metals (Moundrea-Agrafioti 1996). In Northern and Western Europe, studies on edge tools advanced quickly,

DATE BC	PHASES	ABBREVIATIONS
6700/6500–5800	Early Neolithic	EN
5800–5400/5300	Middle Neolithic	MN
5400/5300–4800	Late Neolithic I	LN I
4800–4600/4500	Late Neolithic II	LN II
4600/4500–3300/3100	Final Neolithic/Chalcolithic	FN

Tab. 1 Dates and archaeological phases for the Greek Neolithic.

Tab. 1 *Datierungen und archäologische Phasen des griechischen Neolithikums.*

exploring issues beyond the material dimension of technology[1] and shedding light on the choices, actions, and identities of the social agents who produced and used them. In the Aegean world, however, although edge tools were ›more visible‹ to scholars than other ground stone tool categories, their study remained limited in scale and scope for many decades (Tsoraki 2011). Only in recent years has there been a surge in the systematic analysis of ground stone tool assemblages from individual archaeological sites, bringing the study of edge tools to the forefront alongside other long-understudied tool categories, such as grinding tools.

As a result, we now have in our hands a series of specialised studies from a number of excavated sites, mainly located in Northern Greece, that paint a picture of diverse coexisting practices and traditions regarding the raw material selection, manufacture, use, and disposal of edge tools. This paper seeks to combine the available published data pertaining to the Neolithic edge tool technologies of Greece (7th–4th millennia BC) and to provide an interregional and diachronic overview (Tab. 1–2). The main attributes of the edge tool technological traditions are mapped, and, through their comparative analysis, regional and supra-regional patterns of behaviour are investigated and highlighted.

Methods and constraints

A review of the literature highlights several limitations that should be mentioned here.

Several factors stemming from the current state of research in the Aegean contribute to a research image of uneven detail. Our knowledge of the Neolithic in Northern and Central Greece is well substantiated due to a wealth of excavations, many of which are extensive and systematic. By contrast, although a significant number of regional surveys of Southern Greece and the islands have been executed in recent decades (e.g., Georgiadis 2012; Runnels et al. 1995; Watrous et al. 2017), there are only a few Neolithic reference sites that have been excavated to some extent and for which published data is available.

Information on edge tools (and other ground stone tool categories) from various Greek Neolithic sites is inconsistent due to differing approaches by scholars. Detailed publications of Greek edge tool assemblages are rare, and regional or diachronic studies are absent. From the published material, only a few assemblages have been subject to an in-depth analysis by ground stone specialists[2]. Despite the existence of some non-specialist yet thorough publications of excavated sites, not all provide references on individual specimens, hindering data quantification. Many other publications only mention the total number of tools recovered (sometimes even this basic information is lacking) in sections labelled »small finds«, but without further details on their techno-morphological characteristics or contexts of recovery. Additionally, inconsistent terminology and a lack of specialised classification schemes[3] pose further obstacles to comparative data analysis.

To address these limitations and maximise the information extracted from the diverse set of data available, both quantitative and qualitative data were stored in the database created for the needs of this study. The data derive mostly from publications on various prehistoric sites across Greece, and only in a few cases from unpublished archaeological material. They relate to all stages of a tool's life-cycle: from raw material selection, production processes, and practices of curation to episodes of use/reuse/secondary use or recycling and their final abandonment/disposal/deposition. Aspects of typology, morphometrics, preservation, contexts of retrieval, and co-findings have also been recorded. Due to limitations in the extent of this overview, the focus has been placed exclusively on the Neolithic period. In total, data on the assemblages of 58 sites have been collected (Fig. 1). Data from surface surveys (regional or site-specific) were not included. The single exception, Vrastero, Western Macedonia, is a survey complemented by excavation. Through the collection, analysis, correlation, and interpretation of data, the objective is to uncover patterns and trends that may reveal diverse coexisting practices and traditions and, in a broad manner, shed light on social and cultural phenomena. Efforts have been made to quantify, where possible, the available information and to produce tables illustrating the results. However, as mentioned, not all publications are equally analytical. A basic consequence is that, in some cases, the absence of references to a trait cannot be interpreted by default as an indication of its absence. Therefore, some tool features, although potentially important indicators (of choices, trends, identities, etc.), could not be (fully) exploited at this point.

1 E.g., Bradley/Edmonds 1993; Edmonds 1995; Pétrequin et al. 1998; Ricq-de Bouard 1996.
2 E.g., Almasidou 2019; Bekiaris 2018; Chadou 2011; Chondrou 2018; Ninou 2022; Stroulia 2010; Stroulia 2018; Stroulia 2018a; Tsoraki 2008.
3 To date, many scholars apply the classification system structured by C. Tsountas in his pioneering work in the early 20th century, based on the edge tool assemblages from Sesklo and Dimini, two Thessalian sites in Central Greece (see Tsountas 1908). However, the abundance of new excavation data brought to light in the last decades from different regions of the country calls for the creation of new classification systems adapted to the specific characteristics of each geographical area.

NO.	SITE	PUBLICATION	DATE	EDGE TOOLS	TOTAL NUMBER OF EDGE TOOLS (n)
1	Makri	(1) Melfos et al. 2001 (2) Stroulia 2005a	MN–LN	YES	92
2	Dikili Tash	(1) Sériadès 1992	EN–FN	YES	54 (30 MN + 24 LN/FN)
3	Sitagroi	(1) Elster 2003 (2) Elster 2003a (3) Dixon 2003 (4) Dixon 2003a	late MN/(early) LN–FN	YES	73 (based on Elster 2003, Tab. 5,2)
4	Olynthus	(1) Mylonas 1929	LN	YES	72
5	Koroneia	(1) Almasidou 2019	MN–LN	YES	64
6	Stavroupoli	(1) Alisøy 2002	MN–LN	YES	27
7	Agrosykia	(1) Chrysostomou et al. 2007	FN	YES	1 stratified and at least 5 more
8	Sosandra	(1) Georgiadou 2015	EN	YES	4
9	Nea Nikomedeia	(1) Rodden 1962 (2) Rodden 1964 (3) Rodden/Rodden 1964 (4) Rodden/Rodden 1964a (5) Sugaya 1992	EN	YES	
10	Paliambela	(1) Siamidou 2017	EN–LN	YES	
11	Makriyalos	(1) Yerousi 1999 (2) Tsoraki 2007 (3) Tsoraki 2008 (4) Tsoraki 2011 (5) Tsoraki 2011a (6) Tsoraki 2011b	LN	YES	1893
12	Kleitos	(1) Chondrou 2018 (2) Chondrou 2022	LN–FN	YES	1101
13	Toumba Kremasti Koilada	(1) Chondrou 2011 (2) Stroulia 2014 (3) Stroulia/Chondrou 2013	LN	YES	> 600
14	Megalo Nisi Galanis	(1) Stroulia 2005 (2) Fotiadis et al. 2019	EN–early FN	YES	36
15	Mavropigi–Fyllotsairi	(1) Ninou 2022	EN	YES	164
16	Koromilia	(1) Bekiaris 2018, 24–26; 210	LN	YES	around 100
17	Avgi	(1) Bekiaris et al. 2017 (2) Bekiaris 2018	MN–LN	YES	176
18	Dispilio	(1) Stratouli 2002 (2) Melfos/Stratouli 2002	MN–FN	YES	
19	Xirolimni	(Chondrou, pers.obs.)	EN	YES	
20	Servia	(1) Mould/Wardle 2000 (2) Mould et al. 2000	EN–LN	YES	66 stratified
21	Varemenoi Goulon	(1) Stroulia 2018a	EN–MN	YES	2335 (surface finds and excavation material, semifinished/finished specimens and production debris)
22	Vrastero	(1) Dimaki et al. 2023	Neolithic	YES	> 3000 (surface finds and excavation material, semifinished/finished specimens and production debris)
23	Theopetra Cave	(1) Christopoulou 2000	EN–LN	YES	28
24	Platia Magoula Zarkou	(1) Stroulia 2022	MN–LN	YES	33 (MN: 20; LN: 12; MN/LN: 1)
25	Argissa	(1) Milojčić 1962 (2) Perlès 2001 (3) Reingruber 2008	EN–LN	YES	Reingruber: 13 (EN)
26	Mandra	(Chondrou, pers. obs)	LN–FN	YES	
27	Ayia Sofia Magoula	(1) Milojčić et al. 1976	LN	YES	16 mentioned in the catalogue
28	Achilleion	(1) Winn/Shimabuku 1989	EN–MN	YES	58 (Phase I: 1; Phase II: 7; Phase III: 28; Phase IV: 22)

