

# COMBUSTION RELATED FEATURES IN UPPER PALEOLITHIC SITES OF EASTERN ROMANIA. CASE STUDY BISTRICIOARA - LUTĂRIE III (NEAMŢ COUNTY)

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## Abstract:

*Combustion related features are common occurrences in most archaeological contexts, expressed in various forms and/or states of preservation. As the analytical strategies involved in their study have become more complex and diversified, the relationship between fire-use and human evolution/behavior is undoubtedly, better understood. Even in Paleolithic sites, exposed to a myriad of post-depositional processes over long periods of time, combustion related features are routinely recognizable, either as well-preserved structures or as more subtle and/or amorphous clusters of burnt materials. Combustion related elements (fire-hearths, burnt patches of sediment, accumulations of ashes, charcoals, burnt fauna, etc.) are frequently mentioned in connection to Upper Paleolithic sites located in Eastern Romania. However, descriptions of their size, morphology and content are, in many cases, either superficial or lacking entirely. Furthermore, additional in-depth microscopic analyses are, at the moment, even more uncommon. Aware of these mentioned impediments, our current contribution is focused on partially tackling this issue. In addition to critically reviewing the existing data regarding combustion features found in Upper Paleolithic sites in east Romania, new information from the recently excavated site of Bistricioara-Lutărie III is discussed, with emphasis on the size and morphology of combustion related features.*

**Keywords:** *Upper Paleolithic; Eastern Romania; Fire-hearth; combustion; morphology.*

## 1. INTRODUCTION

The macro- and microscopic study of hearths and other combustion structures has long proven as a productive pursuit in archaeology, as it provides insights in multiple aspects of past behaviors, as well as the environmental settings in which they took place. Generally, combustion features are defined as concentrated deposits of burned materials occurring in archaeological contexts, resulting from either intentional or unintentional firing, in some cases without anthropic intervention (forest and brush fires, lightning strikes, spontaneous combustion of flammable materials etc.)<sup>1</sup>. As well, such features may further be classified as contained (fire-hearths, kilns,

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<sup>1</sup> MENTZER 2017: 411-424; MALLOL ET AL. 2017: 299-330.

ovens, etc.), usually affecting a rather limited area, or uncontained (fire destruction events, land or settlement fire management, etc.), the latter spread over large surfaces. Even if post-depositional events are bound to affect all such features to a certain degree, they may also be considered as primary/intact (with their components in the original position of firing) or reworked (with their components moved, scattered, redeposited, washed etc.)<sup>2</sup>.

Due to the definitive alternating effect of the flame and/or high temperatures on different organic and inorganic materials, combustion features are commonly recognized even in older contexts, such as Paleolithic sites. Nevertheless, the further back in time we dive, the harder it might become to fit such features into clear categories (intentional vs. unintentional, contained vs. uncontained), drawbacks which obstructs the understanding of a key aspect in human history – when and how has fire become a tool?

From its very beginning, the conscious use of fire has played an important part in hominin evolution, shaping the paths walked by our ancestors and their close relatives<sup>3</sup>. As expected, a special attention in literature has been placed on the early stages of interaction with fire, process ultimately leading to intentional fire production, the latter seen as the true hallmark of fully mastered pyrotechnology. Even if the Neanderthals ability to produce fire is still a matter of debate<sup>4</sup>, it is fairly accepted that this was a common practice for Upper Paleolithic Anatomically Modern Humans (AMH)<sup>5</sup>. Nevertheless, as argued by some, the focus on the early phases of fire use has left other aspects rather underexplored and noticeably less attention was given to modern human pyrotechnology throughout the Upper Paleolithic, especially in regard to ample diachronic studies of variation in size and morphology of combustion feature<sup>6</sup>. Instead, particular issues, such as fuel sources, food processing or the production of backed clay objects<sup>7</sup> were preferably addressed. For instance, in a recent study dedicated to European Upper Paleolithic pyrotechnology, out of the 164 sites considered for analysis (dated within the 47.5000 cal. BP and ~ 13.000 cal. BP range), only in 55 cases more detailed descriptions of contained combustion features were available<sup>8</sup>. All in all, the study gathered information regarding the size and morphology of 133 fire hearths, highlighting at the same time the lack of consistency in describing such features. Moreover, the noticed temporal or geographical gaps in collected data may reflect various biases (site preservation issues, misinterpretations, omissions in reporting, etc.), unrelated to actual diachronic trends in Upper Paleolithic pyrotechnology<sup>9</sup>. If applying a basic field methodology, such as the one proposed by Mallol and Henry<sup>10</sup>, could diminish the imbalance seen in researching and describing fire-hearths,

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<sup>2</sup> MENTZER 2017: 411-424; MALLOL *et al.* 2017: 299-330.

