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Examining recycling behaviors at Semizbugu P1 (2022), Kazakhstan

Keywords: archaeology, Paleolithic, recycling, stone tools, surface site

Түйін сөздер: археология, палеолит, реутилизация, тас құралдар, ашық типті ескерткіштер

Ключевые слова: археология, палеолит, вторичная переработка, каменные орудия, стоянка открытого типа

Emily Coco[1]*, Talgat Mamirov[2]
[1]*Corresponding author, PhD candidate, researcher, Center for the Study of Human Origins, Department of Anthropology, New York University, NY, USA. Email: ec3307@nyu.edu
[2]Candidate of historical sciences, Deputy Director for Science, Margulan Institute of Archaeology, Almaty, Kazakhstan. Email: tmamirov@mail.ru

Abstract. This article presents the preliminary results of a new project aimed at investigating the behavioural aspects of stone tool reutilisation at the Semizbugu Palaeolithic complex. Monuments with surface artifacts are ideal sites for recycling, as artifacts are easy to locate and reuse on the day surface in such environments. As part of this project, artifacts were analysed at a new site, designated P1 (2022) of the Semizbugu settlement complex, with a focus on the identification of recycled objects, mainly by the presence of double patina. The results presented here describe the nature of the secondary use of the artifacts. The relevance of the work carried out is associated primarily with the fact that this is a completely new approach in the study of Paleolithic monuments of Kazakhstan, represented by numerous sites of the so-called "open type". On the example of the Semizbugu P1 monument (2022) it is possible to extrapolate the received conclusions with other similar monuments of the region for understanding of character of principles of reutilization and behavioral aspects in the past. Direct field studies at the Semizbugu complex were preceded by laboratory work on materials collected in the 1960s by A.G. Medoev.

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Эмили Коко[1]*,
Талғат Базарбайұлы Мамиров[2]
[1]*корреспондент авторы, докторант, зерттеуші, Адамның шығу тегін зерттеу орталығы, антропология факультеті, Нью-Йорк университеті, Нью-Йорк, АҚШ
[2]тарих ғылымдарының кандидаты, директордың ғылым жөніндегі орынбасары, Ә.Х. Марғұлан ат. Археология институты, Алматы қ., Қазақстан

Эмили Коко[1]*, Талгат БазарбаевичМамиров[2]
[1]*автор-корреспондент, докторант, исследователь, Центр изучения происхождения человека, факультет антропологии, Нью-Йоркский университет, Нью-Йорк, США
[2]кандидат исторических наук, заместитель директора по науке, Институт археологии им. А.Х. Маргулана, г. Алматы, Казахстан

СемізбұғыP1(2022) артефактілерініңреутилизациялаубойыншамінез-құлықаспектілерінзерттеу, Қазақстан

Аннотация. Бұл мақалада Семізбұғы палеолиттік кешеніндегі тас құралдарын қалпына келтірудің мінез-құлық аспектілерін зерттеуге бағытталған жаңа жобаның алдын-ала нәтижелері келтірілген. Артефактілері беткі қабатта орналасқан ескерткіштер қайта өңдеуге өте ыңғайлы орын болып табылады, өйткені мұндай жағдайда артефактілерді жердің күндізгі бетінде оңай табуға және қайта пайдалануға болады. Осы жоба аясында 2022 жылы Семізбұғы тұрақ кешенінің P1 (2022) ретінде белгіленген жаңа жерде артефактілер талданып, қайта өңделген заттарды сәйкестендіру үшін, негізінен, қоспатинаның болуына баса назар аударылды. Мұнда ұсынылған нәтижелер артефактілерді екінші рет пайдалану түрін сипаттайды. Жүргізілген жұмыстардың өзектілігі, ең алдымен, «ашық типті» деп аталатын көптеген тұрақтармен ұсынылған Қазақстанның палеолиттік ескерткіштерін зерттеудің мүлдем жаңа тәсілі болып табылатындығымен байланысты. Семізбұғы P1 (2022) ескерткішінің мысалын қолдана отырып, алынған тұжырымдарды аймақтың басқа ұқсас ескерткіштерімен экстраполяциялауға болады, бұл өткен замандағы реутилизация принциптерімен мінез-құлық аспектілерінің сипатын түсіну үшін қажет. Семізбұғы кешеніндегі далалық зерттеулердің алдында өткен ғасырдың 60-жылдарында А.Г. Медоев жинаған материалдар бойынша зертханалық жұмыстар жүргізілді.