TO BE CONTINUED

NO.	SITE	PUBLICATION	DATE	EDGE TOOLS	TOTAL NUMBER OF EDGE TOOLS (n)
29	Visviki Magoula	(1) Bergner 2015	EN–FN	YES	109
30	Sesklo	(1) Tsountas 1908 (2) Moundrea-Agrafioti 1981 (3) Kotsakis 1981 (3) Christopoulou 1992 (3) Papathanassopoulos 1996	EN–MN	YES	112 (Christopoulou 1992)
31	Dimini	(1) Tsountas 1908 (2) Moundrea-Agrafioti 1981	LN	YES	
32	Pefkakia Magoula	(1) Weisshaar 1989	LN/FN	YES	13
33	Ayios Petros	(1) Moundrea-Agrafioti 1981 (2) Efstratiou 1985	MN	YES	22
34	Cyclops Cave	(1) Sampson/Orphanidis 2008	EN–LN	NO	
35	Ayios Vlasis	(Chondrou, pers. obs.)	EN	YES	
36	Elateia	(1) Weinberg 1962	EN–MN	YES	3 (1 EN, 1 MN)
37	Toumba Balomenou	(1) Tzavella-Evjen 2012 (2) Adam 2012	EN–LN	YES	78
38	Sarakenos Cave	(1) Davri 2023	EN–LN	YES	91 (EN: 2; MN: 10; LN: 78; one with no dating)
39	Tharrounia/ Skoteini Cave	(1) Sugaya 1993	LN–FN	YES	21 (14 from the cave, 7 from the settlement, but none from the cemetery)
40	Drakaina Cave	(1) Melfos et al. 2020 (2) Stratouli/Metaxas 2017 (3) Stratouli/Metaxas 2018 (4) Stratouli et al. 2022	LN–FN	YES	6
41	Limnes Cave	(1) Sampson 1997	LN	NO	
42	Tsoungiza	(1) Dabney et al. 2020	EN–MN / FN	YES	6
43	Ayioryitika	(1) Petrakis 2002	EN/MN–FN	YES	57
44	Lerna	(1) Banks 2015	EN–MN	YES	45
45	Anemodouri (hoard findspot)	(1) Tsountas 1901	Neolithic	YES	4
46	Franchthi Cave	(1) Stroulia 2003 (2) Stroulia 2010	EN–FN	YES	88 (62 from cave, 26 from Paralia)
47	Alepotrypa Cave	(1) Stroulia 2018	EN/LN–FN	YES	31 (EN phase: 5?/LN phase: 6/FN: 8?)
48	Kitsos Cave	(1) Perlès 1981	LN–FN	YES	8 (6 from inside the cave, 2 from outside)
49	Ayia Triada Cave	(1) Mavridis/Tankosić 2009	LN–FN	NO	
50	Kephala	(1) Coleman 1977	LN	YES	6
51	Ftelia	(1) Sampson 2002	LN	YES	4
52	Saliagos	(1) Evans/Renfrew 1968 (2) Oosterom 1968 (3) Boleti 2009	LN	YES	36
53	Yali	(1) Sampson 1988	FN	YES	4
54	Kastro (Alimnia islet)	(1) Sampson 1987	FN	NO	
55	Ayios Yeoryios Cave, Kalithies (Rhodes)	(1) Sampson 1987	LN–FN	YES	1
56	Aposelemis cemetery	(1) Agelarakis/Kanta 2020	Neolithic	YES	
57	Katsambas	(1) Galanidou/Manteli 2008	EN	YES	12
58	Knossos	(1) Evans 1964 (2) Moundrea-Agrafioti 1992	EN–LN	YES	65

Tab. 2 Sites included in the analysis, relevant publications, Neolithic dating of the sites, and number of recovered edge tools.

Tab. 2 *In der Analyse ausgewertete Fundorte, relevante Publikationen, ihre neolithische Datierung, Anzahl der entdeckten Schneidwerkzeuge.*

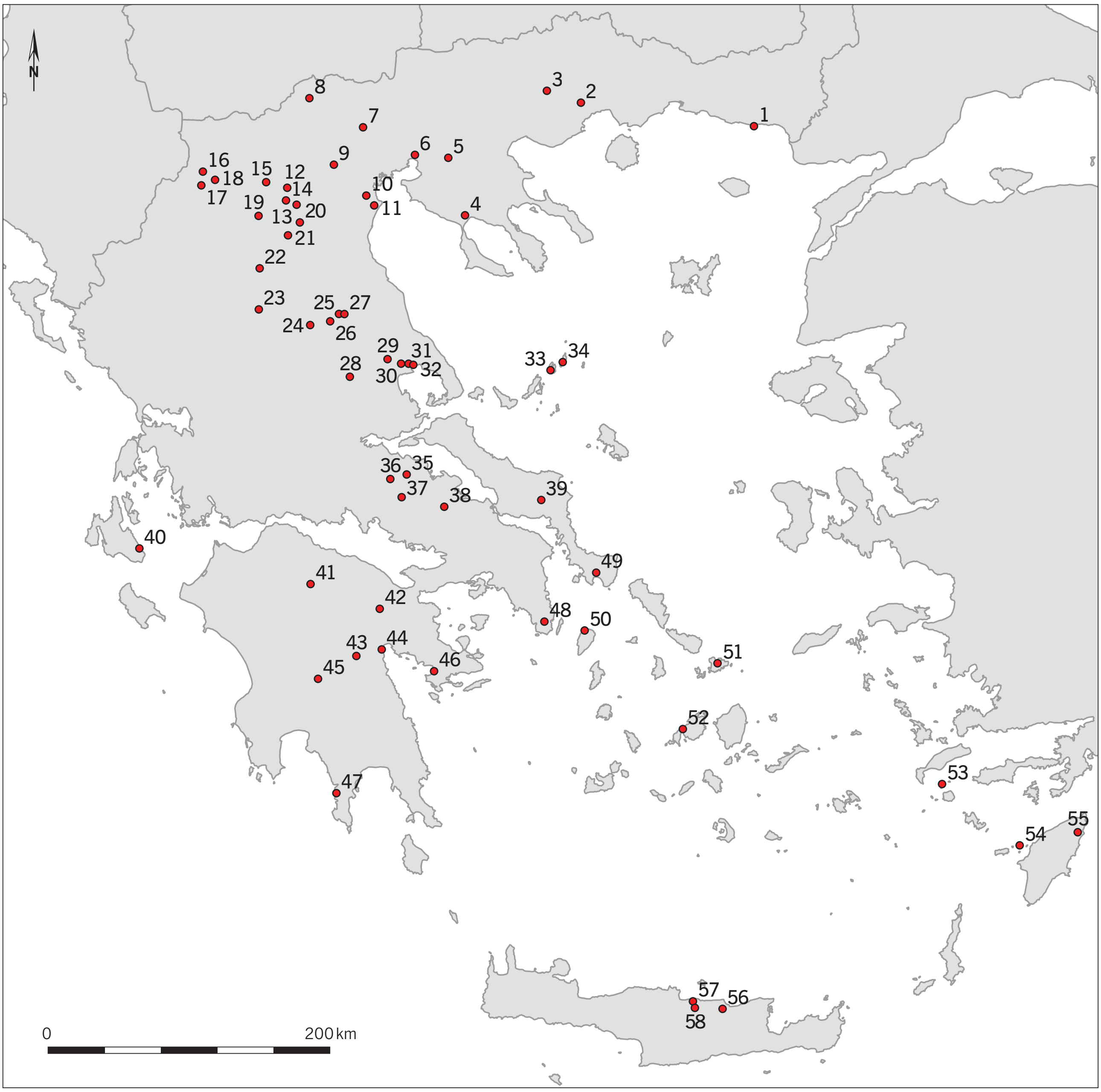

Fig. 1 Map of Greece with marked locations of the Neolithic sites discussed in the paper: 1 Makri; 2 Dikili Tash; 3 Sitagroi; 4 Olynthus; 5 Koroneia; 6 Stavroupoli; 7 Agrosykia; 8 Sosandra; 9 Nea Nikomedeia; 10 Paliambela; 11 Makriyalos; 12 Kleitos; 13 Toumba Kremasti Koilada; 14 Megalo Nisi Galanis; 15 Mavropigi-Fyllotsairi; 16 Koromilia; 17 Avgi; 18 Dispilio; 19 Xirolimni; 20 Servia; 21 Varemenoi Goulon; 22 Vrastero; 23 Theopetra Cave; 24 Platia Magoula Zarkou; 25 Argissa; 26 Mandra; 27 Ayia Sofia Magoula; 28 Achilleion; 29 Visviki Magoula; 30 Sesklo; 31 Dimini; 32 Pefkakia Magoula; 33 Ayios Petros; 34 Cyclops Cave; 35 Ayios Vlasis; 36 Elateia; 37 Toumba Balomenou; 38 Sarakenos Cave; 39 Tharrounia/Skoteini Cave; 40 Drakaina Cave; 41 Limnes Cave; 42 Tsoungiza; 43 Ayioryitika; 44 Lerna; 45 Anemodouri; 46 Franchthi Cave; 47 Alepotrypa Cave; 48 Kitsos Cave; 49 Ayia Triada Cave; 50 Kephala; 51 Ftelia; 52 Saliagos; 53 Yali; 54 Kastro (Alimnia islet); 55 Ayios Yeoryios Cave; 56 Aposelemis cemetery; 57 Katsambas; 58 Knossos.