<sup>3</sup> ROEBROEKS, VILLA 2011; CHAZAN 2017: 351-359.

<sup>4</sup> But see AGAM *et al.* 2023.

<sup>5</sup> ROEBROEKS, VILLA 2011: 5209-5214; BRITTINGHAM *ET AL.* 2019; SORENSEN 2017: 114-128; ALLUÉ *et al.* 2022: 227-249; MURPHREE, ALDEIAS 2022.

<sup>6</sup> MURPHREE, ALDEIAS 2022.

<sup>7</sup> See, for instance, THÉRY-PARISOT 2002: 1415-1421; NAKAZAWA *ET AL.* 2009: 684-693; BERESFORD-JONES *ET AL.* 2010: 2799-2811; PRYOR *ET AL.* 2016: 1-12; FLADERER *ET AL.* 2014: 115-133; SVOBODA *ET AL.* 2015: 195-210.

<sup>8</sup> MURPHREE, ALDEIAS 2022.

<sup>9</sup> MURPHREE, ALDEIAS 2022.

<sup>10</sup> MALLOL, HENRY 2017: 217-229.

the lacunar character of data might prove harder to overcome just by establishing specific protocols, as it probably reflects manifold and intricate factors.

By operating with four different types of constrained combustion features (*open fire-hearths, fire pits, prepared burning surfaces, and fire installations*<sup>11</sup>), the study of Murphree and Aldeias revealed some interesting results. While the Initial Upper Paleolithic seems to be characterized mainly by the presence of ephemeral, open fire-hearths, a regionalization of fire-use might have happened during the Aurignacian, with pit features more common in western Europe and prepared burning surfaces more common in eastern Europe<sup>12</sup>. Furthermore, the Middle Upper Paleolithic (Gravettian) reveals a substantial diversification of pyrotechnology, as well as intensive reuse of fire *loci*, in some instances accompanied by secondary surrounding features with multiple functions (fuel storage, boiling pits, waste removal, heat control, etc.)<sup>13</sup>. Unexpectedly, at a European level the peak of the Last Glacial Maximum (LGM) shows a striking diminishing in the number of known combustion related features, which cannot be explained solely by the lower number of sites. Alternatively, the downward trend was related to other factors, such as the lack of proper reporting or poor preservation, although the absence of fire (possibly due to lack of fuel) in many sites cannot be excluded either<sup>14</sup>. Finally, late and post-LGM sites are apparently characterized by a resurgence of open, flat combustion features<sup>15</sup>.

The aim of the present study is to critically review and analyze available data pertaining to combustion related features investigated in Upper Paleolithic sites in Eastern Romania (using the four main types mentioned above), in order to see how this particular region fits into the wider European frame, acknowledging at the same time potential impediments, such as poor chronometric support or lack of detailed descriptions. Fortunately, a new set of information on combustion features was gathered over the past few years at the site of Bistricioara-Lutărie III, in the Ceahlău Basin. A preliminary assessment of these features (including size, shape, macroscopic content, and preservation state) will also be presented in the following.

## 2. OVERVIEW OF COMBUSTION FEATURES IN UPPER PALEOLITHIC SITES OF EASTERN ROMANIA

Although there are more than 250 points with UP discoveries in Eastern Romania, slightly above ten percent were investigated through more extensive field excavations, many providing also preserved combustion related features<sup>16</sup>. In terms of landscape, the area comprises an admixture of mountains, hills, plateaus, and plains, with the high area of the Eastern Carpathians to the west (with maximum altitudes of around 1900 m asl) and the Moldavian Plateau to the east (around 200 m asl in the lower floodplains). Due to specific factors influencing Romanian archaeological field research (such as the focus on preventive excavations relating to major hydrotechnical infrastructure

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<sup>11</sup> As defined by MALLOL *et al.* 2017: 299-330.