Алғыс: Бұл материал № 2133751 грант бойынша Ұлттық ғылыми қордың қолдауымен орындалған жұмысқа негізделген. Бұл жұмысты қаржыландыруды Лики қоры, АҚШ студенттеріне арналған Фулбрайт бағдарламасы және Раньери халықаралық стипендиаттар қорыда қамтамасыз етті. Коллекцияларға және далалық учаскіге қолжеткізу О.А. Артюхованың, Ә.Х. Марғұлан атындағы Археология институты, әл-Фараби атындағы Қазақ ұлттық университеті жанындағы Қазақстанның Палеолит музейінің көмегі арқасында мүмкін болды. ЕК өзінің далалық тобына да алғыс білдіргісі келеді.

Сілтеме жасау үшін: Коко Э., Мамиров Т.Б. Семізбұғы P1 (2022) артефактілерінің реутилизациялау бойынша мінез-құлық аспектілерін зерттеу, Қазақстан. *Қазақстан археологиясы.* 2022. № 3 (17). 103–114-бб. (Ағылшынша). DOI: 10.52967/akz2022.3.17.103.114

Изучение поведенческих аспектов по реутилизации артефактов на Семизбугу P1 (2022), Казахстан

Аннотация. В данной статье представлены предварительные результаты нового проекта, направленного на изучение поведенческих аспектов по реутилизации каменных орудий на палеолитическом комплексе Семизбугу. Памятники с поверхностным залеганием артефактов являются идеальным местом для вторичной переработки, поскольку в таких условиях артефакты легко обнаружить на дневной поверхности и повторно их использовать. В рамках данного проекта артефакты были проанализированы на новом месте, обозначенном в 2022 г. как P1 (2022) комплекса стоянок Семизбугу, с акцентом на идентификацию переработанных предметов, главным образом, по наличию двойной патины. Представленные здесь результаты описывают характер вторичного использования артефактов. Актуальность проведенных работ связана в первую очередь с тем, что это является совершенно новым подходом в изучении палеолитических памятников Казахстана, представленных многочисленными стоянками так называемого «открытого типа». На примере памятника Семизбугу P1 (2022) можно экстраполировать полученные выводы с другими аналогичными памятниками региона для понимания характера принципов реутилизации и поведенческих аспектов в прошлом. Непосредственно полевым исследованиям на комплексе Семизбугу, предшествовали лабораторные работы по материалам, собранным в 60-е гг. прошлого века А.Г. Медоевым.

Благодарности: Данный материал основан на работе, выполненной при поддержке Национального научного фонда по гранту № 2133751. Финансирование этой работы также было предоставлено Фондом Лики, программой Фулбрайта для студентов США и Фондом международных стипендиатов Раньери. Доступ к коллекциям и полевому участку стал возможен благодаря помощи О.А. Артюховой, Института археологии им. Маргулана, Музея палеолита Казахстана при Казахстанском национальном университете им. аль-Фараби. ЕК также хотела бы поблагодарить свою полевую группу.

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1 Introduction *(Coco E., Mamirov T.)*

The Paleolithic surface site complex, Semizbugu (fig. 1), located in the Saryarka region of Central Kazakhstan, has some of the best known surface deposits in Kazakhstan [Derevianko et al. 1993; 1998; Taimagambetov 1997; Artyukhova et al. 2001; Artyukhova 2013; Artyukhova, Mamirov 2014; Osipova, Artyukhova 2019]. Discovered in 1961 by A.G. Medoev during his work on the geological expedition of the Institute of Geology of the Kazakh SSR Academy of Sciences, the Semizbugu deposits are dense concentrations of stone tool artifacts located on the flat tops and slopes of the Semizbugu hills [Taimagambetov, Ozherelyev 2009; Artyukhova, Mamirov 2014]. Tens of thousands of artifacts were collected at 11 different sites in this landscape in the 1960s by A.G. Medoev; analysis of these artifacts was carried out to determine the technological and typological characteristics [Derevianko et al. 1993; Artyukhova et al. 2001; Artyukhova, Mamirov 2014].

Fig. 1. Map of Kazakhstan with the location of Semizbugu indicated by the red star. Other surface deposits in Kazakhstan identified by the green squares. Projected coordinate system is EPSG 28412 (Pulkovo 1942/G-K zone 12). Data sources: site locations – after Osipova et al. 2020: Artyukhova, Mamirov 2014; vector and raster map data from ©Natural Earth

1-сур. Қызыл жұлдызмен белгіленген Қазақстан картасында орналасқан Семизбугу. Қазақстандағы басқа ашық типті ескерткіштер жасыл алаңдармен белгіленген. Жобаланған координаттар жүйесі-EPSG 28412 (Пулково 1942/G-K 12 аймағы). Дереккөздер: Осипова және т. б. 2020; Артюхова, Мамиров 2014 деректері бойынша объектілердің орналасқан жері; табиғи жер векторлық және растрлық карталарының деректері ©Natural Earth