Abb. 1 *Karte Griechenlands mit den neolithischen Fundstellen aus dem Beitrag: 1 Makri; 2 Dikili Tash; 3 Sitagroi; 4 Olynthos; 5 Koroneia; 6 Stavroupoli; 7 Agrosykia; 8 Sosandra; 9 Nea Nikomedeia; 10 Paliambela; 11 Makrigialos; 12 Kleitos; 13 Toumba Kremasti Koilada; 14 Megalo Nisi Galanis; 15 Mavropigi-Fyllotsairi; 16 Koromilia; 17 Avgi; 18 Dispilio; 19 Xirolimni; 20 Servia; 21 Varemenoi Goulon; 22 Vrastero; 23 Theopetra-Höhle; 24 Platia Magula Zarkou; 25 Argissa; 26 Mandra; 27 Agia Sofia Magula; 28 Achilleion; 29 Visviki-Magula; 30 Sesklo; 31 Dimini; 32 Pefkakia-Magula; 33 Agios Petros; 34 Zyklopenhöhle; 35 Agios Vlasis; 36 Elateia; 37 Toumba Balomenou; 38 Sarakenos-Höhle; 39 Tharrounia/Skoteini-Höhle; 40 Drakaina-Höhle; 41 Limnes-Höhle; 42 Tsoungiza; 43 Agiorgitika; 44 Lerna; 45 Anemodouri; 46 Höhle von Franchthi; 47 Alepotrypa-Höhle; 48 Kitsos-Höhle; 49 Höhle von Agia Triada; 50 Kephala; 51 Ftelia; 52 Saliagos; 53 Yali; 54 Kastro (Insel Alimnia); 55 Höhle von Agios Georgios; 56 Nekropole von Aposelemis; 57 Katsambas; 58 Knossos.*

Neolithic edge tool technologies in Greece – distribution and morphology

Edge tools are neither represented to the same degree in all Greek Neolithic ground stone assemblages, nor are they ubiquitous (cf. Tab. 2). This imbalance could be attributed to the different extent of the excavations: Many assemblages have resulted from limited-scale excavations, whereas far fewer derive from extensive, systematic ones. For example, the sites of Makriyalos and Kleitos, situated in Central and Western Macedonia respectively (North-Western Greece), constitute rare cases of extensive excavations that yielded

NO.	SITE	DATING	TYPE OF SITE	EDGE TOOLS	TOTAL NUMBER OF EDGE TOOLS (n)
23	Theopetra Cave	EN–LN	CAVE	YES	28
33	Ayios Petros	MN	ISLAND	YES	22
34	Cyclops Cave	EN–LN	CAVE/ISLAND	**NO**	
38	Sarakenos Cave	EN–LN	CAVE	YES	91
39	Tharrounia/Skoteini Cave	LN–FN	CAVE/ISLAND	YES	21 (14 from the cave, 7 from the settlement)
40	Drakaina Cave	LN–FN	CAVE/ISLAND	YES	6
41	Limnes Cave	LN	CAVE	**NO**	
46	Franchthi Cave	EN–FN	CAVE	YES	88 (62 from the cave, 26 from the Paralia)
47	Alepotrypa Cave	EN/LN–FN	CAVE	YES	31 (EN phase: 5?/LN phase: 6/FN: 8?)
48	Kitsos Cave	LN–FN	CAVE	YES	8 (6 from inside the cave, 2 from outside)
49	Ayia Triada Cave	LN–FN	CAVE/ISLAND	**NO**	
50	Kephala	LN	ISLAND	YES	6
51	Ftelia	LN	ISLAND	YES	4
52	Saliagos	LN	ISLAND	YES	36
53	Yali	FN	ISLAND	YES	4
54	Kastro (Alimnia islet)	FN	ISLAND	**NO**	
55	Ayios Yeoryios Cave, Kalithies (Rhodes)	LN–FN	CAVE/ISLAND	YES	1
56	Aposelemis cemetery	Neolithic	ISLAND	YES	?
57	Katsambas	EN	ISLAND	YES	12
58	Knossos	EN–LN	ISLAND	YES	65

Tab. 3 Cave and island sites and the number of edge tools retrieved per site.

Tab. 3 *Fundorte in Höhlen und auf Inseln sowie die Anzahl der bekannten Schneidwerkzeuge je Fundort.*

the two largest edge tool assemblages originating from excavated Greek Neolithic sites[4]. However, an examination of the origin of the assemblages that contain fewer than 10 edge tools or none at all shows that all but four originate from cave and cave/island sites (the caves of Ayia Triada in Euboea, Ayios Yeoryios in Rhodes island, Dodecanese, Cyclops in Youra island, North Aegean, Drakaina in Kefalonia island, Western Greece, Kitsos in Attica, and Limnes in the Peloponnese) or island sites (Ftelia in Mykonos island, Cyclades, Yali in the Dodecanese, Kastro in Alimnia island, Dodecanese, and Kephala in Kea island, Cyclades; Tab. 3). The four exceptions come from small-scale excavations[5] (Agrosykia in Central Macedonia, Elateia in Central Greece, Sosandra in Central Macedonia, and Tsoungiza in the Peloponnese), suggesting that the limited number of relevant finds may be due to the lesser extent of the excavation.

If the overall pattern is not the result of research bias, then the varying presence of the tools in question could be linked to the diversified economy of the communities inhabiting and utilising these insular and cavernous landscapes and to the differentiated needs imposed by their particular environment (see also Stroulia 2003, 129), or to a special function these sites might have. Indeed, for some cave sites, the idea of their ritual use (whether exclusive or not) has been proposed – e.g., for the caves of Alepotrypa in the Peloponnese (Stroulia 2018) and Drakaina (Stratouli/Metaxas 2017; Stratouli/Metaxas 2018). Perhaps, therefore, the activities systematically carried out at these sites may not have necessitated the use of edge tools. Alternatively, it is possible that these tools were employed in activities performed outside the cave premises, leading to a different pattern of deposition or disposal compared to other tool types. Different regional trajectories may also contribute to this phenomenon. For example, in the Dodecanese islands, South Aegean, the introduction and use of metals, occurring earlier than in mainland Greece, may account for the limited use of stone tools and the scarcity of edge tools, at least as far as the later phases of the Neolithic are concerned (Sampson 1987, 133).

There are of course caves and island sites that do not conform to this pattern, such as the Franchthi Cave, Peloponnese, that yielded a total of 88 finds from its Neolithic strata (Stroulia 2010), or Saliagos, South Aegean, with 36 finds (Evans/Renfrew 1968). Furthermore, differences in edge tool concentration are evident within the same island or between neighbouring ones, suggesting that varying traditions may be at play among closely situated communities (see, for example, the case of the Dodecanese islands,

4 See Tsoraki 2008; Tsoraki 2011; Chondrou 2018; Chondrou 2022. Two other assemblages from the sites of Varemenoi Goulon and Vrastero, again from North-western Greece, comprise a large number of surface finds (Stroulia 2018a; Dimaki et al. 2023).

5 A fifth case, Anemodouri, is not an excavation but the findspot of a stray find.

Fig. 2 The largest currently known edge tool from Neolithic Greece with its three associated finds (findspot: Anemodouri, Peloponnese).

Abb. 2 *Das größte bisher bekannte Schneidwerkzeug aus dem neolithischen Griechenland mit den drei vergesellschafteten Funden (Fundstelle: Anemodouri, Peloponnes).*

Georgiadis 2017). The most striking exception, however, is the case of the Sarakenos Cave, Central Greece, which yielded a stunning total of 91 edge tools, mostly from Late Neolithic (LN) deposits (Davri 2023). It is evident, therefore, that a single explanation cannot account for the observed diversity.

It has been suggested that edge tools became gradually established in the Greek Neolithic toolkit, with minimal presence in the earliest Neolithic phases (EN I) and small dimensions that could hardly be compatible with a tree-cutting function (Perlès 2001; Theocharis 1967), but growing larger and more abundant later on. Indeed, the majority of data seems to fit into the proposed model, and there are several cases, such as Achilleion, Sesklo, both in Thessaly, and Franchthi, where the number of edge tools is limited in their Early Neolithic (EN) phases but increases over time. A similar observation has been made regarding the island of Crete in South Aegean (Moundrea-Agrafioti 1992, 175). However, this pattern could be influenced by preservation factors and the general scarcity of data on the earliest EN phases (Moundrea-Agrafioti 1981, 241–244). Alternatively, it could mean that land-clearing with the use of stone edge tools was not as important an activity at that time as previously assumed (Moundrea-Agrafioti 1981, 244).