<sup>12</sup> MURPHREE, ALDEIAS 2022.

<sup>13</sup> MURPHREE, ALDEIAS 2022.

<sup>14</sup> MURPHREE, ALDEIAS 2022.

<sup>15</sup> MURPHREE, ALDEIAS 2022.

<sup>16</sup> PĂUNESCU 1998, PĂUNESCU 1999.

projects), there are two main clusters of investigated sites, one in the Ceahlău Basin and one on the Middle Prut Valley, although several sites in the Siret Valley are also worth mentioning (**Pl. I**).

Regarding combustion features, the subject did not enjoy a lot of attention in the past and only two studies are specifically focused on this topic. In 1961, M. Bitiri attempted a preliminary classification of Upper Paleolithic hearths known at that moment in Romania, establishing five categories: *flat hearths*, *hearths associated with nearby pits*, *hearths lined with stone slabs*, *fire pits*, and *fire pits lined with stone slabs*<sup>17</sup>. In his bachelor thesis defended in 2007, Al. Ciornei gathered, as well, information regarding combustion features in Romania. As the author himself admits, the results of his analysis (based also on the categories previously established by M. Bitiri) were strongly influenced by the rather uneven and poor quality of available data<sup>18</sup>.

More recently, the previously proposed chrono-cultural assignments<sup>19</sup> of many sites from Eastern Romania (including several which yielded combustion features), as well as the assumed integrity of their analytical units (archaeological layers), were challenged based on technological, chronological, or stratigraphical grounds<sup>20</sup>, considerably reshaping the cultural framework established and developed during the second half of the 20th century.

In the following, a chrono-cultural presentation of relevant combustion features will be attempted, considering the three large European technocomplexes attested in Eastern Romania: Aurignacian, Gravettian, and Epigravettian.

### 2.1. AURIGNACIAN COMBUSTION FEATURES

Although there are other sites potentially hosting Early Upper Paleolithic/Aurignacian contexts in Eastern Romania<sup>21</sup>, so far only the site of *Mitoc-Malu Galben* (on the Middle Prut Valley) has enough data to undoubtedly credit this cultural assignment<sup>22</sup>. Here, there are five archaeological units with Aurignacian finds (called *assemblages*) dated between ca. 37.000 – 32.000 cal. BP, out of which three yielded combustion features, the latter very briefly described as *well preserved and rich in charcoal remains*, reaching around 1 sq. m in surface<sup>23</sup>. Overall, at least some combustion features seem to have been affected by post-depositional processes<sup>24</sup>, although the nature of these disturbances is not specifically addressed. Two hearths are mentioned in the *Lower Aurignacian* unit, but no plans or further details are available<sup>25</sup>. In the *Aurignacian I* unit (dated at ca. 34.000 cal. BP) seven hearths were investigated in total. Associated limestone slabs are mentioned for three of them<sup>26</sup>, serving most likely as prepared burning surfaces. The only illustrated

<sup>17</sup> BITIRI 1961: 7-15.

<sup>18</sup> CIORNEI 2007 (ms).

<sup>19</sup> NICOLĂESCU-PLOPȘOR ET AL. 1966: 5-114; PĂUNESCU 1998.

<sup>20</sup> NIȚĂ-BĂLĂȘESCU 2008; STEGUWEIT et al. 2009: 139-157; ANGHELINU et al. 2012: 7-46; ANGHELINU, NIȚĂ 2014: 172-192; ANGHELINU et al. 2018: 183-219; CORDOȘ et al. 2021: 7-28.

<sup>21</sup> Such as the undated layer 1 in *Mitoc-Pârâul lui Istrati* (see CHIRICA ET AL. 1996).

<sup>22</sup> OTTE et al. 2007.

<sup>23</sup> CHIRICA 2007: 167-172.

<sup>24</sup> CHIRICA 1996: 86-87.

<sup>25</sup> CHIRICA 2007: 167-172.

<sup>26</sup> NOIRET 2009: 56-57.

hearth has an oval shape, with dimensions of approximately 1 x 0.7 m<sup>27</sup>. In the *Aurignacian III* unit (ca. 33.500 cal. BP), ten hearths are mentioned, one associated with limestone slabs disposed in a triangular shape<sup>28</sup>.