Рис. 1. Карта Казахстана с местоположением Семизбугу, обозначенным красной звездой. Другие памятники открытого типа в Казахстане обозначены зелеными квадратами. Проектируемая система координат – EPSG 28412 (Пулково 1942/зона G-K 12). Источники: местоположения объектов – (по: [Осипова и др. 2020; Артюхова, Мамиров 2014]); данные векторных и растровых карт ©Natural Earth

Surface sites would have been ideal locations for recycling in the past. Artifacts at surface sites are exposed on the ground for long periods of time. This makes it more likely that ancient people would have found previously discarded artifacts at these sites to recycle [Camilli, Ebert 1992]. Despite this, few studies explicitly investigate recycling in surface contexts [Mcdonald 1991]. Stone tool recycling is defined as any instance in which stone artifacts are scavenged and then reworked, with some period of discard between episodes of manufacture [Amick 2007; Vaquero 2011; Barkai et al.2015**a**].The most reliable indication of recycling is evidence of knapping after some sort of surface alteration, such as a patina or rock varnish, has formed [Vaquero 2011; Vaquero et al. 2012; 2015; Turq et al. 2013; Peresani et al. 2015; Shimelmitz 2015]. This results in flake scars of different colors that demonstrate the discard period between use events.

Instances of reuse have been identified at Semizbugu, but recycling has not been extensively studied. Previous research found that some artifacts have overlapping retouch patterns attributed to different technological traditions [Artyukhova 2013; Artyukhova, Mamirov 2014]. Additionally, some researchers have argued that different surface conditions on the faces of artifacts at Semizbugu could indicate use in multiple Paleolithic periods [Artyukhova, Mamirov 2014]. This is because patinas have been correlated with particular typological phases at Semizbugu [Artyukhova 2013; Artyukhova, Mamirov 2014]. For example, diagnostic Acheulean and Mousterian materials often have a thick, deep, ochre-colored patina, whereas the late Paleolithic material looks “fresher” [Artyukhova, Mamirov 2014]. As a result, previous studies at Semizbugu have described multiples weathering stages of artifacts [Artyukhova, Mamirov 2014; Osipova, Artyukhova 2019]. These stages are strongly altered, medium altered, weakly altered, and not altered, as determined by the formation of patina, degree of ferrugination, and degree of polishing. The well-documented weathering of artifacts at Semizbugu means that recycling should also be easily identifiable.

The results presented in this article represent the first study at Semizbugu focused on examining recycling behaviors in these deposits.

2 Research methods*(Coco E.)*

In the summer of 2022, field expeditions were undertaken to Semizbugu to collect newdata. The site of Semizbugu P1 (2022) is located on the southern slope of a hill in the Semizbugu mountains (fig. 2). The site is situated between Semizbugu 4 and the flat top of a hill where Semizbugu sites 7 through 10 are located. In May 2022, during surveys to identify new locations for data collection, we outline a rough area across which artifacts were spread on this slope. In June 2022, we collected data following the methodology outlined below for every artifact within three quadrants near the center of the concentration of artifacts on the slope. The first quadrant was 20 m by 20 m; the subsequent two quadrants were each 20 m by 10 m, to the east and south of the first quadrant respectively.

The new data collection methodology used during the 2022 field expeditions focused on collecting spatial data and individual artifact data, with each artifact being analyzed for signatures of recycling. Spatial locations of each artifact were recorded using Emlid Reach RS2 multi-band GNSS receivers. Additional artifact data was collected using standardized KoboToolBox forms to record the following data for each artifact:

1. maximum length, maximum width, maximum thickness, and weight;
2. cortex surface percentage and type;
3. attributes relating to determining technology, including platform attributes, flake scar number and direction, and retouch type as suggested by Andrefsky [Andrefsky 2005];