From a metrical point of view, Greek edge tool assemblages tend to be relatively small-sized (Tab. 4). There are many factors to account for the limited size of an edge tool, related to both manufacture and use. For example, the inherent form and size of raw materials available in each region constrain the size of the resulting tools. Moreover, the wear incurred during use necessitates regular resharpening of the tool to maintain the functionality of its cutting edge, which gradually reduces tool dimensions. Extensive breakages and subsequent repair activities can result in

NO.	SITE	DATE	DIMENSION RANGE (Length-Width-Thickness) *based on intact specimens	AVERAGE DIMENSIONS (Length-Width-Thickness) *based on intact specimens
2	Dikili Tash	EN–FN	2.70–11.20 x 0.90–6.30 x 0.70–3.10 cm	
3	Sitagroi	late MN/ (early) LN–FN	3.20–14.90 x 1.60–5.00 x 0.80–2.90 cm	6.42 x 3.55 x 1.60 cm
4	Olynthus	LN	3.50–13.00 x 1.10–4.60 x 1.00–2.50 cm	
5	Koroneia	MN–LN	2.60–10.80 cm length x 1.20–5.80 cm width	
6	Stavroupoli	MN–LN		7.30 x 4.13 x 1.74 cm
8	Sosandra	EN	5.00–13.40 x 1.10–5.30 x 1.00–4.40 cm	7.85 x 3.35 x 2.00 cm
11	Makriyalos	LN	1.80–14.40 x 0.60–6.90 x 0.30–5.20 cm	4.90 x 3.50 x 2.10 cm
12	Kleitos	LN–FN	2.10–19.60 x 1.10–7.30 x 0.30–4.10 cm	5.60 x 3.10 x 1.40 cm
13	Toumba Kremasti Koilada	LN	3.00–14.00 cm length (but there are fragments of even bigger tools, e.g., a refitted tool with a length of 17.00 cm)	7.00 x 3.70 x 2.00 cm
14	Megalo Nisi Galanis	EN – early FN	3.00–10.00 cm length	
15	Mavropigi-Fyllotsairi	EN	3.00–26.00 x 1.00–7.00 x 1.00–7.00 cm	
17	Avgi	MN–LN	2.50–12.40 x 1.10–6.90 x 0.40–4.30 cm	7.10 x 3.50 x 2.00 cm
20	Servia	EN–LN	2.60–20.00 x 0.90–7.60 x 0.50–5.40 cm	8.26 x 4.00 x 2.01 cm
21	Varemenoi Goulon	EN–MN	2.70–17.70 x 1.50–6.30 x 0.40–5.30 cm (but most fragments originate from large tools 13.00–15.00 cm in length)	8.30 x 3.90 x 2.50 cm
23	Theopetra Cave	EN–LN	3.40–8.40 x 0.80–5.50 x 0.70–3.10 cm	5.40 x 3.12 x 1.54 cm
24	Platia Magoula Zarkou	MN–LN	3.00–13.60 x 1.20–4.90 x 0.80–3.50 cm	6.50 x 3.60 x 1.90 cm
29	Visviki Magoula	EN–FN	AXES: 3.10–8.50 length x 1.10–5.10 cm width (the majority of tools measure 4.00–6.00 cm in length) / ADZES: 3.30–14.60 length x 2.20–4.70 cm width (the majority of tools measure 4.00–6.00 cm in length)	
30	Sesklo	EN–MN	2.50–10.50 cm length	
37	Toumba Balomenou	EN–LN		Group I: 9.40 x 4.70 x 3.50 cm/ Group II: 4.00 x 2.90 x 1.30 cm
38	Sarakenos Cave	EN–LN	1.90–13.50 x 0.80–5.70 x 0.40–4.50 cm	5.46 x 3.27 x 1.77 cm
39	Tharrounia/ Skoteini Cave	LN–FN	2.30–6.30 cm length + one specimen 14.90 cm	
40	Drakaina Cave	LN–FN	2.00–7.00 cm length	
44	Lerna	EN–MN	4.80–9.33 x 2.14–5.62 x 1.60–3.70 cm	7.00 x 4.19 x 2.86 cm
45	Anemodouri (hoard findspot)	Neolithic	5.90–27.80 cm length	
46	Franchthi Cave	EN–FN	2.00–9.60 x 0.80–4.90 x 0.40–3.70 cm	4.54 x 3.01 x 1.67 cm
47	Alepotrypa Cave	EN/LN–FN	2.70–8.70 x 1.40–5.20 x 0.80–3.40 cm	4.80 x 3.20 x 1.70 cm
48	Kitsos Cave	LN–FN	2.80–6.60 x 1.30–4.80 x 0.90–1.90 cm	3.75 x 2.65 x 1.32 cm
50	Kephala	LN	3.00–8.20 x 1.70–4.20 x 1.00–2.40 cm	5.53 x 2.57 x 1.45 cm
52	Saliagos	LN	< 6.00 cm	
57	Katsambas	EN	small ones: 4.50–6.00 cm length – larger ones: 8.00–8.40 cm length	
58	Knossos	EN–LN	1.40–10.70 x 2.50–7.00 x 0.80–3.70 cm	5.45 length x 4.25 cm width

Tab. 4 Range of edge tool dimensions and average dimensions per site, where available or possible to calculate.

Tab. 4 *Kleinste und größte sowie Durchschnittmaße der Schneidwerkzeuge je Fundort, sofern diese vorliegen oder berechnet werden können.*

Fig. 3 A quartz crystal shaped by abrasion to resemble a miniature edge tool. It was probably used as an amulet (LN Kleitos, Western Macedonia).

Abb. 3 *Quarzkristall, der durch Abschleifen einem Miniaturschneidwerkzeug gleicht. Er wurde vermutlich als Amulett verwendet (Spätneolithikum, Kleitos, Westmakedonien).*

even more rapid dimensional changes. In addition, edge tools are often secondarily used (e.g., as pounders or abrasive tools), resulting in alterations to their original form. Evidence from the Makriyalos assemblage supports the idea of size reduction through use: Larger tools bear signs of heavier use and abundant evidence of resharpening compared to smaller ones (Tsoraki 2008, 88–89). In the case of the Franchthi and Alepotrypa assemblages, on the other hand, where no intact specimen exceeds 10 cm in length, the exact opposite has been observed: Larger tools do not display evidence of intense resharpening, unlike smaller ones. In these cases, the predominance of small tools has been interpreted as a deliberate function-related manufacturing choice, with potential (additional) symbolic, non-utilitarian dimensions, at least in some instances (Stroulia 2003, 71–79; Stroulia 2018, 214).

The small size of Greek Neolithic edge tools – certainly the result of a combination of factors – contrasts sharply with their generally much larger Western European counterparts (Tsoraki 2008, 88). Interestingly, however, a difference in tool size emerges when comparing sites from Northern and Southern Greece, with edge tools from the north being typically larger than those from the south. This discrepancy may be linked to the type and function of the sites, since most of the Neolithic sites investigated in the south are caves (Stroulia 2018, 213–214).

There are only a few exceptions of oversized tools in archaeological assemblages from Neolithic Greece. The four largest specimens identified so far include one tool from Anemodouri, in the Peloponnese, measuring about 28 cm in length and weighing over 1.5 kg (Fig. 2; Tsountas 1901), two tools from Nea Nikomedeia, Central Macedonia, measuring 27.5 cm and 26 cm in length (Sugaya 1992), and one tool from Mavropigi-Fyllotsairi, Western Macedonia, slightly exceeding 26 cm in length (Ninou 2022). They all constitute extreme rarities and are rather unlikely to have had a utilitarian function (Sugaya 1992) as they originate from special contexts of possible ritual and symbolic character. The intriguing find from Anemodouri was part of a hoard of four axes recovered from a ceramic vessel that also contained charcoal, which was surrounded by scattered potsherds and fragments of obsidian blades (Tsountas 1901). The Nea Nikomedeia axes were found alongside clay female figurines in a building identified as a ›shrine‹ by the excavator (Rodden 1964; Rodden/Rodden 1964; Rodden/Rodden 1964a), whereas the tool from Mavropigi-Fyllotsairi was found in association with a burial (Ninou 2022). The special attributes of these finds, along with their context of retrieval and other oversized finds – although of no such metrical extremes – from other sites, combine with other features to suggest a possible symbolic dimension of these artefacts (Sampson/Sugaya 1989). These features may include the possible presence of colouring substances on the surfaces of some of them (Sugaya 1992, 72), the existence of extremely finely made ›greenstone miniature axes‹ and other small well-made edge tools of various materials (Fig. 3) that possibly functioned as amulets (see Gimbutas 1989, 333, for the case of Achilleion; Stroulia 2010, 76–77 for the Franchthi

NO.	SITE	DATE	MAIN RAW MATERIAL	SIGNS OF QUARRING	SIGNS OF LOCAL MANUFACTUTING	FLAKING	SAWING	DRILLING
1	Makri	MN–LN	(various in unknown percentages: greenschist, serpentine, metagabbro)			YES		
2	Dikili Tash	EN–FN	(various in unknown percentages: jadeite?, limestone, silex etc.)				YES (based on Séfériadès 1992, Tab. 178b)	
3	Sitagroi	late MN/(early) LN–FN	metadolerite, metagabbro	YES			YES	YES (n = 2)
4	Olynthus	LN	(various in unknown percentages: black ironstone, limestone, soapstone)				YES	
5	Koroneia	MN–LN	serpentinite		5 unfinished specimens	YES	YES	YES (n = 1)
6	Stavroupoli	MN–LN	serpentinite			(possible)	YES (n = 1)	
7	Agrosykia	FN						
8	Sosandra	EN	serpentinite, gabbro					
9	Nea Nikomedeia	EN	marble, serpentine	YES ? – with sawing			YES	
10	Paliambela	EN–LN						
11	Makriyalos	LN	serpentinite	YES – limited indications of sawing application		YES (n=2, according to Tsoraki 2008, Tab. 4,26–30)	YES	
12	Kleitos	LN–FN	serpentinite		15 unfinished specimens and production debris	YES	YES	YES (n = 5)
13	Toumba Kremasti Koilada	LN	serpentinite, gabbro		YES	YES	YES – rare	YES (n = 3)
14	Megalo Nisi Galanis	EN–early FN	serpentinite, gabbro		YES	YES	YES	
15	Mavropigi-Fyllotsairi	EN	serpentinite			YES	YES	
16	Koromilia	LN	gneiss, granite, amphibolite			YES	YES	
17	Avgi	MN–LN	serpentinite	YES	9 unfinished specimens and possible production debris?	YES	YES	
18	Dispilio	MN–FN	serpentinite	YES	YES (workshop)		YES	
19	Xirolimni	EN				YES – rare?	YES	
20	Servia	EN–LN	serpentinite, basalt		a few flakes (unstratified) and unfinished specimens (phase 2, 3, 7)	YES	YES	
21	Varemenoi Goulon	EN–MN	gabbro		YES (workshop)	YES	YES – rare	YES (n = 2)

