

AN ENEOLITHIC INNOVATION FROM SOUTH-EASTERN TRANSYLVANIA. THE ARIUȘD-CUCUTENI CULTURE SICKLE BLADE FROM RUPEA 4-LA MOVILĂ SETTLEMENT (RUPEA, BRAȘOV COUNTY)¹

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1. Introduction.

Among the natural factors that led to the proliferation of the human species around the globe, the climate had the greatest impact, and the Holocene² is the geological period in which the human species experienced an exponential population growth. This increase is due to global warming³, which has led to radical changes - positive from the perspective of human demography - in terms of vegetation, hydrosphere, biosphere, etc. Another important factor that led to the proliferation of the human species is the ability of man to create/innovate/use tools in order to increase the chances of survival and implicitly to increase the chances of perpetuation of the species. The emergence of the agrarian economy 10,000-12,000 years ago in the area east of the Mediterranean Sea⁴, in an area that stretches over a length of about 2,000 km, called *the Fertile Crescent*⁵, is probably the most important consequence of the factors mentioned above. The diffusion of agricultural knowledge and technology⁶, of some

¹ This article is the English edition, with some additions, of the study that was published in „ArheoVest”, VIII, 2020, p. 45-67. I thank Alexandru Kovács for translating this study into English.

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² Holocene is the current geological era, which began approximately 11,700 years ago.

³ Even if from the perspective of temperature the Holocene is a period of net warming compared to the Pleistocene (the period preceding it), within it there are a series of temperature variations (Joos Fortunat, I. Colin Prentice, *A paleo-perspective on changes in atmospheric CO₂ and climate*, în: *Scope*, 62, 2004, p. 172-174, Fig. 7.3) that have had a direct influence on the development or regression of human civilization (Beatrice Ciută, *Cultivarea plantelor în pre- și protoistoria bazinului intracarpatic din România: analize statistice și spațiale efectuate asupra macroresturilor vegetale*, Ed. Altip, Alba-Iulia, 2009,, p. 42).

⁴ Research has led to the conclusion that globally, independently, there were several areas in which agriculture emerged and later spread, in different periods of time, the species of domesticated plants and animals being different (Ciută, *op.cit.*, 2009, p. 50, 57, with the related bibliography; Dorian Q. Fuller, George Willcox, Robin G. Allaby, Cultivation and domestication had multiple origins: arguments against the core area hypothesis for the origins of agriculture in the Near East, în: *World Archaeology*, vol: 43, No: 4, p. 628-652, *passim*). The beginning of agriculture in all these places seems to have been a response to similar needs of human communities (David R. Harris, Gordon C. Hillman, *Foraging and farming: the evolution of plant exploitation*, Ed. Taylor & Francis Ltd., Londra, 1989, p. 12).

⁵ For a brief synthesis on the domestication of the first plants and the theories regarding their dissemination in Europe, see Ciută, *op. cit.*, 2009, p. 56-58, with the related bibliography.

⁶ Recent genetic studies on the *Fertile Crescent* area lead to the conclusion that the dissemination of agricultural ideas and technology has been faster than the displacement of human communities that initially possessed this knowledge (Iosif Lazaridis, Dani Nadel, Gary Rollefson, Deborah C. Merrett, Nadin Rohland, Swapan Mallick,

species of plants and domesticated animals, first to the areas adjacent to the *Fertile Crescent*, later to more distant areas, determined fundamental changes of social behavior⁷ in the human communities that took over, used and perfected these techniques. The economy based on the cultivation and selection of plants in order to increase crop productivity and adapting plants to new soils and climatic factors - a process that continues today - has allowed human communities access to regular food resources in predictable quantities⁸, generating a chain of consequences that led to the emergence of the first civilizations.

Although the technological evolution of the means used to harvest cereals⁹ can be traced in general from the Pre-Pottery Neolithic¹⁰ of the Near East to the modern era, from the simplest tools, such as those that did not involve cutting (simple harvesting sticks¹¹, *mesorias*-type tools¹², scapulae with notches for separating spikes from stems¹³, and others) or those

Daniel Fernandes, Mario Novak, Beatriz Gamarra, Kendra Sirak, Sarah Connell, Kristin Stewardson, Eadaoin Harney, Qiaomei Fu, Gloria Gonzalez-Fortes, Eppie R. Jones, Songül Alpaslan Roodenberg, György Lengyel, Fanny Bocquentin, Boris Gasparian, Janet M. Monge, Michael Gregg, Vered Eshed, Ahuva-Sivan Mizrahi, Christopher Meiklejohn, Fokke Gerritsen, Luminița Bejenaru, Matthias Blüher, Archie Campbell, Gianpiero Cavalleri, David Comas, Philippe Froguel, Edmund Gilbert, Shona M. Kerr, Peter Kovacs, Johannes Krause, Darren Mcgettigan, Michael Merrigan, D. Andrew Merriwether, Seamus O'reilly, Martin B. Richards, Ornella Semino, Michel Shamoon-pour, Gheorghe Ștefănescu, Michael Stumvoll, Anke Tönjes, Antonio Torroni, James F. Wilson, Loic Yengo, Nelli A. Hovhannisyan, Nick Patterson, Ron Pinhasi, David Reich, *Genomic insights into the origin of farming in the ancient Near East*, in: *Nature*, 536, 2016, p. 4).

⁷ We refer to the reduction of the mobility of human communities until their full sedentarization, a behavior that generated over time the emergence of city-states and great ancient civilizations (an analysis of proto-urban settlements for the period between Pre-Pottery and Late Neolithic see in Gheorghe Lazarovici, Cornelia-Magda Lazarovici, *Are there cities and fairs in the neolithic? Part I – from PPN to late Neolithic (Part II is referring to Copper Age)*, in: *Acta Terrae Septemcastrensis*, XVIII, 2019, p. 22-91, *passim*); the emergence of complex rituals and religious beliefs, in close connection with the agrarian economy, which led to the construction of monumental sacred spaces (Adela Kovács, *Temple, sanctuare, altare în Neoliticul și Epoca Cuprului din sud-estul Europei*, Ed. Karl A. Romstorfer Suceava, Suceava, 2016, *passim*); and so on.

⁸ Although at a global level agricultural output has so far been characterized by a high degree of meteorodependence, predictability has been a perpetual concern for human communities, who have tried to compensate for this shortcoming through innovative technologies such as irrigation systems, selection and use of certain varieties of plants with favorable genetic characteristics, or the improvement of techniques of harvesting and storage of crops, and increasingly complex mechanisms of trade.

⁹ In this case we are referring specifically to wheat and barley.

¹⁰ See, for example, Ian Kuijt, Adrian Nigel Goring-Morris, *Foraging, Farming, and Social Complexity in the Pre-Pottery Neolithic of the Southern Levant: A Review and Synthesis*, in: *Journal of World Prehistory*, Vol. 16, No. 4, December 2002, p. 378-380, 386, 399-401, 411-412, 417, and the related bibliography.

¹¹ Without leaving archaeological traces, but attested by ethnographic studies (Patricia C. Anderson, Mondher M'hamdi, *Harvesting of the wild grass alfa (stipa tenacissima L.) by pulling in the high tunisian steppe: an unusual method*, in: *Explaining and exploring diversity in agricultural technology*, Annelou van Gijn, John C. Wihittaker and Patricia C. Anderson Ed., Oxbow Books, 2014, *passim*), the technique of uprooting wild plants using harvesting sticks could have been used by prehistoric agricultural communities.

¹² A tool consisting of two wooden rods, about 50 cm long, tied together at one end with a leather cord, used to separate spikes from stems (Felicia Monah, Dan Monah, *Cercetari arheobotanice in tell-ul calcolitic Poduri-Dealul Ghindaru*, Ed. Constantin Matasă, 2008, Piatra Neamț, p. 188, with related bibliography; Juan José Ibáñez, Ignacio Clemente Conte, Bernard GASSIN, Juan Francisco Gibajas, Jesús González Urquijo, Belén Márquez, Sylvie Philibert, Amelia Rodríguez Rodríguez, *Harvesting technology during the Neolithic in South-West Europe*, in: *Conference: "Prehistoric Technology" 40 years later: Functional Studies and the Russian Legacy At: Verona (Italy) 20-23 April, 2005*, Natural History Museum - University of Verona, Volume: BAR-IS, 1783, British Archaeological Report, 2008, p. 191, Fig. 13; Patricia C. Anderson, *Neolithic Tools Used For Stripping Ears From Hulled Cereals: An update*, in: *Regards croisés sur les outils liés au travail des végétaux. An interdisciplinary focus on plant-working tools*. XXXIIIe rencontres internationales d'archéologie et d'histoire d'Antibes, Sous la direction de p. C. Anderson, C. Cheval et A. Durand, Éditions APDCA, Antibes, 2013 p. 90, with related bibliography).