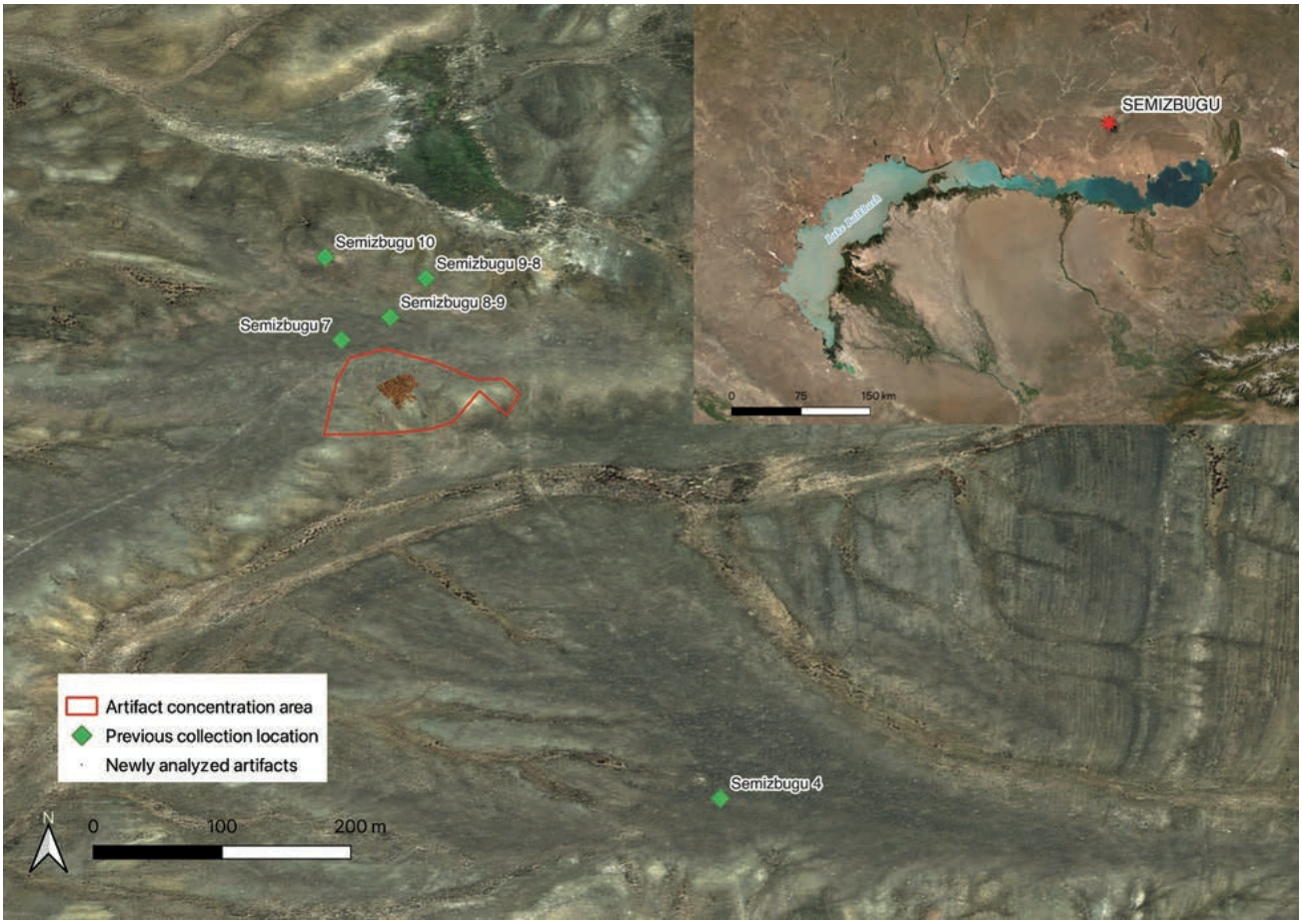

Fig. 2. Location of Semizbugu P1(2022) within the Semizbugu site complex. Projected coordinate system is EPSG 4326 (WGS 84). Data sources: raster map data from Bing and ESRI

2-сур. Семизбугу P1(2022) орналасқан жері Семизбугу нысандары кешенінде. Жобаланған координаттар жүйесі-EPSG 4326 (WGS 84). Дереккөздер: Bing және ESRI растрлық карта деректері

Рис. 2. Местоположение Семизбугу P1(2022) в комплексе объектов Семизбугу. Проектируемая система координат - EPSG 4326 (WGS 84). Источники: данные растровых карт от Bing и ESRI

4. artifact class (i.e. broken flake, complete flake, core, tool) per categories from Phillips and colleagues [Phillips et al. 2017];
5. weathering classes, following those previously described for Semizbugu;
6. signatures of recycling on individual artifacts consistent with previous research on recycling, including:
   a. artifacts with double patina;
   b. artifacts with multiple technological/typological signatures;
   c. flakes with removals on their ventral faces; and
   d. cores used as hammer stones or hammer stones used as cores.

3 Results *(Coco E.)*

In total, 696 artifacts were analyzed from Semizbugu P1 (2022). This means that the density of artifacts in this deposit is approximately 2 artifacts per every square meter. Nearly 20% of the artifacts

had some sort of recycling signature, with the majority being identified as recycled due to the presence of double patinas (fig. 3). That results in a density of one recycled object for every 3 square meters.