NO.	SITE	DATE	MAIN RAW MATERIAL	SIGNS OF QUARRING	SIGNS OF LOCAL MANU-FACTUTING	FLAKING	SAWING	DRILLING
22	Vrastero	Neolithic	ophioliths		YES (workshop)	YES		
23	Theopetra Cave	EN–LN	ophioliths					
24	Platia Magoula Zarkou	MN–LN	gabbro, serpentinite			YES (n = 1)	YES (n = 1)	
25	Argissa	EN–LN	greenstone (Reingruber 2008)					
26	Mandra	LN–FN				YES – rare	YES	
27	Ayia Sofia Magoula	LN						
28	Achilleion	EN–MN	serpentine or jadeite		at least 1 unfinished specimen			
29	Visviki Magoula	EN–FN	serpentinite, amphibolite					YES (n = 2)
30	Sesklo	EN–MN			YES	YES	YES	
31	Dimini	LN				YES		
32	Pefkakia Magoula	LN/FN						
33	Ayios Petros	MN	red volcanic stone				YES	
34	Cyclops Cave	EN–LN						
35	Ayios Vlasis	EN			YES *possible workshop	YES	YES – rare	
36	Elateia	EN–MN	basalt, greenstone					
37	Toumba Balomenou	EN–LN	(various in unknown percentages: basalt, serpentinite, steatite, tuff)					
38	Sarakenos Cave	EN–LN	greenstones (meta-ophiolite group)					
39	Tharrounia/Skoteini Cave	LN–FN						
40	Drakaina Cave	LN–FN	gabbro					
41	Limnes Cave	LN						
42	Tsoungiza	EN-MN/FN	granite, serpentinite					
43	Ayioryitika	EN/MN–FN	greenstone					
44	Lerna	EN–MN	serpentinite					
45	Anemodouri (hoard findspot)	Neolithic	jadeite, diabase, greenstone					
46	Franchthi Cave	EN–FN	serpentinite		YES	YES (n = 1)		
47	Alepotrypa Cave	EN/LN–FN	metavolcanic material		only 1 possible unfinished specimen			
48	Kitsos Cave	LN–FN	serpentinite, jadeite					
49	Ayia Triada Cave	LN–FN						

NO.	SITE	DATE	MAIN RAW MATERIAL	SIGNS OF QUARRING	SIGNS OF LOCAL MANUFACTUTING	FLAKING	SAWING	DRILLING
50	Kephala	LN	(2 emery)			(possibly, judging by the drawing and photos of two artefacts, Nr. 1 and 38)		
51	Ftelia	LN	greenstone					
52	Saliagos	LN	emery			YES		
53	Yali	FN	sandstone					
54	Kastro (Alimnia islet)	FN						
55	Ayios Yeoryios Cave, Kalithies (Rhodes)	LN–FN	flint					
56	Aposelemis cemetery	Neolithic						
57	Katsambas	EN	metamorphic stones					
58	Knossos	EN–LN	serpentinite		one or two possible unfinished specimens (Evans 1964, Fig. 51,11; Pl. 54.4,1)	YES (n = 2)	YES	

Tab. 5 Main raw materials used for edge tool production and different traces of manufacture per site.

Tab. 5 *Hauptrohstoffe für die Herstellung von Schneidwerkzeugen und die verschiedenen Herstellungsspuren je Standort.*

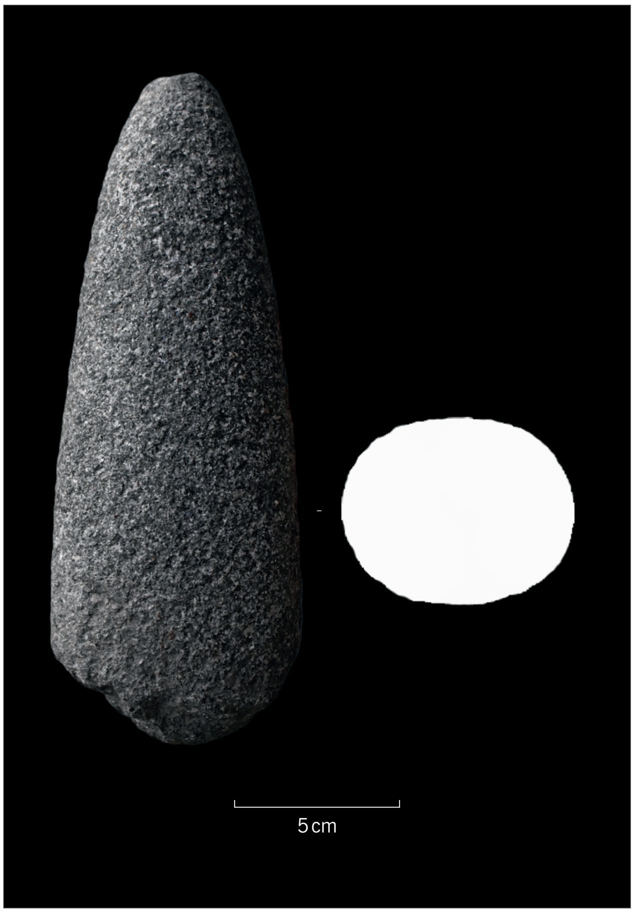

Fig. 4 A semi-finished example of Tsountas's type A edge tool with almost circular section (Neolithic, Vrastero, Western Macedonia).

Abb. 4 *Halbfertiges Schneidwerkzeug von Christos Tsountas' Typ A mit fast rundem Querschnitt (Neolithikum, Vrastero, Westmakedonien).*

Cave), and certain stylised figurines that morphologically resemble edge tools[6]. An example of the last category of finds is the 24.5 cm long axe-shaped object from Sesklo with traces of ochre, initially interpreted as a stylised painted figurine (Tsountas 1908, 288–289; 306 Fig. 230b).

In terms of morphology, edge tools exhibit a remarkable diversity, which sometimes appears to be a deliberate manufacturing choice and at other times seems more closely related to the initial morphology of the raw material used. However, one specific morphological type is worthy of special mention, as it is identified within the typological scheme of Tsountas (1908) as one of the characteristic tool types of the Thessalian world: the spindle-shaped robust axe with a circular or oval section (Type A, Fig. 4). The interesting thing about this type is that it appears to have a rather specific distribution: It is present on the Thessalian plain – e.g., at Sesklo and Dimini (Moundrea-Agrafioti 1985; Tsountas 1901) – and in the southern part of Central Greece – e.g., at Toumba Balomenou (Tzavella-Evjen 2012)

Fig. 5 Semi-finished edge tools representing various stages of their production sequence (Neolithic, Vrastero, Western Macedonia).

Abb. 5 *Halbfertige Schneidwerkzeuge in verschiedenen Herstellungsstadien (Neolithikum, Vrastero, Westmakedonien).*

and Ayios Vlasis (Chondrou, pers. obs.) – whereas, to the north of the Thessalian plain, it turns up at some sites – e.g., at Servia (Mould et al. 2000, 139–146), Varemenoi Goulon (Stroulia 2018a), and Vrastero (Chondrou, pers. obs.) all situated in Western Macedonia – but not at others in the same region – e.g., at Kleitos and Toumba Kremasti Koilada (Chondrou 2011; Chondrou 2018).

Neolithic edge tool technologies in Greece – raw materials and manufacture

Regarding the locales of edge tool production, the available evidence varies. In a series of sites, only a few semi-finished specimens are preserved (Tab. 5). If the scant representation of manufacturing remains is not due to the limited extent of the excavation, we may be dealing with a hybrid model of tool acquisition, where some tools arrive at the settlement as ready-made artefacts but others as raw materials to be shaped *in situ*. Alternatively, (some) tools may have arrived in a semi-finished form to be completed on site. In any case, one would expect redesigning practices – just as with maintenance activities, i.e., resharpening – to have been executed on site (as well). There are, however, the cases of Dispilio (Stratouli 2002), Varemenoi Goulon (Stroulia 2018a), Vrastero (Dimaki et al. 2023), all in Western Macedonia, and Ayios Vlasis (Chondrou pers. obs.) in Central Greece, where the bulk of the available evidence suggests mass tool production in organised workshops (Fig. 5). Thus, while the simplest forms of edge tools could have been made by any Neolithic individual, their greatest requirement being patience rather than any particularly complex know-how, the existence of workshops implies an early form of technical specialisation and division of labour and confirms that the production of edge tools in Neolithic Greece was – to some extent – a specialised craft. At least three of these workshops are associated with settlements, suggesting the existence of communities oriented to the production and distribution of such implements.