¹³ Such as the notched scapulae from the neolithic site of Ganj Dareh (Iran), used to separate spikes from stems (Patricia C. Anderson, *op. cit.*, p. 92-97, with related bibliography).

involving cutting (lithic blades/knives, bone sickles, stone sickles), to complex ones (composite sickles with lithic inserts, later sickles made of metal - bronze and iron), and even modern equipment, for prehistoric times one cannot accurately identify the moments when technological leaps were made or various innovations¹⁴ were implemented in various geographical areas. In this context, the identification of any clues of technological innovation in prehistory becomes important, regardless of the field in which it manifested itself (agriculture, transport, living spaces, trade, war, etc.).

The present study aims to introduce into the scientific circuit two lithic artifacts used as inserts of prehistoric (Eneolithic) composite sickles, one of which, based on technical peculiarities and the way of use suggested by traces of wear and polish specific to sickle blades¹⁵, could be an innovation used in the harvesting process, and the second could be an early prototype or an attempt to imitate the first artifact. These were identified on the arable surface that overlaps the fortified Ariuşd-Cucuteni settlement¹⁶, phase A2-A3¹⁷, from Rupea 4 - La Movilă (Fig. 1).

From a geographical point of view, the site from Rupea 4 - La Movilă is located in the north of Braşov County, to the east of Rupea city, and belongs to southeastern Transylvania, being overlapped by arable agricultural land. The area still represents a natural communication node between the Homorod Depression (located to the north), the Hârtibaciu Plateau (located to the west), the Făgăraş Depression (located to the south) and the Bârsa Depression (located to the east), having in the immediate vicinity access to the middle course of the Olt River¹⁸ and the salt resources of the Homorod Depression¹⁹ and the east of the

¹⁴ Innovation: "solving a technical problem or organizing work in order to improve labor productivity" (Dexonline.ro accessed on August 14, 2020).

¹⁵ The repeated contact of the lithic blades with the fibers of the stems of the cereals, whose nervures have a high silicon content, leads to the appearance of a specific polish on the contact areas of the blades, easy to observe at macroscopic level. For a brief familiarization with the subject, see Jacob Vardi, Isaac Gilead, *Keeping the razor sharp: hafting and maintenance of sickles in the southern Levant during the 6th and 5th millennia bc*, în: *Stone Tools in Transition: From Hunter-Gatherers to Farming Societies in the Near East*, F. Borrell, J. J. Ibáñez, M. Molist (eds.), Ed. Universitat Autònoma de Barcelona, Servei de Publicacions, 2013, Barcelona, p. 1716-1717, with the related bibliography.

¹⁶ Geomagnetic research in 2019 (Carsten Mischka, Georg Schafferer, Cornelia-Magda Lazarovici, Gheorghe Lazarovici, Silviu Gridan, *Cercetari geofizice în sud-estul Transilvaniei. Zona Rupea (jud. Braşov)*) corroborated with archaeological materials identified by surface research, lead to the conclusion that in the area of agricultural land called by locals La Movilă there were most likely several prehistoric settlements. One of them is the one in the northeast of the terrace belonging to the Ariuşd-Cucuteni culture, which was fortified with a system formed by defense ditches and palisades (Gheorghe Lazarovici, Cornelia-Magda Lazarovici, Silviu Gridan, *Fotograficiile de la Rupea*, în: *A 53-a sesiune de rapoarte arheologice*, Sibiu, 13-15 septembrie).

¹⁷ The assignment was made based on the analysis of ceramic materials from surface research (Silviu Gridan, *Un nou punct arheologic neolitic în sud-estul Transilvaniei, oraşul Rupea (jud. Braşov)*, în: *ArheoVest*, Nr. II: [Simpozion ArheoVest, Ediția a II-a:] In onoream Gheorghe Lazarovici, Interdisciplinaritate în Arheologie, Timișoara, 6 decembrie 2014, Vol. 1: Arheologie, Vol. 2: Metode Interdisciplinare, Asociația "ArheoVest" Timișoara, JATEPress Kiadó, Szeged, 2014, p. 246, note 11) and the survey conducted in 2018 (Gheorghe Lazarovici, Cornelia-Magda Lazarovici, Silviu Gridan, Olimpia Gridan, Horia Pirău, Constantin Aparaschivei, Mircea Oancă, Claudiu Florian, Cristian Roman, *Cercetări arheologice la Rupea. Campania din 2018*, în: „Acta Terrae Fogarasiensis”, VII, Ed. Negru Vodă, Făgăraş, 2018 p. 35).

¹⁸ "Which in the past ensured a good way of communication with long-distance territories, facilitating material and cultural exchanges" (Silviu Gridan, Claudiu Florian, *Contribuții la cunoașterea neoliticului și eneoliticului din sud-estul Transilvaniei, comuna Homorod (județul Braşov)*, în: *ArheoVest*, Nr. III: [Simpozion ArheoVest, Ediția a III-a:] In Memoriam Florin Medeleț, Interdisciplinaritate în Arheologie și Istorie, Timișoara, 28 noiembrie 2015, p. 21). For example, see Dorel Marc, *Sisteme de transport și de comercializare tradițională a sării*, în: Valeriu Cavruc; Andreea Chiricescu (eds), *Sarea, timpul și omul*, Ed. Angustia, Sfântu Gheorghe, 2006, p. 152-157.

Făgăraș Depression²⁰, particularly important resources for human communities of all times.



Fig. 1. Aerial view of area Rupea 4 - La Movilă with the markings the Cucuteni-Ariuşd settlement and the approximate positions of the defensive ditches (photo Carsten Mischka, modified).

So far, the area called by locals La Movilă has benefited from surface archaeological research - periegesis²¹, geophysical measurements²² - and archaeological surveys²³, the research concluding that an area of about 6 hectares has been occupied/used by human communities belonging to several eras and cultures²⁴; due to the incipient stage of the research, it is not yet possible to establish precisely the cultural affiliation and the relations between the different archeological complexes spread on this surface²⁵.

2. Description of the lithic material.

During the surface research, in addition to the ceramic materials, which are in a state of accentuated fragmentation, which nevertheless allowed the shaping of a general image in terms of archaeological potential and general chronological limits of the site, a number of lithic materials were also identified, specific to both hunter-gatherer communities and farming communities²⁶.

¹⁹ Valerii Kavruk, Maria-Magdalena Ştefan, Dan Buzea, Dan Ştefan, Zsigmond Lóránd Bordi, *O analiză arheologică şi etnografică a rutelor de aprovizionare cu sare din sud-estul Transilvaniei*, în: „Istros”, XXIII, Ed. Istros, Brăila, 2017, p. 381-430, with the related bibliography.

²⁰ Gheorghe Lazarovici, Cornelia-Magda Lazarovici, Silviu Gridan, *Surse de sare şi procesul de neolitizare din S-E Transilvaniei*, în: „Anuarul Muzeului Etnografic al Transilvaniei”, Ed. Argonaut, Cluj-Napoca, 2018, p. 303-319.

²¹ S. Gridan, *op. cit.*, 2014. In 2015 the research was joined by Lucica Olga Savu and Mihaela Cioc from Braşov County History Museum.

²² Mischka *et alii*, *op. cit.*, 2019.

²³ Gh. Lazarovici *et alii*, *op. cit.*, 2018a; Gh. Lazarovici *et alii*, *op. cit.*, 2019.

²⁴ Starting with the Middle Paleolithic, epoch represented by lithic materials (Adrian Doboş, Silviu Gridan, *Recente descoperiri paleolitice în sud-estul Transilvaniei: microzona Rupea – Homorod – Ungra, judeţul Braşov*, în: „Materiale şi Cercetări Arheologice”, Serie Nouă, XIV, 2018, p. 7, 11), continuing with the Neolithic and Copper Age, epochs represented by ceramic and lithic materials belonging to several cultures: Starčevo-Criş, Linear Pottery with musical notes, Precucuteni, Bodrogkeresztúr (S. Gridan, *op. cit.*, 2014, p. 246, note 11), Ariuşd-Cucuteni (*Ibidem*; Gh. Lazarovici *et alii*, *op. cit.*, 2018a, p. 35), and the Iron Age represented by a reduced number of ceramic fragments belonging to the Gáva culture.

²⁵ With the exception of two Ariuşd-Cucuteni houses, identified during the survey conducted in 2018 (Gh. Lazarovici *et alii*, *op. cit.*, 2018a, p. 34-35).

²⁶ We are referring to: strikers/crushers, nuclei, splinters, blades, micro-blades, points, scrapers, whetstones, grinders, polishers, the raw material being diverse. Only a small part of these materials has been mentioned or analyzed in published studies (S. Gridan, *op. cit.*, 2014, p. 248-249, Fig. 8-10; A. Doboş, S. Gridan, *op. cit.*, 2018, p. 8-11, Fig. 4. 1, 8, 9, Fig. 5. 4, 5, 7; Gh. Lazarovici *et alii*, *op. cit.*, 2018a, p. 34, Fig. 15 d, e).