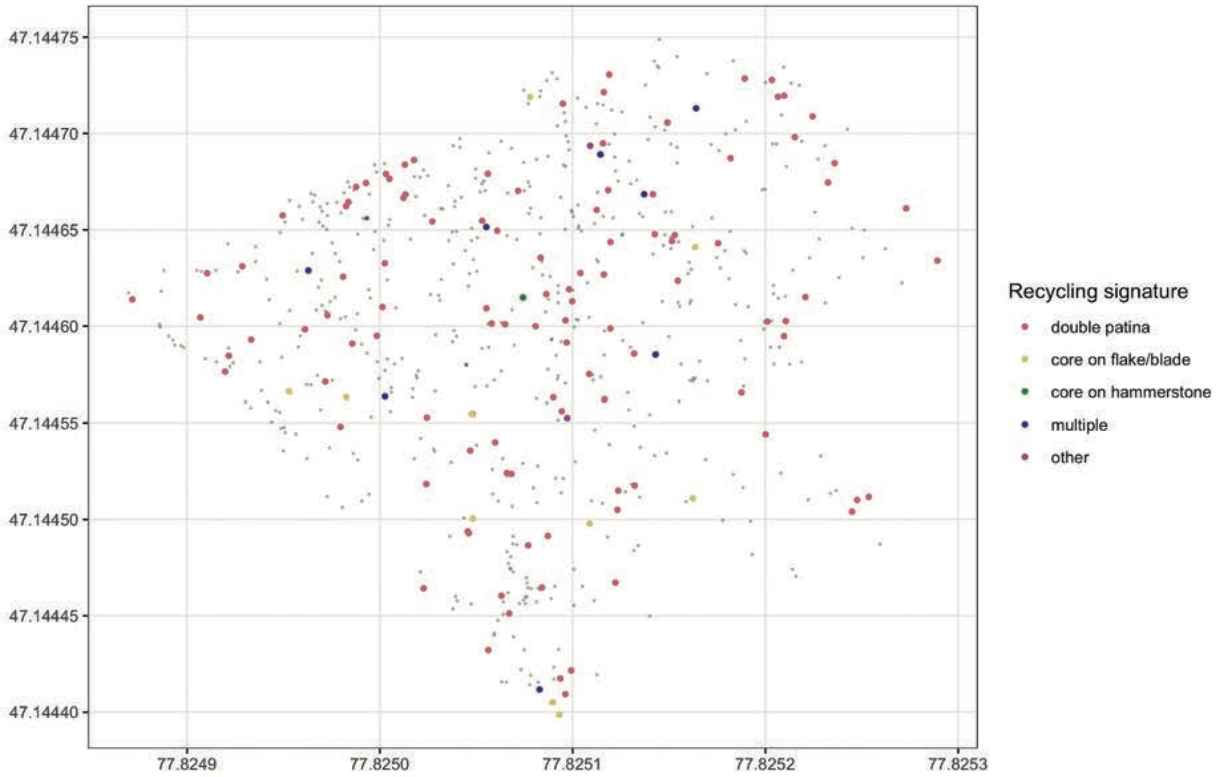

Fig. 3. Scheme of spatial location artifacts analyzed at Semizbugu P1 (2022). Small light grey dots represent artifacts without any recycling signatures. Large, colored dots represent recycled artifacts, with colors corresponding to the type of recycling signature

3-сур. Семизбугу P1 (2022) талданған артефактілердің кеңістіктік орналасу схемасы. Кішкентай ашық сұр нүктелер артефактілерді ешқандай өңдеу белгілері жоқ дегенін көрсетеді. Үлкен түсті нүктелер қайта өңделген артефактілерді білдіреді, олардың түстері қайта өңдеу қолтаңбасының түріне сәйкес келеді

Рис. 3. Схема пространственного расположения артефактов, проанализированных на Семизбугу P1 (2022). Маленькие светло-серые точки представляют артефакты без каких-либо признаков переработки. Большие цветные точки представляют переработанные артефакты, цвета которых соответствуют типу подписи переработки

Nearly 50% of the artifacts found at Semizbugu P1 (2022) are complete flakes, with the next most numerous artifact type being tools (24% of the artifacts). Cores make up a relatively small percentage of the assemblages at just 5.5% of the artifacts.

We investigated whether recycling more frequently occurred on certain types of artifacts (fig. 4a). Artifacts were classified into seven different artifact type categories: complete flakes, broken flakes, cores, core fragments, tools, tool fragments, and shatter. We found that artifacts that are tools are significantly more likely to be recycled. We also looked specifically at what types of tools are more likely to be recycled. When comparing tool types, most tool categories have some sort of recycling signature to varying degrees. Interestingly, none of the broad tool categories (fig. 4b) are significantly more likely to have recycled