Regarding the manufacture of edge tools, the available evidence testifies to a significant degree of variability in all stages of the production sequence, from raw material acquisition to the formation of the final product. The rocks used as raw materials belong to all three major geological groups: metamorphic, igneous, and sedimentary. Among the most preferable materials are serpentinite and gabbro. However, since many publications refer to ›greenish rocks‹ without further explanation or supplementary data from petrographic, mineralogical, or geochemical analyses, there is no feasible way to determine the actual numbers. Nevertheless, what can be said is that a distinct and widespread preference for serpentinite is evident in numerous Greek settlements throughout the Neolithic period (see also Moundrea-Agrafioti 1996, 104; Perlès 2001, 232). Since the natural properties of the rock would have played a vital role in raw material selection (Delgado-Raack et al. 2020), scholars have associated this particular choice of serpentinite with the rock's softness and, therefore, easiness to shape, although it is exactly this soft-

6 Sugaya (1992, 75) has raised questions regarding the existence of a ›stone-axe belief‹ associated with the deification of edge tools within certain ritual contexts.

Fig. 6 Two examples of the identifiable group of tools made of a particular variety of serpentinite that probably came to Kleitos from Dispilio, both Western Macedonia.

Abb. 6 *Zwei Beispiele für die identifizierbare Gruppe von Werkzeugen aus bestimmten Serpentinitarten, welche wahrscheinlich von Dispilio nach Kleitos, beide Westmakedonien, gelangten.*

ness that raises questions about the functions of the tools produced (see Stroulia 2003, 66; Tsoraki 2011b, 296). In the case of Makriyalos, the use of durable igneous rocks such as basalt for some tools was interpreted as a function-related choice, although it would also entail more time-consuming production processes (Tsoraki 2008, 109). At the same time, however, a relation between specific rock categories and tool types (coarse igneous rocks for axes, finer ones for adzes, serpentinite for chisels) was found to not fully comply with functional criteria (Tsoraki 2011b, 289; 295).

Colour (and colour patterning) is another natural property of stone that, as demonstrated by some site-specific specialised studies, would not have been overlooked by prehistoric people (Bekiaris et al. 2017; Chondrou 2018; Tsoraki 2011b). The techniques of grinding and especially polishing that were applied in the formation of edge tools enhanced the colour properties of rocks, making them distinctive and recognisable. In the case of Kleitos, the preference for certain materials over others in edge tool technology has been linked to the visual appearance of the tools, to their recognisability, and to the potential projection of particular identities in a very densely populated area (Chondrou 2018; Chondrou 2022).

The availability of the raw material, its accessibility, and one's own proximity to its source(s), as well as the origin of the raw material (with any associated connotations), would have certainly influenced the selection of rocks. In most cases, the raw materials used for edge tool production were locally or regionally available, but cases of exploitation of more distant sources are also known. For example, in the earliest phase of Sitagroi, Eastern Macedonia, only local stones were used, later supplemented by imported materials from outside the Drama region (Elster 2003, 185). In Tsoungiza, Southern Greece, all the rocks used for edge tool production were brought from further away (Dabney et al. 2020). In Franchthi, although the majority of tools were made of locally/regionally available raw materials, there are singular occurrences of non-local rock types such as andesite and fired steatite (Stroulia 2010, 66; 126). At Knossos, Crete, in South Aegean, the raw materials came from distant areas of the island (Strasser 2004; Strasser 2008; Strasser/Fassoulas 2004), whereas, at Ayios Petros in the Sporades, North Aegean, and at Saliagos in the Cyclades, South Aegean, materials came from outside the islets, i.e., from the nearby island of Psathouras (Moundrea-Agrafioti 1981, 180) and from the emery deposits of Naxos Island

(Oosterom 1968, 99), respectively. In the Drakaina Cave on the island of Kephalonia, the gabbro used for edge tools must have been of an even more distant origin since it does not occur on any Ionian island and most probably came from the area of Pindos on mainland Greece (Melfos et al. 2020). The limited number of axes made of basalt found in certain Dodecanese islands (e.g., Karpathos, Symi) suggests the importation of this volcanic material (whether as a raw material or as finished objects remains unknown), complementing the exploitation of the local stone sources (Georgiadis 2017). Finally, with regard to the relatively limited number of jadeite edge tools found in Greece and elsewhere in Southeast Europe, field investigations and analyses have partially confirmed an earlier hypothesis: the raw material of many – though not all – sampled Greek finds was traced to the island of Syros (Sørensen et al. 2017). However, the quantity and quality of these finds suggest that the production on Syros, although it predates the exploitation of Alpine sources (Sørensen et al. 2017), was limited, as was the circulation of these products. This supports the idea that the majority of Southeast European jadeite finds likely had an Alpine origin (Pétrequin et al. 2017).

The aforementioned examples illustrate the extensive circulation of raw materials and/or finished artefacts, often spanning several dozen kilometres. However, these movements and exchanges did not always have the same form and mechanisms of execution, nor did they serve the same needs or carry equivalent meanings and values. This is exemplified by the case of Kleitos, located in the alluvial Kitrini Limni basin in North-western Greece, where the absence of suitable raw materials forced the local communities to turn to raw material sources outside their immediate vicinity from locations more than 20 km away, at least as far as good-quality material is concerned (Chondrou 2018). Analysis of the Kleitos edge tool assemblage revealed a distinct and identifiable group of edge tools of high craftsmanship and good-quality serpentinite possibly originating from Dispilio, approximately 50 km away. If this is the case, it would mean the existence of a regional network of edge tool circulation (Fig. 6; Chondrou 2018; Chondrou 2022, 251–252), which, according to the evidence, supplied at least one more settlement in Western Macedonia, Avgi (Bekiaris et al. 2017; Stratouli 2019). Additionally, four tools in the same assemblage were made of ophitasvestite (green Thessalian stone), a rare and hard serpentinite breccia known for its impressive optical traits and found approximately 100 km away, in the area of Larissa, Central Greece (Melfos 2008 and pers. comm.). The exchange systems for these two cases – the tools possibly originating from Dispilio and the tools made of ophitasvestite – may differ significantly. Finds with a very limited presence in overall assemblages, such as the ophitasvestitic rarities found in Kleitos, could represent small-scale exchanges (between individuals or groups), gifts, random discoveries, or travel mementos (for a similar hypothesis on a different assemblage, see Stroulia 2003, 126–127).

The available data suggest that the most common strategy of raw material acquisition for edge tool production was the exploitation of secondary deposits, such as stream and river beds, achieved through the collection of pebbles and cobbles. In a few cases, the collection of naturally detached or fragmented material from primary sources has also been proposed, whereas the exploitation of primary sources through quarrying is extremely rare (cf. Tab. 5; note: in none of the cases where quarrying is mentioned has the specific site of Neolithic material extraction been identified).

Edge tools were the result of specific production sequences that usually required significant work investment, involving multiple manufacturing techniques, specific technical means (e.g., hard and soft hammers, saws) and a certain know-how. A range of techniques (flaking, sawing, drilling, pecking, grinding, and polishing) were employed and combined in diverse ways to form the tools.

When examining the published data, an interesting underrepresentation or complete absence of the technique of flaking is observed in edge tool assemblages from Southern mainland Greece, from the islands, and – to a lesser extent – from Central Greece. In these areas, edge tools are frequently formed through pecking and grinding, or even exclusively through grinding, on collected cobbles and pebbles that, in shape and size, closely resemble the intended final product. It is characteristic that Moundrea-Agrafioti (1996), who studied edge tools from a number of Thessalian sites, does not mention the technique of flaking as part of their manufacturing sequence. At the Franchthi site, only one specimen out of a set of 88 edge tools bears traces of this technique (Stroulia 2010), whereas, in the Neolithic material from Knossos, Crete, only two do so (Evans 1964, 229). Saliagos in the Cyclades (Boleti 2009, 221) and Ayios Vlasis in Central Greece (Chondrou, pers. obs.) exhibit a more intense application of flaking and can be considered intriguing exceptions.

In contrast, flaking is clearly more often attested in edge tool assemblages from Northern Greece (cf. Tab. 5)[7] although it is not uniformly applied in all assemblages or to the same stages of the tools' life-cycles. For instance, in Makriyalos, contrary to other northern sites, flaking – generally limited in its application (Tsoraki 2011, 236) – was rarely used at the initial stage of the reduction sequence, being primarily related to maintenance episodes instead (Tsoraki 2008, 64; Yerousi 1999, 61).

The uneven application of flaking cannot be attributed to the raw materials used (*contra* Perlès 2001, 233 Footnote 11). As mentioned, many settlements share a preference for similar rock types, such as serpentinite. Although considered unsuitable for shaping through flaking (see Stroulia 2010, 68), serpentinite has indeed been found to have been manipulated in this way in several Greek settlements (e.g., Kleitos, Western Macedonia, where the application of flaking is particularly extensive; Chondrou 2018). Thus, rather than viewing it as a consequence of raw material con-

7 Regrettably, documentation of this technique is frequently lacking in available publications: in the case of Stavroupoli, Central Macedonia, for example, flaking is mentioned as one of the tool shaping techniques without any further elaboration (Alisøy 2002, 567). Similarly, in the publication of Servia, the existence of a flaking stage in the manufacturing sequence of edge tools is merely suggested by the identification of a few flakes and fragments, without providing detailed references (Mould et al. 2000, 115; 117).

straints, the selective use of flaking should be interpreted as indicative of diverse cultural choices and technological traditions among prehistoric communities. The strong presence of flaking in the *chaînes opératoires* of Northern Greece may also hint at possible affinities with the north, since flaking is well-attested in the edge tool technologies of the Balkans throughout the Neolithic, where it was not only used for the shaping of preformed blanks but also for the production of the blanks themselves[8]. The latter process, namely, the use of flaking for the production of a flake or a blade to be shaped into a ground edge tool, proves so far to be a rarity in Greece, with a few examples documented, in the north, at Xirolimni, Toumba Kremasti Koilada, and Kleitos, Western Macedonia[9], in Central Greece, at Mandra, Thessaly (Chondrou, pers. obs.), in the Eastern Aegean, at Saliagos (Boleti 2009, 224), and in the south, at Knossos, Crete (Evans 1964, 186). Nevertheless, the scattered distribution of the known evidence suggests the possibility of more similar cases yet to be identified.