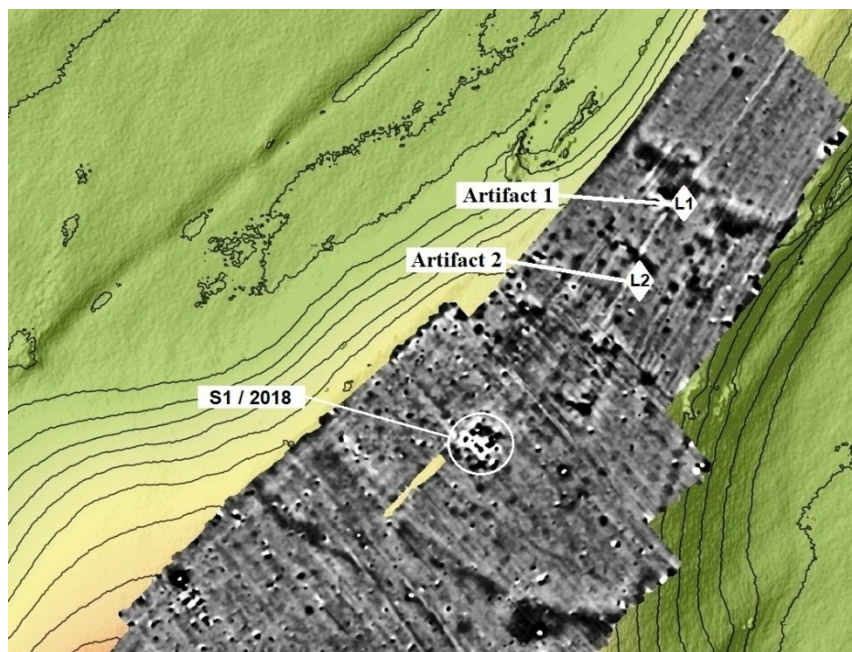


Fig. 2. The positions of the two lithic artifacts and the S1/2018 survey within the Ariuşd-Cucuteni fortified settlement from Rupea 4 - La Movilă (photo Carsten Mischka, 2019, modified²⁷).

The present study will analyze from a typological and functional point of view two small lithic blades that present at macroscopic level some inedite features. Although the two items are not associated with a stratigraphic context²⁸, the indirect information suggests that they most probably belonged to the Ariuşd-Cucuteni community from this settlement, respectively: the presence in their vicinity only of Ariuşd-Cucuteni ceramic fragments and fragments of adobe; the positioning of the items, according to the information provided by the geophysical studies from 2019²⁹, inside the fortified settlement (Fig. 2), in areas with a magnetic response greater than 2 nT and a volume greater than 1 m³; the stratigraphy obtained following the S1/2018 survey, located inside the Ariuşd-Cucuteni fortified settlement (Fig. 2), did not reveal any other levels of dwelling besides that of the Ariuşd-Cucuteni culture³⁰.

2.1 Artifact L1.

The first artifact, which we will call L1 (Fig. 3. a), with dimensions max. length = 32 mm, max. width = 12 mm, max. height = 5 mm, is a tool obtained on a laminar support, median fragment, which has ripples, has an irregular contour, triangular cross section at the proximal end and trapezoidal at the distal end, rectilinear profile and no cortical traces. The left side has direct, fine, continuous marginal unifacial retouches, along its entire length, but also wide direct retouches, which seem to have had the role of diminishing the thickness of the blade on a length of 12 mm in the proximal half and its width on a length of 16 mm in the

²⁷ The image represents a fragment from the magnetogram of the site Rupea 4 - La Movilă made by dr. Carsten Mischka in 2019, posted online by the author at the address: https://www.uf.phil.fau.de/abteilungen/juengere-urgeschichte/projekte-der-juengeren-urgeschichte/diachrone-landschaftsarchaeologie-im-spaetneolithikum-und-in-der-kupferzeit-in-der-moldau-moldova-rumaenien/#rupea_2019_2 (accessed 29.09.2020).

²⁸ The position of the lithic blades on the arable field which overlays the Ariuşd-Cucuteni settlement has been recorded with a GARMIN - *Montana 650t* device, respectively 46°02'15.9"N 25°15'21.9"E for the first artifact (L1) and 46°02'15.2"N 25°15'21.3"E for the second artifact (L2).

²⁹ C. Mischka *et alii*, *op. cit.*, 2019.

³⁰ Gh. Lazarovici *et alii*, *op. cit.*, 2018a, p. 34-35.

distal half. The right side has along its length direct, deep, continuous, steep, denticulated unifacial retouches, and presents at macroscopic level, along its entire length, a polish specific to prolonged use (Fig. 3. a; Fig. 5. a, b).

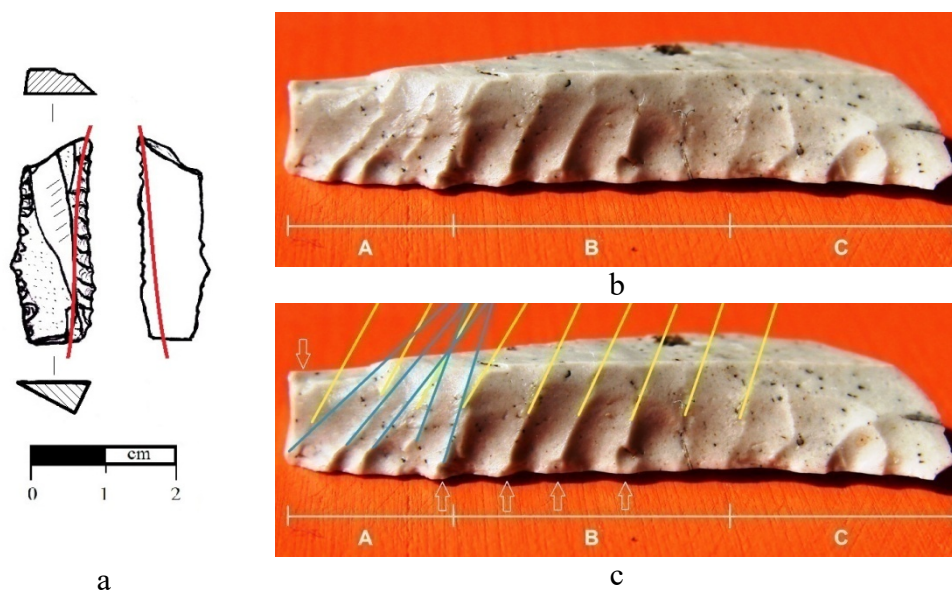


Fig. 3. a. The L1 insert of composite sickle (drawing by Silviu GRIDAN). b. Detail with the serrated side of L1 (photo Silviu Gridan); c. Orientation of the edges of the primary (yellow lines) and secondary stigmas (blue lines), and the irregular splintering caused by use (indicated by arrows).

The raw material from which the artifact was made is an opaque, light gray rock, with black inclusions with dimensions between 0.1 mm and 1.9 mm, present on the entire surface³¹. The type of rock from which the laminar support was cut has not yet been determined by specialized analyzes and for this reason the hardness index of the artifact L1 part has not been determined either³².

The question is whether the polish on the right side of the blade comes from repeated operations on various materials such as leather, wood, bone, horn³³, reeds³⁴ or the use of the blade as an insert of a composite sickle used to harvest cereals³⁵? The answer to this question is suggested by the uniform presence of the polish along the entire length of the blade, both on the dorsal face and on the ventral face (Fig. 3. a, b), the latter face offering better observation

³¹ From the point of view of the raw material, at the level of macroscopic analysis, in the Eneolithic settlement from Șoimuș 2 - Lângă Sat (Hunedoara County), a composite sickle insert with different typological characteristics was reported, made of a similar rock (Mihaela-Maria Barbu, *Industria litică cioplită din aşezarea eneolitică de la Șoimuș 2 – Lângă Sat*, în: „Tyragetia”, Serie Nouă, Vol. VII (XXII), nr. 1, Chişinău, 2013, p. 78-79, Fig. 3. 6a, 6b, 11).

³² The hardness index of the raw material can contribute, besides other factors, to determine the intensity and duration of use of the blade (J. Vardi *et alii*, *op. cit.*, p. 1716-1717, with the related bibliography).

³³ For examples see Diana-Măriuca Vornicu, *Arheologia experimentală ca bază a metodei traseologice. Studiu de caz: utilizarea străpungătoarelor în preistorie*, în: „Buletinul Muzeului Judeţean Teleorman”, Seria Arheologie, 7, 2015, p. 206-208, Fig. 7, 8.