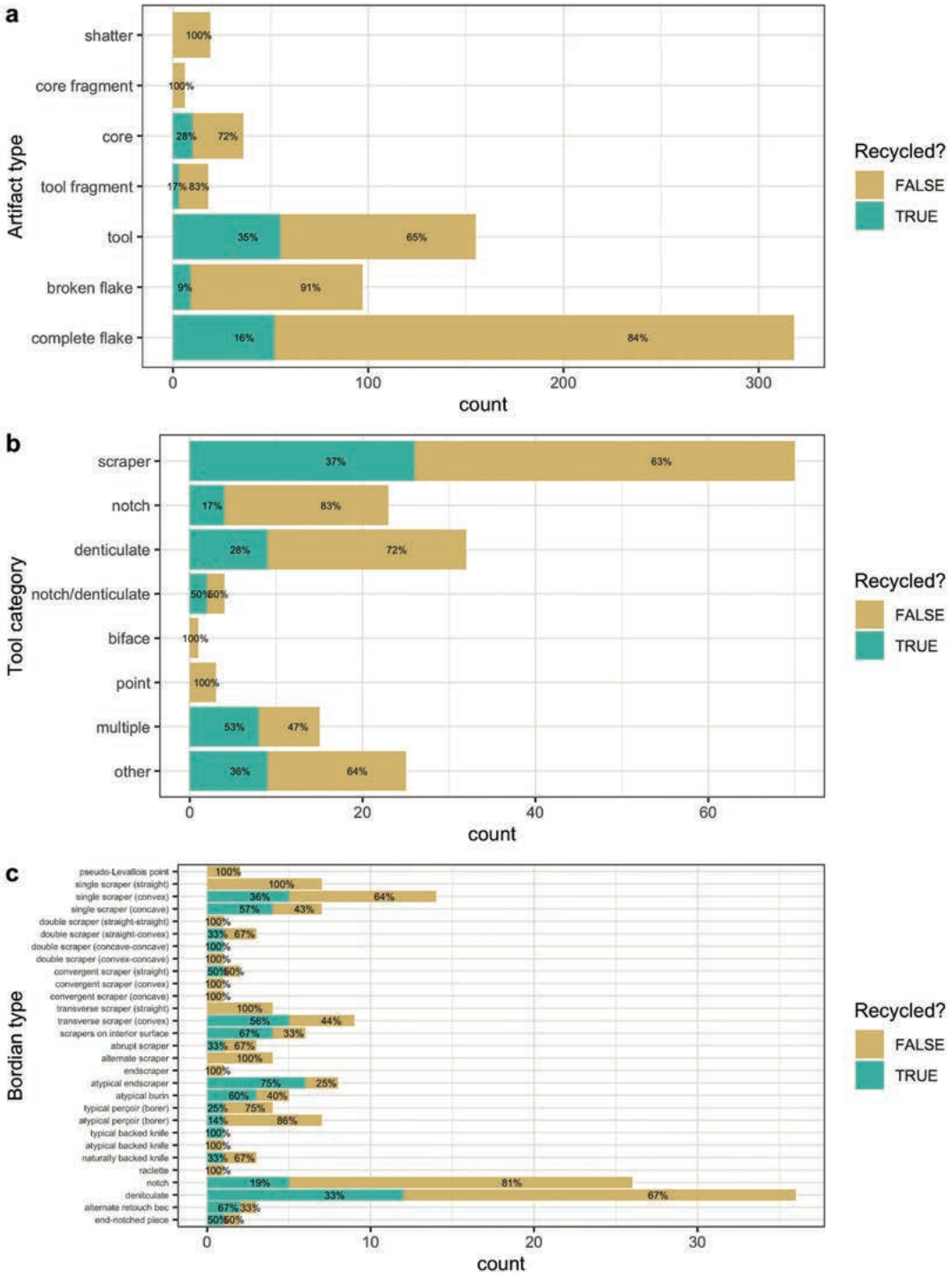

Fig. 4. Number of artifacts by artifact type (a), tool type (b), and Bordian type (c). Percentage of recycled and non-recycled objects given for each category

4-сур. Артефакт түрі (a), қару түрі (b) және «Бордтің түрі-парақ» (c) бойынша артефактілер саны. Әрбір санат үшін келтірілген қайта өңделген және қайта өңделмеген объектілердің пайызы

Рис. 4. Количество артефактов по типу артефактов (a), типу орудий (b) и «Бордовскому тип-листу» (c). Процентпереработанныхинепереработанныхобъектов, приведенныйдлякаждойкатегории

signatures; however, when tools are broken out by Bordian types (fig. 4c), it seems that burins, end scrapers, single scrapers, transverse scrapers, and interior surface scrapers are more likely to have recycling signatures compared to non-tools.

In addition to categorically defining artifacts, we looked at the relationship between recycling and artifact size, as determined by length, width, thickness, and weight. Specifically, we used Kolmogorov-Smirnov tests to compare the distribution of each of the artifact size variables for recycled variables to the overall distribution of these variables for all artifacts. We found significant differences in the distributions of weight, length, and width, but not thickness (fig. 5). Artifacts with recycling signatures are heavier, longer, and wider than the average artifact in this deposit.