The data on Aurignacian combustion features is, therefore, rather scarce. In most cases, no details are provided in relation to the shape, dimension, thickness, or content of the hearths. The available descriptions hint mostly towards simple, open features, usually associated with larger concentrations of finds, interpreted as knapping workshops<sup>29</sup>. The botanical samples collected from one of the hearths (in the *Aurignacian I* unit) were clearly dominated by coniferous remains (*Picea*), but traces of sedges (*Cyperaceae*) and grasses (*Poaceae*) were also present<sup>30</sup>.

## 2.2. GRAVETTIAN COMBUSTION FEATURES

Compared to the Aurignacian, the Gravettian technocomplex is better represented in Eastern Romania, with multiple sites assigned to this chrono-cultural unit, many displaying also clear traits to support this assignment. At *Mitoc-Malu Galben*, the switch happened rather fast, with a relatively short interval between the last Aurignacian (ca. 32.000 cal. BP) and the first Gravettian assemblages (ca. 31.000 cal. BP)<sup>31</sup>. Forty-seven combustion features were documented in the Gravettian units (covering the time span between 31.000 cal. BP and 27.000 cal. BP). The hearths are generally described as smaller than the previous ones<sup>32</sup>, but further details are only available in some cases. Therefore, in the *Gravettian I* unit (ca. 31.000 cal. BP), a hearth bordered by seven limestone slabs is mentioned, while in the *Gravettian II* unit (ca. 29.000 cal. BP) the hearth found in square B2 was lined with 24 sandstone slabs<sup>33</sup>. In feature 29 (interpreted as a knapping workshop), two partially overlapping hearths are mentioned, suggesting the reuse of the same spot in at least two occasions. However, the feature (clearly Gravettian) is not assigned to any of the four analytical units<sup>34</sup>. A pit combustion feature, further lined with pebbles and one sandstone slab is mentioned in the *Gravettian III* unit (ca. 28.500 cal. BP). Pebbles and sandstone slabs were also used for one hearth discovered in the *Gravettian IV* unit (ca. 27.500 cal. BP)<sup>35</sup>. As no particular attention was paid to the rest of the hearths, we can assume they were of the open, flat type. Unfortunately, their sizes and shapes are not described/illustrated. Botanical samples were recovered and analysed from one hearth in the *Gravettian II* unit, revealing wood charcoals (*Picea* and *Alnus*) and other traces from various grasses and sedges<sup>36</sup>.

In the Bistrița Valley (middle sector of the river), the site of *Piatra-Neamț – Poiana Cireșului* hosts several layers assigned to the Gravettian. However, (*very thick*) hearths are only mentioned in relation to the *Gravettian III* layer (which probably consists of multiple occupations dated between

<sup>27</sup> NOIRET 2009: 56-57.

<sup>28</sup> NOIRET 2009: 56-57.

<sup>29</sup> CHIRICA 1996: 86-87; CHIRICA 2007: 167-172; NOIRET 2009: 56-57.

<sup>30</sup> DAMBLON 2007: 67-80.

<sup>31</sup> DAMBLON, HAESAERTS 2007: 53-66.

<sup>32</sup> CHIRICA 1996: 86-87; CHIRICA 2007: 167-172.

<sup>33</sup> CHIRICA 2007: 167-172; NOIRET 2009: 58.

<sup>34</sup> CHIRICA 2007: 167-172.

<sup>35</sup> CHIRICA 2007: 167-172.

<sup>36</sup> DAMBLON 2007: 67-80.

ca. 31.000 cal. BP and ca. 29.500 cal. BP)<sup>37</sup>. No details are available regarding the number of combustion features, nor their size, shape, or content. Based on several published illustrations, at least some seem to be connected to stone arrangements or nearby pits<sup>38</sup>.

Further downstream, the sites of Lespezi-*Lutărie* and Buda-*Dealul Viei* also provided Gravettian habitations. Layer VI in Lespezi (recently delivering an age of around 28.500 cal. BP) preserved only small burnt patches, interpreted as washed-out hearths<sup>39</sup>. At Buda, layer C (dated at 27.500 cal. BP) yielded seven shallow pit features with rounded shapes (circular or oval), ranging in size between 0.6 and 2 m<sup>40</sup>.