³⁴ J. Vardi *et alii*, *op. cit.*, p. 1717, with the related bibliography; Osamu Maeda, Leilani Lucas, Fabio Silva, Ken-Ichi Tanno, Dorian Q. Fuller, *Narrowing the harvest: Increasing sickle investment and the rise of domesticated cereal agriculture in the Fertile Crescent*, în: „Quaternary Science Reviews”, vol. 145, 2016, p. 229, with the related bibliography.

³⁵ For the problem of correlating the level of wear of the sickle blades based on the quantification of the brightness intensity of the specific polish, see J. Vardi *et alii*, *op. cit.*, p. 1716-1718, with the related bibliography.

conditions for obtaining an answer³⁶.

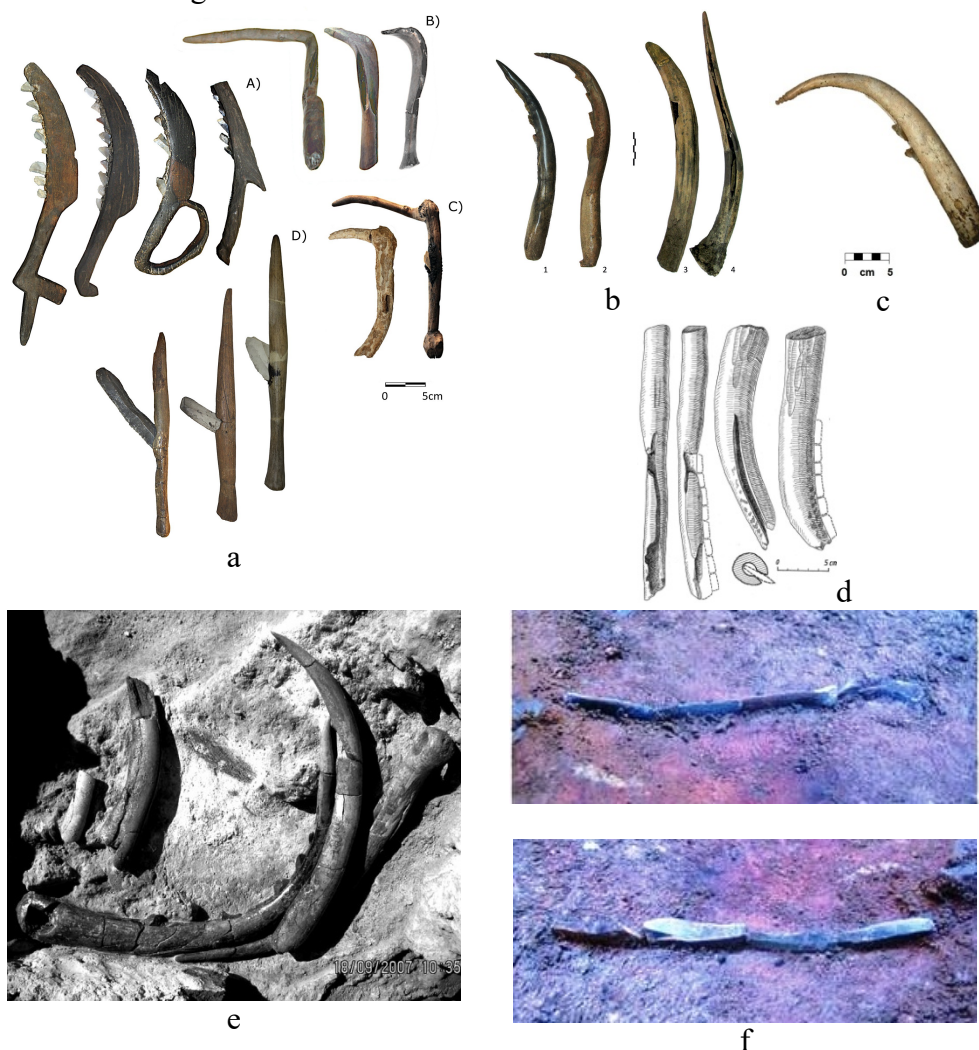


Fig. 4. Examples of composite sickles belongin to the European Neolithic: a. Sickles with wooden supports discovered in settlements in the central and western Mediterranean area (apud Mazzucco *et alii*, 2020³⁷); b. Sickles with deer antler supports from the early Neolithic *tell* from Karanovo (Bulgaria) (apud Gurova, 2016³⁸); c. Sickle with deer antler support from the late Neolithic settlement from the Yasa tepe *tell* (Bulgaria) (image modified apud Valchev, 2015³⁹); d. "Deer antler sickles from the polychrome ceramics phase of the Cârcea culture", Cârcea (Dolj County, România) (apud Cârciumar, 1996⁴⁰); e. A hoard of four antler sickles at the bottom of a grain storage bin - Late Neolithic 1, 5500-5200 BC - from

³⁶ The ventral face of the blade is a rectilinear surface, so the limits of the surface on which the polish can be distinguished are easier to observe and quantify.

³⁷ Niccolò Mazzucco, Juan José Ibáñez, Giacomo Capuzzo, Bernard Gassin, Mario Mineo, Juan Francisco Giaja, *Migration, adaptation, innovation: The spread of Neolithic harvesting technologies in the Mediterranean*, in: PLoS ONE vol. 15 (4), 2020, p. 11, fig. 4.

³⁸ Maria Gurova, *Prehistoric sickles in the collection of the National Museum of Archaeology in Sofia*, in: *Southeast Europe and Anatolia in prehistory, Essays in honor of Vassil Nikolov on his 65th anniversary*, edited by Krum Bacvarov and Ralf Gleser, Ed. dr. Rudolf Habelt GmbH, Bonn 2016, p. 160, Fig. 2.

³⁹ Todor Valchev, *The Horn Sickle from the Prehistoric Settlement Mound Yasa Tepe near tehe Village of Kabile, Yambol Municipality, Bulgaria*, International conference 13-14.03.2015, Skopje, Macedonia, poster. on line: https://www.academia.edu/11664725/The_horn_sickle_from_the_prehistoric_settlement_mound_Yasa_tepe_near_the_village_of_Kabile_Yambol_Municipality_Bulgaria

⁴⁰ Marin Cârciumar, *Paleoetnobotanica. Studii în Preistoria și Protoistoria României (Istoria agriculturii din România)*, Ed. Glasul Bucovinei, Helios, Iași, 1996, p. 132, Fig. 6.

Provadia-Solnitsata (Bulgaria) (apud Nikolov, 2012⁴¹); f. Four eneolithic blades, aligned *in situ*, with the edges containing the polish upwards (Șoimuș - Lângă Sat, Hunedoara County, România) (apud Barbu, 2018⁴²).

Thus, on the ventral face, starting from the edge of the blade towards the longitudinal-median area of the face, the surface on which the polish is present has a width between 0.5 mm and 4 mm, the polish being displayed obliquely to the longitudinal-median line, and the wider part of the polished surface is in the proximal area of the support (Fig. 3. a). These findings lead to the conclusion that the L1 blade was inserted into a support⁴³ which allowed only on a well-defined portion of the blade surface the contact between it and the materials with which it interacted repeatedly, i.e. that portion intended to cut, unprotected by the support, same as in the case of composite sickles produced and used especially in the grain harvesting process (Fig. 4). Such sickles were used by human communities who used various cereal plants as their food source, from the Pre-Pottery Neolithic⁴⁴ in the Middle East (and possibly even earlier⁴⁵), until the Bronze Age when the typology of sickles changed.

Archaeological studies and discoveries have shown that during the harvesting process of cereal plants, composite sickles were used whose support, made of wood or deer antler, had various shapes (linear, curved or in the shape of the letter L) (Fig. 4), in which the lithic inserts that formed the active part of the sickle were placed in two ways: oblique or parallel to the plane of the support⁴⁶.

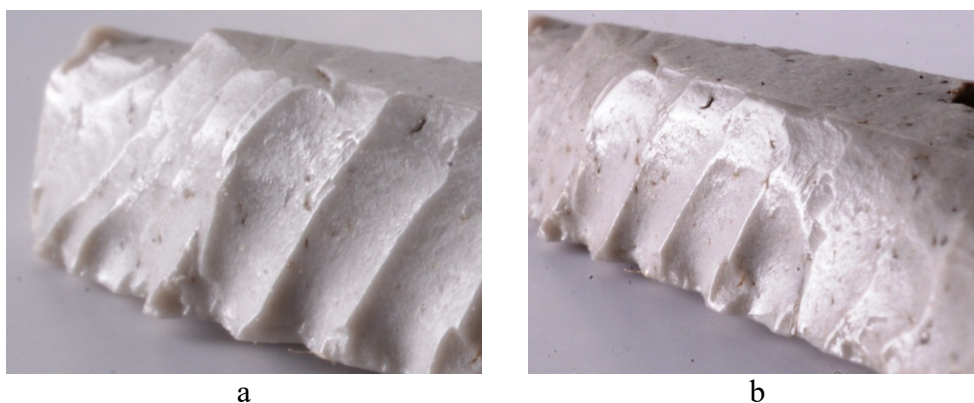


Fig. 5. The specific polish visible at macroscopic level on the dorsal face of the L1 item. **a.** The proximal area; **b.** Middle and distal area (partially visible). (photo Radu POP⁴⁷)

Taking into account all these observations and the fact that within the Cucuteni-Arșișd settlement of Rupea 4 - La Movilă were identified a series of lithic materials specific to cereal

⁴¹ Vassil Nikolov, *Salt, early complex society, urbanization: Provadia-Solnitsata (5500-4200 BC)*, in: V. Nikolov & K. Bacvarov (eds). *Salz und Gold: die Rolle des Salzes im prähistorischen Europa / Salt and Gold: The Role of Salt in Prehistoric Europe*, Ed. Provadia & Veliko Tarnovo, 2012, p. 22, fig. 11.