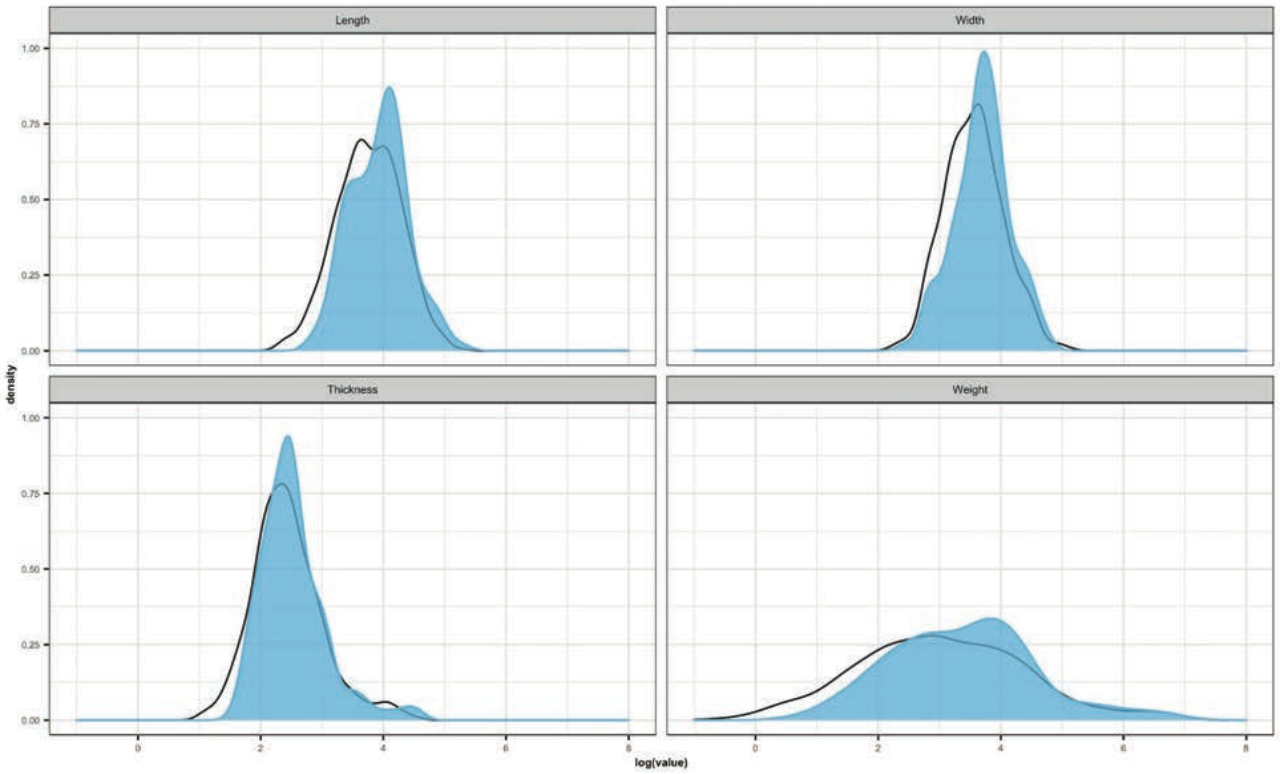

Fig. 5. Core density estimates for distributions of weight, length, width, and thickness of artifacts. Distributions for the entire assemblage shown with black line. Distributions of recycled artifacts shown with blue curve

5-сур. Артефактілердің салмағын, ұзындығын, енін және қалыңдығын бөлу үшін нуклеус тығыздығын бағалау. Бүкіл популяция үшін бөлу қара сызықпен көрсетілген. Қайта өңделген артефактілердің таралуы көк қисықпен көрсетілген

Рис. 5. Оценки плотности нуклеуса для распределений веса, длины, ширины и толщины артефактов. Распределения для всей совокупности показаны черной линией. Распределения переработанных артефактов показаны синей кривой

Finally, we investigated whether recycling signatures were related to weathering stages at Semizbugu P1 (2022) (fig. 6). Using binary logistic regressions, we found that the odds of artifacts having recycling signatures does significantly depend on weathering stage. Specifically, when compared to strongly weathered artifacts, the odds that mildly weathered artifacts have recycling signatures decreases by 58%.

Similarly, the odds that weakly weathered artifacts and unweathered artifacts have recycling signatures are decreased by 22% and 18%, respectively, compared to the odds of strongly weathered artifacts having recycling signatures.