In the Ceahlău Basin, the extensive field campaigns conducted in the second half of the 20<sup>th</sup> century led to the investigation of multiple Upper Paleolithic sites, many hosting several archaeological layers<sup>41</sup>. The formerly proposed cultural sequence/s (which comprised several Aurignacian and Gravettian phases)<sup>42</sup> was seriously called into question as new excavations and reassessments were conducted in the area over the past decades. As a result, the age of the geological sequence hosting most of the archaeological layers was reconsidered as younger than previously assumed (which, in turn, led to a cultural reassignment of the layers, reinforced also by technological studies of the lithic collections)<sup>43</sup>. Additionally, as the integrity and analytical value of some of these *layers* was also contested<sup>44</sup>, a clear assignment of combustion features identified within remains rather difficult. Therefore, with due caution, for the purpose of this study the structures related to *layers* identified in the lower part of the geological sequence (associated with ages prior to ca. 24.000 cal. BP<sup>45</sup>) were deemed Gravettian, while layers located above this boundary were considered Epigravettian *sensu lato*.

In Dârțu and Bistricioara-*Lutărie I-II*, large patches of burnt sediment and charcoal (up to 0.13 – 0.15 m thick) were identified in the lower part of the sequence. As they had no associated archaeological finds (except for a few potentially intrusive lithics in Dârțu), the original interpretations leaned towards natural forest fires<sup>46</sup> or intentional land management strategies<sup>47</sup>. Nevertheless, in both Dârțu and Bistricioara-*Lutărie I-II* multiple fire hearths are mentioned for the subsequent archaeological layers. During the first excavations (1955-1962), oval fire structures connected to nearby rounded pits (filled with ash, charcoal, burnt fauna, lithics) were found in the lower layers. Pit combustion features were also attested at Bistricioara-*Lutărie I*<sup>48</sup>. However, no

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<sup>37</sup> NIȚU *et al.* 2019.

<sup>38</sup> NIȚU *et al.* 2019: Fig. 1, 5.

<sup>39</sup> BITIRI *et al.* 1989: 22-23; PĂUNESCU 1998: 298-314.

<sup>40</sup> BITIRI *et al.* 1989: 22-23; PĂUNESCU 1998: 287-297; see TUFFREAU *et al.* 2018 for layer denominations and absolute chronology.

<sup>41</sup> NICOLĂESCU-PLOPȘOR *et al.* 1966: 5-114; PĂUNESCU 1998.

<sup>42</sup> NICOLĂESCU-PLOPȘOR *et al.* 1966: 5-114; PĂUNESCU 1998.

<sup>43</sup> For details see NIȚĂ-BĂLĂȘESCU 2008; STEGUWEIT *et al.* 2009: 139-157; ANGHELINU *et al.* 2012: 7-46; ANGHELINU, NIȚĂ 2014: 172-192; ANGHELINU *et al.* 2018: 183-219; ANGHELINU *et al.* 2021a: 241-257.

<sup>44</sup> CORDOȘ *et al.* 2021: 7-28.

<sup>45</sup> See ANGHELINU *et al.* 2023 for arguments regarding this chronological boundary.

<sup>46</sup> NICOLĂESCU-PLOPȘOR *et al.* 1966: 5-114; PĂUNESCU 1998: 122-123.

<sup>47</sup> MOGOȘANU 1959: 459-461.

<sup>48</sup> NICOLĂESCU-PLOPȘOR *et al.* 1966: 5-114.