⁴² Mihaela-Maria Barbu, *About two Eneolithic sickles discovered at Șoimuș - Lângă Sat*, in: Iosif Vasile Ferencz, Oana Tutilă, Nicolae Cătălin Rîșcuța (eds). *Representations, signs and symbols, Proceedings of the Symposium on Life and daily life*, Ed. Mega, Cluj-Napoca, 2018, p. 29, fig. 8. F, G.

⁴³ The small size of the item would hardly have allowed its use other than attached to a support.

⁴⁴ I. Kuijt, A. N. Goring-Morris, *op. cit.*, 2002; Iris Groman-Yaroslavski, Ehud Weiss, Dani Nadel, *Composite sickles and cereal harvesting methods at 23,000-years-old Ohalo II, Israel*, in: PLoS ONE 11(11): e0167151. doi:10.1371/journal.pone.0167151, 2016; Maeda *et alii*, *op. cit.*, 2016, and other studies.

⁴⁵ I. Groman-Yaroslavski *et alii*, *op. cit.*, 2016.

⁴⁶ The position of the lithic inserts in the supports was revealed by the complete discovery of some composite sickles or by observing the specific polish of the inserts whose support was not preserved, discovered, for example, "arranged in a row, with the edges with traces of use upwards" (Mihaela-Maria Barbu, *op. cit.*, 2013, p. 78, 80, Fig. 4. 6,7), or abandoned after use.

⁴⁷ I would like to thank again Mr. Radu Pop for the photographs.

growing communities (crushers, scrubbers and grinders - complete or fragmented⁴⁸), we find that the blade L1 can be considered an insert of a composite sickle, placed obliquely in relation to the plane of the support.

Returning to the way in which the right side of the artifact L1 was processed, one can see that the serration was made by invasive retouching, with long and parallel stigmas, made by pressure. The serrations are on average 4 per cm (Fig. 3. b). The edges of the stigmas of these serrations show at macroscopic level, in addition to the specific polish along their entire length, traces of wear due to repeated contact with cereal plants during the harvesting process, respectively: rounding and flattening (Fig. 3. b, c - sectors A, B, C, Fig. 5. a, b), and some edges show irregular chipping in the contact area with the longitudinal marginal line of the ventral and dorsal surfaces (Fig. 3. c - sectors A, B; Fig. 5. a, b), which indicates the involvement in a dynamic, repetitive and intense/prolonged activity not only of the teeth obtained on the longitudinal edge of the blade following the serration process⁴⁹, but also of the edges of the stigmas of the serrations, resulting in the uniqueness of this item.

Analysis of the angle of inclination of the edges of the stigmas in relation to the longitudinal marginal line of the ventral and dorsal surfaces of the blade (Annex 1) reveals that the first 3 stigmas delimited by the first 4 edges (Fig. 3. b - sector A⁵⁰), were initially made with the same inclination and spacing of the edges as the following 6 stigmas (Fig. 3. b - sectors B, C). Subsequently, most likely due to wear and tear caused by intense/prolonged use of the blade, in a process of restoring the active area of the blade L1, they were superimposed by 4 retouches (Fig. 3. b - sector A⁵¹) with narrower stigmas and made at a different angle than the following 6 stigmas, on which no secondary intervention was performed. One can also observe that the edges of the secondary retouches show signs of accentuated wear, in the upper area, on two thirds of their length (Fig. 5. a), which indicates the use of the insert L1 after the "resharpening" of the proximal area.

2.2 Artifact L2

The second artifact, which we will call L2 (Fig. 6), with the dimensions max. length = 37.5 mm, max. width = 13.7 mm, max. height = 5.9 mm, is a tool obtained on a laminar support, median fragment, which has ripples, has an irregular contour, towards the proximal and distal ends triangular cross sections, and the profile is double-curved due to accidents present in the rock structure, in the form of visible hollows both on the ventral face and on the dorsal face of the item (Fig. 6. a).

The dorsal surface has irregular detachments and no cortical marks. The raw material from which the support was cut is a translucent flint, with alternating brown and white color, in the brown areas of the item being visible at macroscopic level small white spots. The hardness index of the L2 artifact has not been determined yet by specialized analyzes. At macroscopic level, on the left side, one can see the polish specific to intense/prolonged use, arranged bifacially, on two thirds of the length of the side. On the ventral face the surface

⁴⁸ S. Gridan, *op. cit.*, 2014, p. 248, and others.

⁴⁹ In fact, "*the technological operation of cutting the stems of agricultural plants, in order to harvest, consists in destroying the continuity of fibers, respectively their sectioning*" (Gelu Nițu, *Cercetări privind optimizarea procesului de lucru pentru tăierea tulpinilor plantelor agricole la momentul recoltării*, Teză de doctorat, Universitatea de Științe Agricole și Medicină Veterinară "Ion Ionescu de la Brad" din Iași, Facultatea de Agricultură, Școala Doctorală de Științe Inginerești, Domeniul Agronomie, Specializarea: Mecanizarea Agriculturii, Iași, 2020, p. 17), the force necessary to section the fibers, and implicitly the energy consumed, being positively influenced by reducing the contact surface between the cutting edge and the plant (Gelu Nițu, *op. cit.*, p. 59), this being the purpose of serrating the L1 artifact. However, this process inevitably leads to a faster wear of the cutting edge (Gelu Nițu, *op. cit.*, p. 59).

⁵⁰ This is visible in the upper half of the serrated area.

⁵¹ This is visible in the lower half of the serrated area.

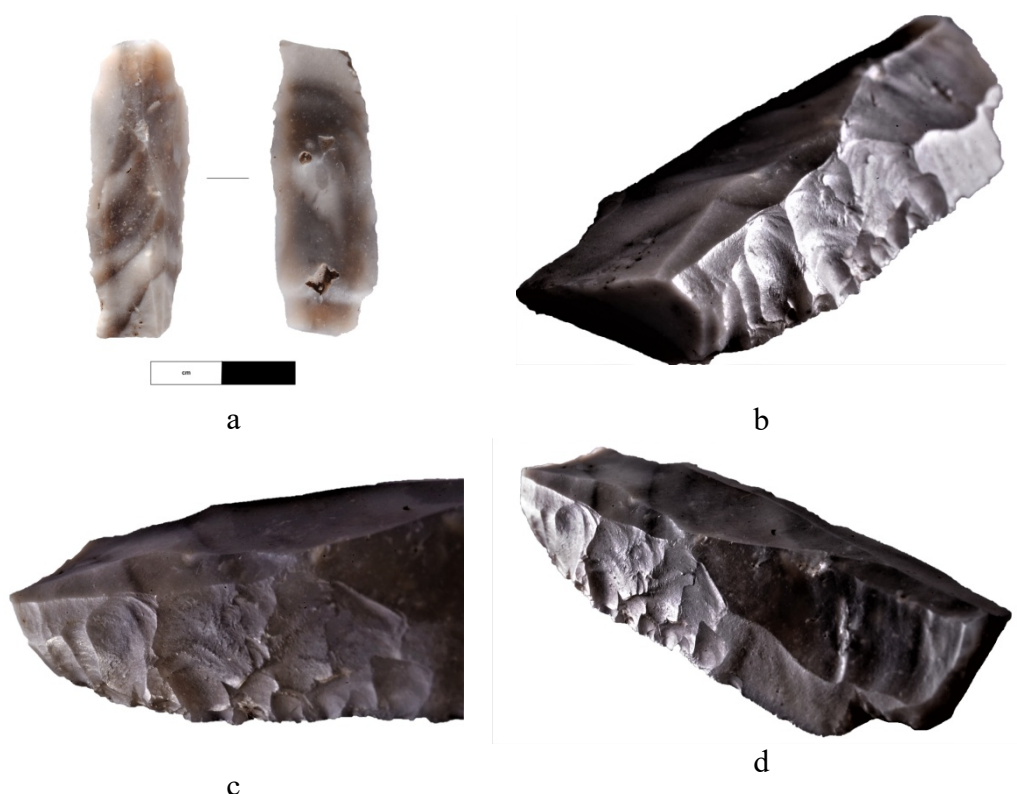


Fig. 6. a. The L2 insert of composite sickle; b-d. Details of the retouches on the left edge (photos Radu POP; graphic processing Silviu Gridan).