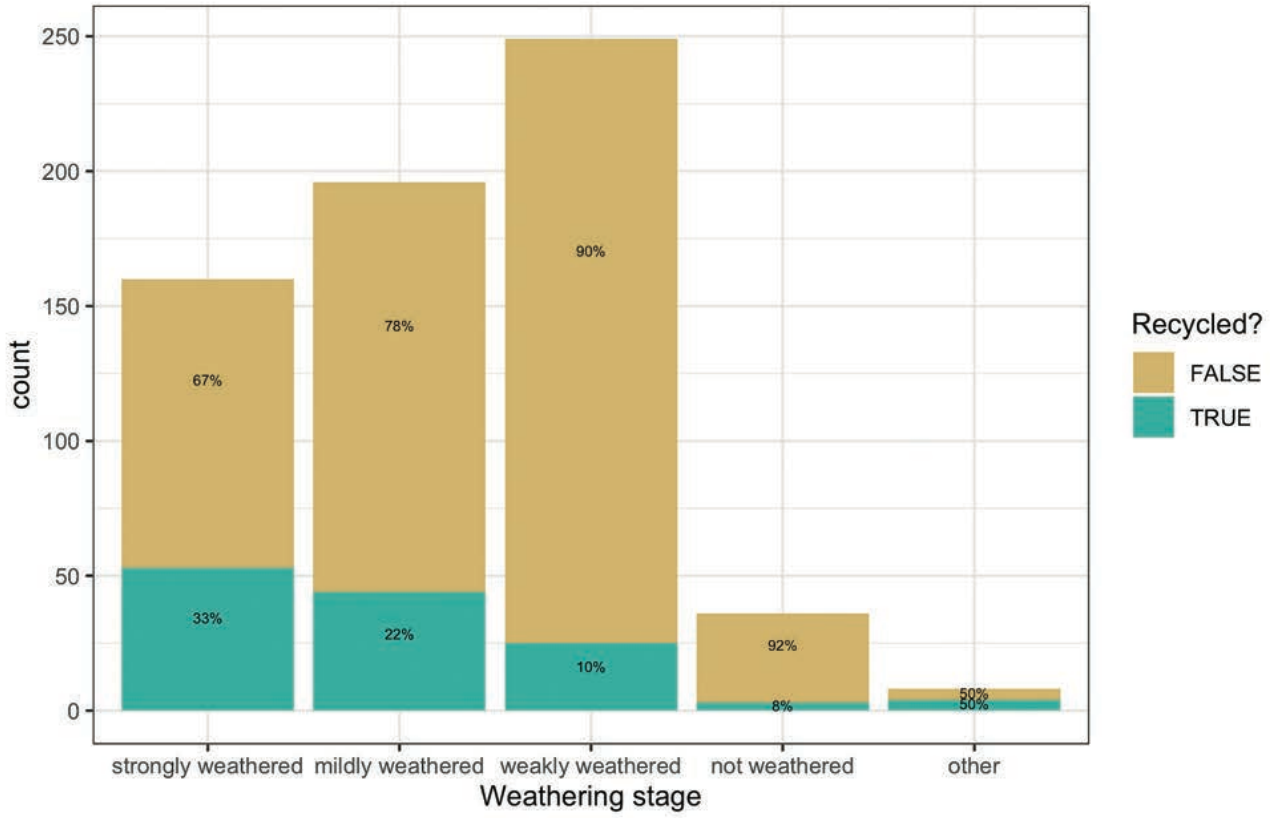

Fig. 6. Number of artifacts by weathering stage. Percentage of recycled and non-recycled objects given for each category

6-сур. Ауа-райының сатылары бойынша артефактілер саны. Әрбір санат үшін көрсетілген қайта өңделген және қайта өңделмеген объектілердің пайыздық арақатынасы

Рис. 6. Количество артефактов по стадиям выветривания. Процентное соотношение переработанных и непереработанных объектов, указанное для каждой категории

4 Discussion and conclusions *(Coco E., Mamirov T.)*

These results from Semizbugu P1 (2022) confirm the presence of recycling behaviors at this Paleolithic site complex. Additionally, the higher likelihood of recycled implements occurring on more weathered artifacts supports the posited relationship between recycling frequency and exposure [Camilli, Ebert 1992]. The results also demonstrate that recycling occurs more frequently on certain types of artifacts, which could indicate preferences when scavenging for recycling material. Selection of specific types of objects for recycling has been noted in stratified cave contexts in Israel [Belfer-Cohen, Bar-Yosef 2015**b**]. However, it is argued that thicker objects are being selected for recycling in these cave contexts, which differs from the patterns at Semizbugu P1 (2022) where thickness of recycled artifacts does not significantly differ from the overall distribution of artifact thickness.

Studying surface deposits like Semizbugu is essential for furthering our understanding of recycling behaviors. Additionally, given the prevalence of surface sites in Kazakhstan, this region is uniquely suited for investigating recycling behaviors in different contexts. This will be invaluable for helping archaeologists to understand possible factors that make recycling more or less likely within a landscape. The recycling of stone tools is a potentially powerful force repeatedly rewriting archaeological patterns throughout history. This project represents an important first step to explore the range of conditions that may promote recycling so we can fully understand how this behavior functioned in the past.

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