particular details are available. More consistent descriptions were provided by Păunescu, after his excavations in the area during the 70s and the 80s. He defined three large categories of combustion related features, based on size and aspect: small patches of charcoal or burnt sediment, proper hearths, and large structures rich in charcoal and/or burnt sediment. In Bistricioara-*Lutărie I-II*, the lower layer (named *layer I* and dated by Păunescu to around 28.000 cal. BP) yielded 15 small burnt patches (less than 0.2 m), 13 hearths, and 7 large structures. The hearths, most with oval shapes, had long axes ranging between 1 m and 1.5 m. At least two seemed to have had a stone base and only one had two small pits in its proximity. On the other hand, the large features (interpreted as dwelling structures) were more often associated with small pits, found either inside or outside. They also contained scattered charcoals and small patches of burnt sediment. In some cases, the fire hearths themselves were located within the boundaries of such larger features<sup>49</sup>. A similar situation was uncovered in Dârțu, in *layers I* (ca. 28.500 cal. BP) and *II* (ca. 25.500 cal. BP). In addition to 3 small burnt patches and 2 large structures, 16 hearths (ranging in size between 0.5 – 1.14 m) were identified in *layer I*. A potential fire pit is mentioned (located inside one of the larger structures), as well as a combustion feature lined with 5 sandstone slabs<sup>50</sup>. In the second layer there were 15 small patches of burnt sediment (all less than 0.5 m in diameter), 16 hearths (between 0.5 – 1.68 m in length), and 5 large structures. No particular types of hearths are described, although at least two did contain a couple of stone fragments<sup>51</sup>. Another potential candidate at hosting Gravettian layers is the site of Cetățica (I-II). While the lowest layer at Cetățica I might be, in fact, older (potentially Late Middle Paleolithic), the second layer (*layer II*) was dated by Păunescu to ca. 28.000 cal. BP. Seven fire hearths were revealed here, as well as several small patches of burnt sediment. Most hearths had oval shapes (the largest with dimensions of 1.95 x 1.67 m) and were described as *simple*, with no further modifications<sup>52</sup>.

Summing up, Gravettian combustion features are better represented in the Eastern Carpathian archaeological record, probably due to the higher number of sites that can more or less be pinned to this time frame. A higher availability of fuel, combined with the cold season of occupations (at least Buda and Bistricioara-*Lutărie III* were documented as autumn – winter camps<sup>53</sup>) should also be considered. The quality and quantity of available data is, nevertheless, uneven. For instance, while the site of Mitoc-*Malu Galben* provides a solid chronological sequence, the reports on combustion features are quite parsimonious. On the other hand, the descriptions offered by Păunescu are more generous (including size, shape, thickness, and content in many cases), yet the chrono-stratigraphical background is less certain.

### 2.3. EPIGRAVETTIAN COMBUSTION FEATURES

The emergence of the Epigravettian in the Eastern Carpathians is still a matter of debate, but recent data suggest a visible cultural shift (in techno-typological choices, raw material procurement, subsistence strategies, etc.) around 24,000 cal. BP<sup>54</sup>, coinciding with the peak of the LGM. While

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<sup>49</sup> PĂUNESCU 1998: 120-170.

<sup>50</sup> PĂUNESCU 1998: 192-237.

<sup>51</sup> PĂUNESCU 1998: 192-237.

<sup>52</sup> PĂUNESCU 1998: 178-188.

<sup>53</sup> BOLOMEY 1989: 271-287; ANGHELINU *et al* 2021b: 210-229.

<sup>54</sup> ANGHELINU *et al*. 2021a: 241-257; ANGHELINU *et al*. 2023: 15-33.

large areas of the continent are depopulated at this time, the Eastern Carpathians may actually have experienced an increase in occupations during the LGM (*sensu lato*)<sup>55</sup>. Furthermore, contrary to the European trend, combustion features seem to be fairly well represented in the archaeological record at the time of the Late Gravettian/Early Epigravettian interface.

At Mitoc-Malu Galben, sporadic habitations (coined as *Dispersed Gravettian*) dated between 24.000 cal BP and 22.000 cal. BP are marked by scattered lithics found at various depths<sup>56</sup>. Only three combustion features are mentioned in association with these artefacts, but no further details are available<sup>57</sup>. Still in the Prut Valley, the site of Cotu Miculinți-Gârla Mare has yielded several archaeological layers which, judging from the uniformity of the artefact collections probably describe a rather rapid succession<sup>58</sup>. The absolute chronology of the site is resting, at the moment, on only two ages. The lowest layer (*layer VII*) is loosely dated to around 24.000 cal. BP, while *layer V* provided an age of around 22.500 cal. BP<sup>59</sup>. At least 15 hearths are mentioned in *layers VII to II*, most with circular or oval shapes<sup>60</sup>. The largest (in *layer IV*) had a diameter of 2 m and was 0.1-0.2 m thick. A possible fire pit is referenced for *layer V*, while in *layer II* a hearth associated with two small pits is described<sup>61</sup>. The nearby site of Crasnaleuca (*Lutărie*) also host multiple layers dated to a similar interval as Cotu Miculinți-Gârla Mare. Nevertheless, the number of preserved combustion features is smaller, possibly related to less extensive investigated surfaces, fragmented in separate soundings. Only three such features are mentioned, one containing charred animal bones, a stone slab, and a few tiny amber fragments. The layers containing combustion features (*VII, V and IV*) are presumably dated between ca. 25.000 – 23.000 cal. BP<sup>62</sup>.