on which, the polish is present has a maximum width between the edge of the blade and the longitudinal-median area of the item of 5.2 mm, the inner edge of the surface on which the polish can be distinguished being oblique to the longitudinal-median line (Fig. 6. a). Based on the macroscopic observations and the arguments used in the case of item L1, we can consider that item L2 was used as an insert of a composite sickle, positioned obliquely to the sickle support. The right side has fine, direct, unifacial retouching in the medial and distal area of the blade. On the left side, the one with specific polish, the retouching process was more accentuated. Thus in the medial and distal area there are direct, abrupt, invasive unifacial retouches (Fig. 6. b-d). Their stigmas reveal that the process was performed successively from the distal area to the medial area (Fig. 6. b-d). The edges of the first two stigmas are long, parallel, narrow, equal in width, made by pressure, being perpendicular to the longitudinal marginal line of the ventral and dorsal surfaces (Fig. 6. b). The following stigmas keep the orientation perpendicular to the longitudinal marginal line of the ventral and dorsal surfaces, being wide, also made by pressure. Their appearance is irregular due to the physical properties of the raw material from which the laminar support was made, which led to random chipping (Fig. 6. c, d). The processing of the left side of the laminar support was superficially invasive.

3. Discussions and some conclusions

3.1 Cultivation and harvesting of cereal plants in the local prehistory

The contextualization of the use of composite sickle inserts in the geographical area to which the Ariuşd settlement from Rupea 4 - La Movilă belongs, in relation to the periods preceding this culture, but also to the immediately following period, could outline the general framework in which the two lithic inserts (L1, L2) were produced and used. Thus, published studies and archaeological reports have shown that in the current territory of Romania⁵², as in all areas where cereal plants have been cultivated, lithic inserts of composite sickles, made of a wide variety of rocks, having different sizes and typologies, represent a widespread category in Neolithic and Eneolithic settlements. The way in which these lithic inserts were produced and used was closely related to the characteristics of the cultivated plants that required the finding of practical solutions to limit crop losses. The oldest material evidence regarding the cultivation of cereal plants on the current territory of Romania comes from the early Neolithic settlements of the Starčevo-Criş culture. Most of them are indirect evidence, such as composite sickles with deer antler support⁵³, grinders and flint blades with specific polish⁵⁴, but also some direct evidence, respectively archaeobotanical clues represented by traces of seeds preserved in the ceramic remains of some pots or even seeds of some species of wheat⁵⁵, barley and others. In the period following the Starčevo-Criş culture, it is assumed that the evolution of the plant cultivation process took place with variable intensity until the end of the Neolithic era, depending on local development and influences and contacts with other neighboring communities⁵⁶. According to specialized studies, it is estimated that the cereals grown preponderantly in the Neolithic period on the current territory of Romania are wheat species *Triticum monococcum*, *Triticum dicoccum*, and *Triticum aestivum*, and barley species *Hordeum vulgare nudum*⁵⁷. For the period of the late Neolithic and Eneolithic in the intracarpethian area we have relatively little archaeobotanical data. The available data on wheat species belonging to the cultural levels Zau, Petreşti and Bodrogkeresztúr (phases II and III) reveal the cultivation mainly of *Triticum monococcum*, followed by *Triticum dicoccum*, the two wheat species being cultivated together or separately⁵⁸. For the same period, in the eastern part of the Eastern Carpathians, near southeastern Transylvania, the archaeobotanical study carried out on plant macro-remains from the chalcolithic *tell* from Poduri-Dealul Ghindaru (Bacău County) revealed the presence of wheat species *Triticum aestivum* and *Triticum dicoccum*, but also the barley species *Hordeum vulgare*, in addition to other plant species⁵⁹. The authors of the study managed to outline an eloquent picture for the

⁵² Due to the geographical location and cultural affiliation of the Ariuşd-Cucuteni settlement Rupea 4 - La Movilă, the present study covers the information on the intra-Carpathian and extra-Carpathian areas of Romania occupied by the Ariuşd-Cucuteni communities. For details see Sándor József Sztáncsuj, *Grupul cultural Ariuşd pe teritoriul Transilvaniei*, Editura Mega, Cluj-Napoca, 2015, p. 108-110, 355, Map 2.

⁵³ Such as those from Valea Răii (Vâlcea County) and Cârcea (Dolj County) (Marin Cârciumar, *Paleoetnobotanica. Studii în Preistoria şi Protoistoria României (Istoria agriculturii din România)*, Ed. Glasul Bucovinei, Helios, Iaşi, 1996, p. 132, Fig. 6; B. Ciută, *op. cit.*, 2009, p. 75).

⁵⁴ A good example is the settlement from Gura Baciului, where there are several grinders in dwellings, as well as blades with specific polish (Gheorghe Lazarovici, Zoia Maxim, *Gura Baciului. Monografie arheologică*, Cluj Napoca, 1995, p. 158, fig. 16/7-9, 11, p. 159, p. 164, fig. 15/12, 15, 25). Sickle blades with specific polish have been discovered in other early Neolithic settlements, too (B. Ciută, *op. cit.*, p. 75, with the related bibliography).

⁵⁵ For example, seeds of the *triticum monococcum* wheat species in the settlements from Glăvăneştii Vechi and Hărman or seeds of the *triticum dicoccum* and *triticum spelta* wheat species in the settlement from Hărman (M. Cârciumar, *op. cit.*, 1996, p. 133).

⁵⁶ B. Ciută, *op. cit.*, p. 79.

⁵⁷ Gheorghe Lazarovici, *Gornea-Preistorie*, Caiete Banatica 5, Seria Arheologie, Reşiţa, 1977, p. 106; M. Cârciumar, *op. cit.*, 1996, p. 132-134.

⁵⁸ B. Ciută, *op. cit.*, 2009, p. 102.

⁵⁹ F. Monah, D. Monah, *op. cit.*, 2008, *passim*.

Precucuteni III, Cucuteni A and Cucuteni B phases⁶⁰, considering, based on the small number of blades with specific polish (reserved opinions, due to unfinished research), that the inhabitants of the *tell* did not widely use sickles with flint blades (composite sickles), most likely practicing mainly the harvesting of cereal stalks by plucking⁶¹. At the end of the Eneolithic and during the early Bronze Age, for the intracarpethian area, it was found that due to the cooling of the climate⁶², the forests regained ground to the detriment of areas cultivated with plants, the cultivation of cereals registering a regression⁶³. The wheat species mainly cultivated by the bearers of the Coțofeni culture, who occupied the intracarpethian basin during this period, were species resistant to drought and low temperatures: *Triticum monococcum* and *Triticum dicoccum*⁶⁴.

The lack of in-depth interdisciplinary studies for the geographical and cultural area considered only allows the issuance of hypotheses regarding the cereal harvesting process. If in the early Neolithic the spread of cereal crops was certainly accompanied by the import of cultivation, harvesting and storage technologies associated with them⁶⁵, later these technologies probably diversified by adapting to local geo-climatic factors (soils, humidity, temperature, etc.) under the influence of the local innovation process or of new technological imports due to migrations or cultural contacts with the neighboring areas⁶⁶. Some hypotheses regarding the possible harvesting method have been advanced according to the characteristics of mature cereal plants of species whose archaeobotanical remains have been discovered in some settlements, the determination of weeding of crops, the presence or absence of lithic inserts from composite sickles in these settlements or in other settlements with inventory specific to cereal-growing communities (grinders, scrubbers, crushers, coulter, etc.), respectively harvesting by cutting with composite sickles⁶⁷; harvesting by uprooting the plants (then transporting the sheaves in the settlement and detaching the grains from the ears by threshing)⁶⁸; harvesting by plucking the ears⁶⁹; harvesting by cutting with composite sickles which, depending on the characteristics of the soil, also led to the uprooting of a large number of plants (then transporting the sheaves in the settlement, exposure to the sun for complete ripening of the ears and threshing for the release of seeds)⁷⁰.

Interdisciplinary studies, experimental archeology, ethnographic and ethnobotanical studies have validated and/or detailed the existence of such harvesting methods or have highlighted the simultaneity of different methods within a community, in various parts of the world, including the intra-Carpathian area of Romania. For example, one of the ethnographic and ethnobotanical studies carried out in the sub-mountainous area of Transylvania recorded the processes of cultivation and harvesting by pre-industrial methods of the species of wheat *einkorn* (*triticum monococcum*)⁷¹, a species present in the geographical area of Transylvania

⁶⁰ *Ibidem*, p. 190.

⁶¹ *Ibidem*, 2008, p. 187.