The application of sawing (Fig. 7) exhibits an interesting geographical distribution as well (cf. Tab 5). It is frequently attested in tool assemblages from the north – e.g., at Kleitos (Chondrou 2018, 92–94), at Megalo Nisi Galanis, Western Macedonia (Stroulia 2005, 573), at Varemenoi Goulon (Stroulia 2018a, 53–55), at Servia (Mould et al. 2000, 112–114), at Makriyalos (Tsoraki 2008, 60; Yerousi 1999, 35–37), at Avgi (Bekiaris 2018, 205–206), at Dispilio (Stratouli 2002, 161–162), at Nea Nikomedeia (Rodden 1962, 279), at Olynthus, Central Macedonia (Mylonas 1929, 75), and at Sitagroi (Elster 2003, 183; 185) – whereas it is notably absent in assemblages from the south (Neolithic Knossos represents an interesting exception). In Central Greece, sawing is quite rarely applied in edge tool manufacture – e.g., at Mandra (Chondrou, pers. obs.), at Sesklo (Moundrea-Agrafioti 1981, 183–184; Tsountas 1908, 314–315), and at Platia Magoula Zarkou, Thessaly (Stroulia 2022, 328) – and appears to be mostly associated with the formation of chisels – often through the segmentation of axes and adzes –, suggesting the existence of a specific correlation between technique and tool type (Moundrea-Agrafioti 1981, 232). A similar situation has been observed at some sites from Northern Greece as well: for example, at Servia, where many – if not all – minimal chisels of the assemblage were produced by splitting axes and adzes through sawing (Mould et al. 2000, 112–114), at Xirolimni, where a small group of thin elongated chisels was produced through multiple sawing episodes (Chondrou, pers. obs.), at Olynthus (Mylonas 1929, 75), and possibly at Sitagroi[10].

Another technique, drilling, was commonly used in the manufacturing of shaft-hole axes, i.e., edge tools with a perforation for the insertion of the haft into the body of the tool. The appearance and use of this tool type in Greece was, until quite recently, thought to have been associated with the Bronze Age period (Tsountas 1908; Moundrea-Agrafioti 1981; Moundrea-Agrafioti 1992). However, recent discoveries indicate that the origins of this technological innovation date back even earlier, to at least the LN period: two LN specimens from Sitagroi have been identified (Elster 2003, 178 Tab. 5,2), one LN specimen from Makriyalos (Tsoraki 2008, 66–67), five specimens from Kleitos in LN layers (Chondrou 2018, 134–137), and at least one LN specimen from Toumba Kremasti Koilada (Stroulia 2014, 66). Similar finds have been reported from Sesklo, Dimini (Tsountas 1908, 319–321) and Visviki Magoula (Bergner 2015, 498) in Thessaly, but their exact dating is uncertain. Furthermore, two specimens were found in Varemenoi Goulon (Stroulia 2018a, 60–61), but it is unclear from the published article whether they were surface finds or part of the excavation material, whereas the sole find from Koroneia is marked as Neolithic with no further details (Almasidou 2019).

The final manufacturing stages were that of grinding and polishing, both time-consuming and laborious. From a strictly functional perspective, the only part of the tool that requires polishing so that the tool is efficient is its edge. However, it is quite common to see grinding and polishing extending to other parts of the tool body, not infrequently throughout its entirety. Finds with meticulous grinding and polishing that obliterate all signs of previous manufacturing stages have in many cases sparked discussions about the symbolism expressed through aesthetics (see, for example, Stroulia 2010, 68–69).

In some instances, a correlation between raw material, size, and surface finishing has been noted. For example, in Neolithic Servia, small, medium, and large specimens are made of raw materials of increasing hardness but exhibit decreasing refinement of their surfaces. Thus, the superbly polished tools of less than 5 cm in length that are made of soft rocks differ greatly from the largest examples (11–20 cm in length) that are made of harder material and are often well-polished only in the area of the blade (Mould et al. 2000, 115). Similar observations have been made at Achilleion (Winn/Shimabuku 1989) and other Thessalian sites (Moundrea-Agrafioti 1981, 195–196).

Sometimes, certain areas of the tool surfaces (usually in the middle or two-thirds along the length of the tool or on and around the butt) are left untreated during the final stages of manufacturing in order to maintain a rough texture and, in this way, to facilitate the hafting of the tool. In other cases, tools receive pecking after polishing, so that rough patches are created for the same purpose. Notches, concavities on the narrow sides, and grooves perpendicular to the long axis of the tool are further indirect evidence for hafting detected in many assemblages (Fig. 8). Unfortunately, hafting in Aegean tool assemblages has not yet been thoroughly investigated through specialised studies. Nevertheless, it is more than certain that the forms of the hafts and the methods by which the stone tools were adjusted to them varied and had multiple dimensions beyond purely utilitarian/practical considerations (for eth-

8 E.g., Antonović 2008; Antonović 2014; Prinz 1988; Tringham et al. 1985; Voytek 1990.

9 Personal observation of the author, cf. also Chondrou 2011; Chondrou 2018; Chondrou 2022.

10 Although the published study does not provide specific references, an association of sawing marks and chisels is evident from the drawings, photographs, and artefact descriptions (see, for example, Elster 2003, 183 Fig. 5,20–21).

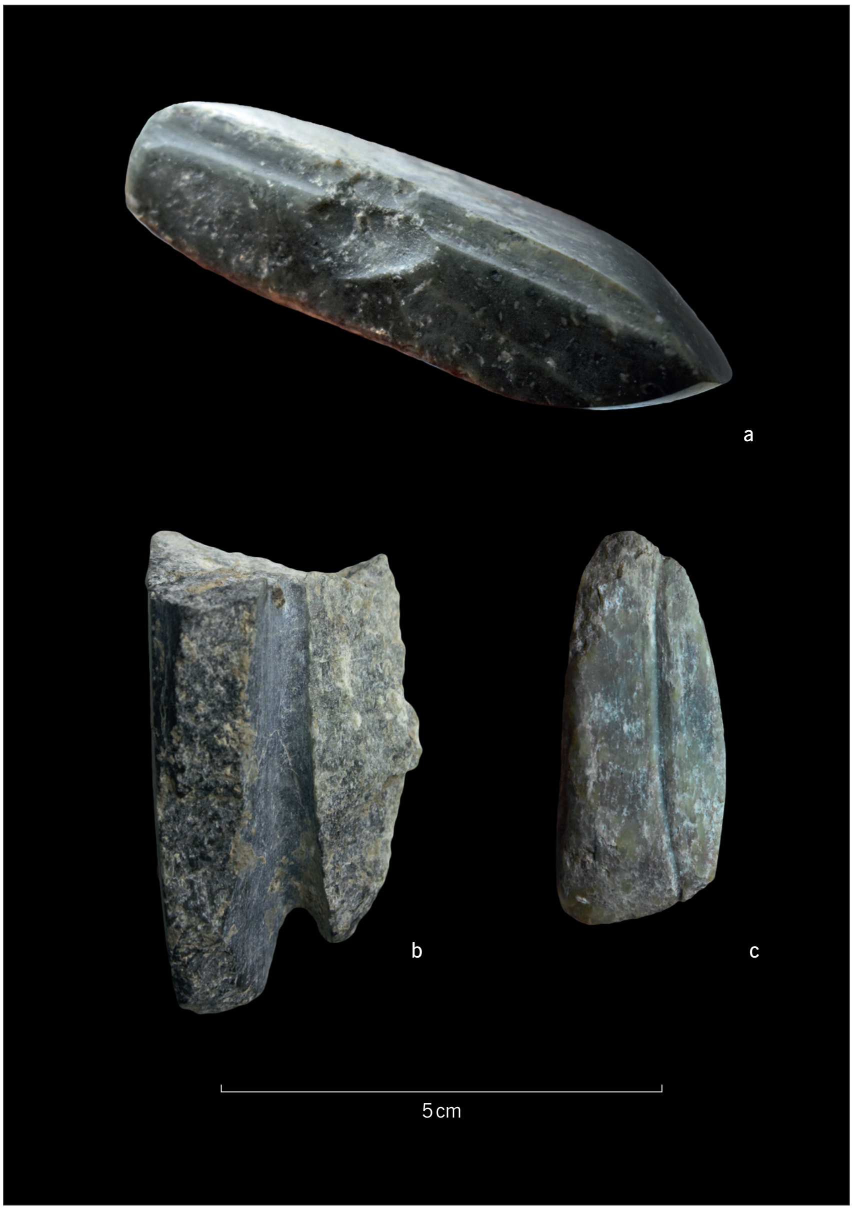

Fig. 7a–c Examples of tools with sawing marks: a chisel from LN Mandra, Thessaly, produced with sawing; b fragment of an edge tool with evidence of sawing from LN Kleitos, Western Macedonia; c small edge tool with unfinished sawing from EN Xirolimni, Western Macedonia.