On the Bistrița Valley, the Early Epigravettian layers at Lespezi-Lutărie (*layers V to II*) are dated between ca. 23.000 and ca. 21.000 cal. BP<sup>63</sup>. They preserved multiple combustion features (especially in *layer IV*), most described as simple, flat hearths (some affected by post-depositional processes). Circular pit structures are also mentioned (usually 0.6 - 0.8 m in diameter), with depths of 0.1-0.15 m, filled with charcoal, ashes, burnt bones and occasionally lithics<sup>64</sup>. An interesting situation is described in *layer II*, which consists of a pit combustion feature lined with flat bones and fragments of horse maxilla. Another pit fire structure found in *layer II* was associated with four small rounded pits, disposed on the edges of the hearth<sup>65</sup>.

In the Ceahlău Basin, the sites of Bistricioara-Lutărie I-II, Cetățica, Dârțu, Podiș, and Bistricioara-Shore also yielded ages associate with the Epigravettian. In some cases, the results suggest potential mixing between different occupations, reason for which the dates (some with large uncertainty intervals) were not further calibrated or modelled. In Bistricioara-Lutărie I-II, *layers II*

<sup>55</sup> ANGHELINU *et al.* 2021a: 241-257; ANGHELINU *et al.* 2023: 15-33.

<sup>56</sup> DAMBLON, HAESAERTS 2007: 53-66.

<sup>57</sup> CHIRICA 2007: 167-172.

<sup>58</sup> BRUDIU 1980a: 5-12; NOIRET 2009.

<sup>59</sup> PĂUNESCU 1999; ANGHELINU *ET AL.* 2023: 15-33.

<sup>60</sup> BRUDIU 1980a: 5-12; PĂUNESCU 1999: 93-102.

<sup>61</sup> BRUDIU 1980a: 5-12; PĂUNESCU 1999: 93-102.

<sup>62</sup> BRUDIU 1980b: 425-444; PĂUNESCU 1999: 103-112.

<sup>63</sup> PĂUNESCU 1998; TUFFREAU *ET AL.* 2018.

<sup>64</sup> BITIRI *et al.* 1989: 22-23.

<sup>65</sup> BITIRI *et al.* 1989: 22-23.



(18330±300 uncal. BP; 20310±150 uncal. BP), *III* (18800±1200 uncal. BP; 20995±875 uncal. BP) and *IV* (19055±925 uncal. BP; 16150±350 uncal. BP) contained, according to Păunescu, around 85 hearths, in addition to 33 small patches of burnt sediment, and 4 large structures with traces of charcoal and/or burnt sediment. Most hearths are described as oval or irregular in shape, with dimensions varying between 0.5 and 1.7 m. At least 9 were further prepared with pebbles or sandstone slabs and many more had a couple of sandstone fragments within their content<sup>66</sup>. In the undated *layer V*, 9 hearths and 8 small burnt patches were also investigated, while in the topmost layer (*VI*), found under the modern surface, no structures were preserved<sup>67</sup>. In Dârțu, *layers III* (17860±190 uncal. BP) and *IV* delivered 10 combustion related features, out of which 6 were labelled as hearths and 4 as small burnt patches. No particular traits were mentioned in relation to the hearths. As in Bistricioara-Lutărie I-II, the topmost layer (*V*) did not preserve *in situ* archaeological features<sup>68</sup>. In Cetățica, 3 hearths were excavated in *layer III* (19760±470 uncal. BP), one associated with five sandstone fragments. Again, in the topmost layers (*IV* and *V*) no features were found<sup>69</sup>. During the excavations in Podiș, 29 hearths and 32 small burnt patches were identified in *layers I* to *IV*. However, most were only partially investigated. The chronology of the site is quite flimsy, with only one absolute age available in *layer III* (16970±360 uncal. BP)<sup>70</sup>. One hearth associated with seven adjacent pits was mentioned in the lowermost layer (*layer I*), while the remaining features were most likely open, flat structures. As it is the case with the sites previously discussed, the topmost layer lacks any identifiable structures<sup>71</sup>.