⁶² During the period 6000-5000 BP there is a decrease in average annual temperatures (B. Ciută, *op. cit.*, 2009, p. 94, p. 158, fig. 15).

⁶³ M. Cărciumaru, *op. cit.*, 1996, p. 138.

⁶⁴ B. Ciută, *op. cit.*, 2009, p. 95.

⁶⁵ Ibáñez *et alii*, 2008, p. 183.

⁶⁶ The process must have been similar to the one found in the mediterranean european area (N. Mazzucco *et alii*, *op. cit.*, 2020, p. 19).

⁶⁷ Gh. Lazarovici, *op. cit.*, 1977, p. 106.

⁶⁸ Eugen Comșa, *Neoliticul pe teritoriul României. Considerații*, Ed. Academiei Republicii Socialiste România, București, 1987, p. 75.

⁶⁹ M. Cărciumaru, *op. cit.*, 1996, p. 134; F. Monah, D. Monah, *op. cit.*, 2008, p. 187.

⁷⁰ Sabin Adrian Luca, *Liubcova-Ornița. Monografie arheologică*, Ed. Macarie, Târgoviște, 1998 1998, p. 94.

⁷¹ Mária Hajnalová, Dagmar Dreslerová, *Ethnobotany of einkorn and emmer in Romania and Slovakia: towards interpretation of archaeological evidence*, în: „Památky Archeologické”, CI / 2010, Praha, p. 171-187.

since the early Neolithic⁷². Thus, the following were revealed: the existence of a multiple process of manual weeding of the crop in order to maintain a high purity of the harvested seeds⁷³; harvesting with iron sickles with a serrated or straight blade, which in some cases also led to the tendency of uprooting the plants during this process⁷⁴; transporting the sheaves in the settlement; after complete drying, the ears were separated from the straw and left to dry completely for a few days, then the seeds were released from the ears by beating with a wooden tool⁷⁵.

The process of harvesting with composite sickles, compared to the harvesting by uprooting of plants or ears, allowed faster harvesting of cereals. This method was appropriate when the cultivated areas were extensive and had to be harvested in a short period of time, especially in environments that were dry during the harvest season⁷⁶. Determining the varieties of cereal plants grown in local prehistory, and thus the characteristics of these plants at harvest⁷⁷, can help us understand which of the harvesting methods could be more efficient, and the causal relationship for choosing a specific type of tool/harvesting method with advantageous characteristics over the harvested variety⁷⁸. In the case of composite sickles, experimental archeology studies have shown that the arrangement of the lithic inserts obliquely on the support, as is the case of the two inserts from Rupea 4 - La Movilă, increased the harvesting speed compared to the use of sickles with parallel inserts⁷⁹. This arrangement also seems to allow for a deeper cutting capacity, and therefore this advantage could have been useful in the case of low-density crops⁸⁰ or if the ripening of the plants, influenced by variety or climate, was rapid⁸¹. Regarding the serration, it was observed that sickle blades with unmodified or finely serrated edges cut more efficiently in high-density cereal fields, compared to coarsely serrated sickle blades, especially in the case of monocultures (either wheat or barley)⁸². Archaeologically and ethnographically, however, it was found that these advantages, highlighted experimentally, did not exclude the simultaneous use in some settlements of typologically differentiated sickles⁸³.

⁷² For example see the case of Hărman, Braşov County (M. Cărciumaru, *op. cit.*, 1996, p. 58).

⁷³ M. Hajnalová, D. Dreslerová, *op. cit.*, 2009, p. 176-178, 180, Fig. 9, 12, 14.

⁷⁴ *Ibidem*, p. 177, fig. 10, nota 24.

⁷⁵ *Ibidem*, p. 178, 188-181, fig. 14, 17.

⁷⁶ Ibáñez *et alii*, *op. cit.*, 2008, p. 191.

⁷⁷ Characteristics such as: resistance to breaking/cutting of stems, resistance to shaking of the seeds from the ears when ripe, etc. For the characteristics of some wheat varieties, see B. Ciută, *op. cit.*, 2009, p. 82, p. 86-87, p. 95, and other studies.

⁷⁸ Some studies have shown that the cultural option could also have played an important role in choosing the methods and means of harvesting (for example see Ibáñez *et alii*, *op. cit.*, 2008, p. 191-193).

⁷⁹ Todor Valchev, the horn sickle from the prehistoric settlement mound yasa tepe near tehe village of kabile, yambol municipality, bulgaria, International conference 13-14.03.2015, Skopje, Macedonia, Mihaela-Maria Barbu, Marius-Gheorghe Barbu, *Date experimentale privind utilizarea secerilor preistorice din piatră cioplită*, în: *ArheoVest*, Nr. IV: *In Honorem Adrian BEJAN, Interdisciplinaritate în Arheologie şi Istorie*, Timişoara, 26 noiembrie 2016, Vol. 1: *Arheologie*, Vol. 2: *Metode Interdisciplinare şi Istorie*, Universitatea de Vest din Timişoara, JATEPress Kiadó, Szeged, 2016, p. 546-547; and other studies.

⁸⁰ Ibáñez *et alii*, *op. cit.*, 2008, 2008, p. 192.

⁸¹ *Ibidem*, p. 191.

⁸² Jacob Vardi, Isaac Gilead, *Keeping the razor sharp: hafting and maintenance of sickles in the southern Levant during the 6th and 5th millennia bc*, în: *Stone Tools in Transition: From Hunter-Gatherers to Farming Societies in the Near East*, F. Borrell, J. J. Ibáñez, M. Molist (eds.), Ed. Universitat Autònoma de Barcelona, Servei de Publicacions, 2013, Barcelona, p. 389, with related bibliography.

⁸³ For example, see: M.-M. Barbu, M.-G. Barbu, *op. cit.*, 2016, p. 548; Hajnalová, Dreslerová, *op. cit.*, 2009, p. 177; and other studies.

3.2 The Ariuşd-Cucuteni culture sickle blades from Rupea 4 - La Movilă

For certain geographical areas and periods of time, it was possible to observe typological evolutions of the lithic inserts of composite sickles⁸⁴, and even possible standardizations of them⁸⁵. In the case of lithic materials from Rupea 4 - La Movilă, due to the small number of items with common typological characteristics, such an analysis cannot be performed yet, but some characteristics of the L1 and L2 artifacts suggest a concern for obtaining different inserts compared to those discovered in almost every Ariuşd-Cucuteni settlement researched in Transylvania⁸⁶. The two inserts have some common features, such as: small size⁸⁷; they are fixed obliquely in relation to the sickle support; retouched active edges (L1 - finely serrated⁸⁸, L2 - finely retouched); high active lateral front, related to the dimensions of the items, defined by the presence of the specific polish on the dorsal face (L1 – max. height = 5 mm; L2 – max. height = 5.1 mm); the end where one can see macroscopically on the ventral face the widest area with specific polish, presents on the dorsal face abrupt, invasive retouches, made by pressure, whose stigmas are long and narrow, parallel, with a high degree of wear (on item L1 in this area there are also secondary retouches with traces of wear). Other characteristics differentiate the two items, such as the different raw material from which the two artifacts were cut, which suggests the possible lack of concern for selecting a certain type of raw material or the lack of this option due to limited access to good quality lithic resources.

The presence of specific polish on the entire surface of the front occupied by the stigmas of the serrations and their edges on the right side of the L1 blade, as well as the wear of the primary and secondary edges of these stigmas (Fig. 6. a, b), indicates the intentionality of the serration and of the blade positioning in the support of the sickle so that the edges of the stigmas are not "residues" of the serration process, but so that they contribute to the realization of a composite sickle insert with superior properties. The fact that the artifact L1 was "resharpened" in a manner similar to that in which the initial serration was performed suggests that the user of the sickle appreciated the qualities offered by this technology involving the edges of the stigmas in the process of cutting cereal stems. These qualities could have been represented by a high productivity, wear resistance, both advantages or other that the user could have preferred. This manner of serration, certainly time consuming, could only be performed by the experienced hand of craftsmen, which the Ariuşd-Cucuteni communities were not lacking⁸⁹.

⁸⁴ I. Kuijt, A. N. Goring-Morris, *op. cit.*, 2002; J. Vardi, I. Gilead, *op. cit.*, 2013; Maeda *et alii*, *op. cit.*, 2016; Mazzucco *et alii*, *op. cit.*, 2020; and other studies.

⁸⁵ For example, see J. Vardi, I. Gilead, 2013, p. 388.

⁸⁶ J. Sztáncsuj, *op. cit.*, 2015, p. 219, 360, 361, pl. III/1; IV/3, 15, 17, and others.

⁸⁷ The small size of the two items undoubtedly required efficient methods/materials of fixing/sticking in the support of the sickle (J. Vardi, I. Gilead, *op. cit.*, 2013, p. 388).

⁸⁸ According to some opinions, serrated edges may be more suitable for cutting dry grain stalks (Ibáñez *et alii*, *op. cit.*, 2008, p. 192).