Abb. 7a–c *Beispiele von Werkzeugen mit Sägespuren. a Durch Sägen hergestellter Meißel (Spätneolithikum, Mandra, Thessalien); b Fragment eines Schneidwerkzeuges mit Sägespuren (Spätneolithikum, Kleitos, Westmakedonien); c unfertig gesägtes, kleines Schneidwerkzeug (Frühneolithikum, Xirolimni, Westmakedonien).*

nographic studies that offer supporting evidence, see, for example, Hodder 1982; Pétrequin/Pétrequin 1993; for an extensive overview regarding the Asian Pacific region, see Buckley 2023).

From a broad perspective, it appears that the *chaînes opératoires* of the edge tools from Southern (and, to some extent, Central) Greece are less complex compared to those from the north. In these southern regions, the techniques of pecking and abrasion – the simplest methods for shaping a stone artefact – are predominantly used, whereas other techniques are infrequent or absent. Additionally, tools from the south often feature more curvilinear shapes, a result of limited intentional shaping of naturally rounded cobbles and pebbles. In contrast, edge tools from the northern parts of the country more often exhibit extensive shaping with complex *chaînes opératoires* that involve the combined application of various techniques and the expenditure of a significant amount of time and labour.

Neolithic edge tool technologies in Greece – discard and deposition practices

Use-wear analyses that would help us identify the functions of Greek Neolithic edge tools are lacking (see Christopoulou 1992 for an early first attempt which, unfortunately, was not followed up by other scholars). Therefore, inferences about the subject are drawn mainly on the basis of the size of the tools, the morphology of their edge, and their state of preservation. A general observation that can be made is that many edge tools present rich biographies with successive stages of use (not necessarily in the same activity) and regular intermediate maintenance episodes. Cases of reshaping, secondary use, or recycling have been documented in numerous assemblages. Often – but, interestingly, not always – these changes are a necessity imposed by accidental breakages that bring the previous use of the tools to an abrupt end.

Fig. 8a–c Examples of tools with evidence of hafting: pecking on a previously polished surface, groove, notches (a; c LN Kleitos; b EN Xirolimni, both Western Macedonia).

Abb. 8a–c *Beispiele von Werkzeugen mit Schäftungsnachweis: Hackspuren auf einer zuvor geschliffenen Oberfläche, Rille, Kerben (a; c Spätneolithikum, Kleitos, Westmakedonien; b Frühneolithikum, Xirolimni, Westmakedonien).*

Regarding the post-use manipulation of edge tools, information can be inferred through contextual analysis, co-findings, and preservation status. One form of recycling observed in several settlements is the incorporation of tools into various features. In terms of sheer numbers, perhaps the most impressive example of edge tool recycling comes from the site of Koroneia, Central Macedonia, where a group of 7 edge tools was uncovered during the cleaning and deconstruction of a single clay hearth (Almasidou 2019, 82). In Kleitos, an edge tool was found embedded in a circular clay platform, with no apparent functional role, as it was not part of either the substructure or the structure's floor. The large dimensions of the tool and its intact and fully functional state make the idea of accidental incorporation unlikely (Chondrou 2018). In Servia, an axe and two adzes were found incorporated into the walls of a Middle Neolithic (MN) building, another axe was incorporated into the floor of a thermal structure, and a few more specimens were found in the fills of pits and postholes (Mould/Wardle 2000, 44–51; Mould et al. 2000, 117). On the other hand, the discovery of two MN axes inside a pot at the same site (Mould/Wardle 2000, 37), as well as a unique hoard of 11 edge tools from MN Lerna, Peloponnese (Banks 2015, 51–52; 191), should probably be considered the result of storage practices.

In North-western Greece, a cluster of settlements exhibits similar methods of edge tool treatment, including deliberate fragmentation, burning, and interment in ditches and pits. Makriyalos (Tsoraki 2008), Kleitos (Chondrou 2018), Avgi (Bekiaris 2018), and Toumba Kremasti Koilada (Chondrou 2011; Stroulia/Chondrou 2013; Stroulia 2014) have all yielded finds that suggest the intentional manipulation of edge tools, among other tool types, beyond their primary function. Interestingly, they are all dated to the LN, suggesting the possible existence of contemporary shared beliefs at a regional level regarding the symbolic manipulation of these particular artefacts. At two of these sites, Kleitos and Makriyalos, a dual model of tool manipulation has been identified, with a differentiated treatment of grinding tools and edge tools, further reinforcing the idea of their function as symbols[11]. Additionally, the suggestion of the ritual breakage of axes has been made for Southern Greece in relation to the assemblages of the Alepotrypa and Franchthi Caves (Stroulia 2010; Stroulia 2018).

11 See also Hodder 1990; for ethnographic examples of tool-related symbolic and/or gendered representations, see Hamon/Le Gall 2011, 27; Lidström Holmberg 1998; Pétrequin/Pétrequin 1993; Taçon 1991.

Evidence for the deposition of edge tools in non-utilitarian spaces related to the dead is scarce and primarily found in the southern regions. Perhaps the clearest examples derive from the Neolithic cemetery of Aposelemis in central Crete and from the cave of Alepotrypa in the Peloponnese. In the first case, stone axes were found as grave offerings regardless of the gender and age of the deceased: a young male individual's burial was furnished with two stone axes, among other offerings, an older female individual's burial contained a small stone axe, and, lastly, the grave of an infant, the richest of the cemetery, was associated with a pit that contained 14 edge tools (Agelarakis/Kanta 2020). In the Alepotrypa Cave, of the 23 edge tools with contextual information available, ten were found in locations with a non-utilitarian function (e.g., areas of primary/secondary burials). They are all reported as bearing use-wear and are considered to be either utilitarian objects that ended their use-lives as offerings in special contexts or were used exclusively in such contexts (Stroulia 2018, 213). One find stands out from the rest both in terms of typology and context: a double-edged tool recovered from the bottom of a Final Neolithic (FN) pot that contained a human skull (Stroulia 2018, 213). A less straightforward association is found in the case of a stone axe from the fill above one of two recovered graves at the Ayioryitika settlement, Peloponnese (Petrakis 2002, 19). Lastly, in the case of the Sarakenos Cave, Central Greece, a higher concentration of tools (and other finds) was found in association with a human skeleton (Davri 2023). The rarity of such find-contexts reinforces the notion that edge tools, like other types of everyday ground stone tools, were not primary choices as offerings in funerary contexts in the Greek Neolithic.

Discussion

This article set out to provide a comprehensive overview of the key characteristics defining edge tool technologies across various regions of Greece during the Neolithic era. While this exploration is by no means exhaustive, the focus has been to delineate the principal technological patterns, both shared and divergent, that illuminate the cultural landscapes of Neolithic Greek communities.

The discernible technological traditions emerging from regional and supra-regional comparisons seem to document a north-south divide in the Greek territory. Taking into account the differences regarding the amount and type of data available from the north and the south, it can be said as a general observation that Northern Greece exhibits a penchant for more complex production of edge tools with more intricate biographies, characterised by frequent resharpening, reshaping, and instances of secondary use or recycling. Conversely, southern locales present tools with simpler *chaînes opératoires*, suggesting disparate approaches to tool production and utilisation. On the other hand, Central Greece, particularly the Thessalian region, appears to harbour a unique blend of technological characteristics, at the same time drawing influences from both southern and northern traditions.

While our understanding of Greek edge tool technologies continues to evolve, there is still a paucity of comprehensive data specific to individual geographical areas. North-western Greece is an exception: Here, due to the greater abundance of archaeological data and specialised studies, we can examine in more detail how the presence or absence of technological traits, as well as the presence or absence of characteristic and identifiable objects, may serve as indicators of contacts and exchanges between regions and traditions. From this point of view, the area north of the Thessalian plain is quite revealing: Certain sites display the prominent use of the flaking technique in edge tool production while at the same time lacking the characteristic Thessalian tool type A, whereas other sites exhibit the reverse picture. In the former case, an orientation towards the traditions of the north is indicated, whereas, in the latter case, the adoption of cultural elements from the south.

Looking ahead, as specialised studies on Aegean assemblages proliferate, a deeper, more nuanced understanding of edge tool technologies is to be anticipated. Future research endeavours, coupled with the application of innovative methodologies and analytical techniques, hold promise for unveiling hitherto unexplored facets of Greek edge tool technologies. All in all, this article has sought to provide a synthesised summary of the existing literature. Some ideas have been formulated and presented, more as food for thought than as conclusions of absolute certainty. Whether they will stand up to the scrutiny of future findings is unknown. What is certain, however, is that, as with many other categories of archaeological finds, edge tools testify to the richness and diversity of human civilization that never ceases to amaze us.

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Tab. 1 after Andreou et al. 1996

Tab. 2–5 author

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