⁸⁹ The presence in the Ariuşd communities of arrowheads, bifacially processed on blades or chips, by wide, steep retouching (Sándor József Sztáncsuj, Katalin T. Biró, Zsolt Kasztovszky, Sándor Józsa, Katalin Gmélíng, Boglárka Maróti, *Lithic implements at Ariuşd (Erősd) a preliminary report*, in: *Communicationes Archaeologicae Hungariae* 2014, Ed. Magyar Nemzeti Múzeum, Budapest, 2015, p. 22-23, Fig. 3. 1-6; S. J. Sztáncsuj, *op. cit.*, 2015, p. 199, p. 366, pl. IX/20, pl. XIV/15–24, 42, pl. XVII/2–5, pl. XVIII/19, Fig. 79; Gh. Lazarovici *et alii*, *op. cit.*, 2018a, p. 34, Fig. 15. d, and other studies), whose finishing is exceptional (Sztáncsuj *et alii*, *op. cit.*, 2014, p. 22), certifies the existence of craftsmen capable of performing such operations. The small number of these arrowheads identified in the Ariuşd settlements in Transylvania, only 36 specimens (Sztáncsuj, *op. cit.*, 2015, p. 199), could suggest a small number of craftsmen able to produce them. In fact, the small number of systematic archeological researches in the area of this culture can offer a more plausible explanation, if we take into account that from the settlement of Rupea 4 - La Movilă alone come four such

Without knowing if the intention of the craftsman who made the L2 artifact was to obtain the serration of the active side, as the first two stigmas suggest, we can see that the stigmas of the retouches could have been similar to those of the L1 artifact, but with a different angle with respect to the longitudinal marginal line of the ventral and dorsal surfaces, if the raw material from which the item was made would have allowed this (Fig. 6. b-d).

Making a tool (L1) with an active front similar to that of the serrated iron blade sickles⁹⁰ (Fig. 7), with an inclination of the "teeth" close to that of industrially produced sickles⁹¹ (Annex 1), and a tool similar in some respects (L2), which could represent an incipient prototype or an attempt to imitate the first tool, may represent the projection of a local innovation process of cereals plant harvesting technology. Innovations could be the result of spontaneous thoughts, or the result of laborious trials. Regardless of how that new knowledge was reached, in order to be used and perpetuated, innovations had to generate benefits for those who put them into practice and used them. In the case of sickles with lithic inserts, an advantage could have been considered the increase of the harvested areas for a certain time interval (hours or days) so as to avoid the loss of seeds by falling to the ground due to the natural ripening process; avoiding the loss of seeds by shaking the plants during the process of cutting with a sickle; improving tool ergonomics; and so on. But even in the case of net advantages offered by an innovation, its use and perpetuation could have been hindered by certain factors. For example: lack of specialized craftsmen able to put the innovations into practice; too much time needed to implement the innovation; lack of raw materials with special physico-chemical characteristics, their existence in insufficient quantities, or difficulties in purchasing them; the degree of conservatism of the community; the disappearance of the problem that the innovation solves (e.g.: the replacement of the cultivated wheat species); and so on.

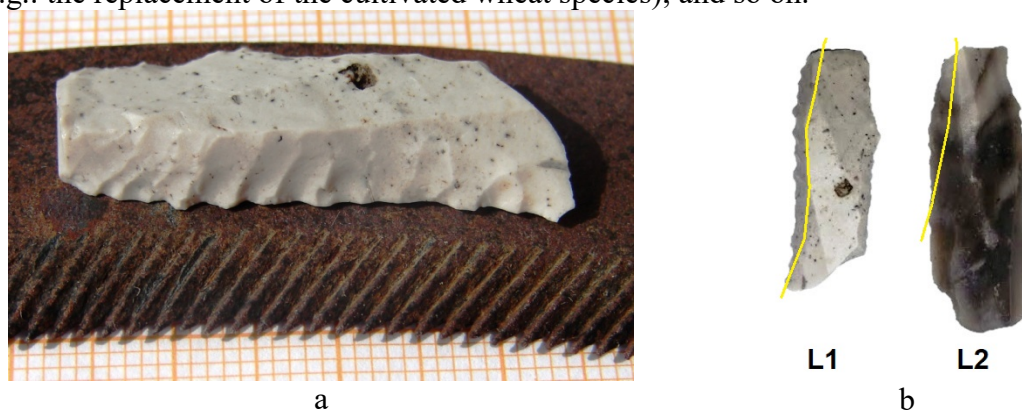


Fig. 7. a. Artifact L1 and the fragment of sector measured from the serrated iron blade of a modern sickle (photo Silviu Gridan); b. Artifacts L1 and L2 adjoined, positioned with the active side facing left (photo Silviu Gridan).

arrowheads: three specimens from surface research and one from the survey S1/2018 (Gh. Lazarovici *et alii*, *op. cit.*, 2018a, p. 34, Fig. 15. d).

⁹⁰ The serrated metal blade sickle, according to indirect archaeological evidence and ethnographic studies, has been used by some farming communities since the Roman Age and the Hellenistic Period, to the present day, from Ukraine and Romania to the Iberian Peninsula and North Africa (Patricia C. Anderson, Isabelle Rodet-Belarbi, Marta Moreno-Garcia, *Sickles with teeth and bone anvils*, in: *Early agricultural Remnants and technical heritage (EARTH): 8,000 years of resilience and innovation*, Series Editors Patricia C. Anderson and Leonor Peña-Chocarro, Coordinating Editor Andreas G. Heiss, Ed. Oxbow Books, Oxford; Hajnalová, Dreslerová, *op. cit.*, 2009; and other studies).

⁹¹ The angle of inclination of the serrations is different depending on the blade sector. The blade has a curved shape, without being an arc of a circle, which causes the contact angle of the serrations to the cutting plane when cutting the stems of harvested plants to be different depending on the area of the blade in which the contact occurs. For this reason, the measurement of the angle of inclination of the serrations of the modern sickle (from the author's collection) was made on a medial sector, with a length of 10 cm and a density of 6 serrations per cm.

Lack in the archaeological literature of references to the possible existence in the Eneolithic settlements, in the geographical area considered in this study, of lithic sickle inserts similar to those in the Eneolithic settlement Rupea 4 - La Movilă, especially with piece L1, can be speculatively explained in many ways: insufficient research; insufficient attention paid to such artifacts; the use in research of methods that do not allow the easy identification of small artifacts; or other explanations. But one of the explanations, which can be confirmed or refuted by future research, may be that the innovation Ariuşd-Cucuteni in southeastern Transylvania, from the Eneolithic settlement Rupea 4 - La Movila, is the product of a moment of sparkle of the human mind that has been lost for reasons we do not know. In such a case, the innovative inserts from Rupea can suggests us that innovation in the lithic field was still present in the Eneolithic society which was naturally preoccupied with developing the new copper metallurgy.

Annex 1

Nr. crt.	Inclination of the edges of the primary stigmas (item L1)	Inclination of the edges of the secondary stigmas (item L1)	Inclination of the serrations in the medial sector (modern sickle)
1	-	46°	56°
2	-	42°	
3	-	43°	
4	61°	-	
5	56°	-	
6	53°	-	
7	60°	-	
8	59°	-	
9	53°	-	
10	63°	-	
11	63°	-	
12	59°	-	
13	63°	-	

O INOVAȚIE ENEOLITICĂ DIN SUD-ESTUL TRANSILVANIEI. LAMA ARIUȘDEANĂ DE SECERĂ DE LA RUPEA 4 - LA MOVILĂ (RUPEA, JUD. BRAȘOV)

Secera compozită cu inserții litice a fost timp de mii de ani, în preistorie, una dintre cele mai eficiente și mai complexe unelte de recoltare a plantelor graminee, începând din neoliticul pre-ceramic din Orientul Apropiat până în epocile metalelor când treptat a fost înlocuită cu alte tipuri de sceri. Studiile aprofundate asupra inserțiilor litice ale secerilor compozite au demonstrat că de-a lungul timpului, în cadrul unor comunități umane, în funcție de regiune, perioada de timp și probabil în funcție de caracteristicile plantelor recoltate, au existat anumite preferințe și modificări în ceea ce privește tipologia inserțiilor și poziționarea acestora în suporturi. Diversitatea constructivă a unor unelte care presupun principii comune de funcționare, așa cum este și cazul secerii compozite cu inserții litice, are la bază procesul de inovare propriu speciei umane. Studiul de față introduce în circuitul științific două piese litice eneolitice, inserții ale unor seceri compozite, identificate în așezarea Ariuşd-Cucuteni de la Rupea 4 - La Movilă (jud. Braşov), din sud-estul Transilvaniei (România), care, în opinia noastră, pot reprezenta dovezi ale unei inovări locale a procesului de recoltare prin secerare a plantelor graminee.

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