Although it is highly probable that many of the (undated) upper layers in the Ceahlău Basin represent Late Epigravettian/ Late Palaeolithic habitations, only the site of Bistricioara-Shore provided viable dating samples within this chronological range (ca. 17.500 – 16.500 cal. BP)<sup>72</sup>. Six distinct overlapping hearths/burnt areas are mentioned in the upper layer (*layer I*), but given the small size of the excavated surface, no details are provided regarding the shape or the size of these features<sup>73</sup>.

#### 2.4. COMBUSTION FEATURES AT BISTRICIOARA-LUTĂRIE III

A later addition to the cluster of sites found in the Ceahlău Basin is the site of Bistricioara-Lutărie III, discovered in 2007 approximately 200 m northeast of Bistricioara-Lutărie I-II, on a lower terrace<sup>74</sup>. Since then, the site was investigated through a series of test trenches, coring campaigns, and systematic excavations. As most known sites in the area, Bistricioara-Lutărie III hosts several archaeological horizons, with varying degrees of preservations. At least seven archaeological horizons were documented in the northern part of the site (Pl. II), in the upper half of the sediment sequence, in lithological units G2 and G1. However, the oldest features of interest are represented

<sup>66</sup> PĂUNESCU 1998: 120-170.

<sup>67</sup> PĂUNESCU 1998: 120-170.

<sup>68</sup> PĂUNESCU 1998: 192-237.

<sup>69</sup> PĂUNESCU 1998: 178-188.

<sup>70</sup> PĂUNESCU 1998: 240-260.

<sup>71</sup> PĂUNESCU 1998: 240-260.

<sup>72</sup> ANGHELINU *et al.* 2018: 183-219.

<sup>73</sup> STEGUWEIT *et al.* 2009: 139-157.

<sup>74</sup> ANGHELINU *et al.* 2021b: 210-229; ANGHELINU *et al.* 2022: 11-29.

by combustion traces (charcoal and burnt sediment lenses) found during coring, associated with unit G3. One collected charcoal sample provided an age of ca. 32.000 cal. BP<sup>75</sup>. Nevertheless, given the method of investigation, these burning events cannot, at the moment, be further interpreted (as intentional or unintentional, contained or uncontained etc.). More consistent traces of fire are found in the lower part of unit G2, represented by massive lenses of burnt sediment and charcoal patches, sometimes up to 0.10 m in thickness (Pl. III). There are two separate lenses (labelled as AH 3.1 and AH 3.0), following the topography of the terrace, with a 10° slope towards the north. At the moment, their lateral continuity is not known, but they cover at least several hundreds of square meters. Although a certain association with artefacts is yet to be proven, given that the age of the features is ca. 28.000 cal. BP<sup>76</sup>, an anthropic origin is very likely, as contemporaneous habitations are attested in the Ceahlău Basin.

The first secure archaeological horizon in Bistricioara-Lutărie III is represented by a Late Gravettian layer (labelled AH 2.5) with shouldered points, dated at ca. 27.000 cal. BP<sup>77</sup>. Although clearly affected by solifluction and slope processes, the preservation of the layer is quite good, with many *in situ* structures. A relatively circular combustion feature was excavated (in T5/2021 and T6/2022), with maximum dimensions of 1.14 x 1 m (surface of ca. 0.85 m<sup>2</sup>), consisting of a brownish to orange burnt sediment base overlapped by lenses of charcoal and ashes, the latter suggesting multiple firing events (Pl. IV.a). The total thickness reaches 0.06 m. The hearth is of the open flat type, but it was in close connection with a complex network of pits, filled with charcoal, burnt sediment, faunal remains, knapped lithics, pigments and stone slabs. In fact, the area of the hearth is quite clear, with many of the finds stacked into the pits (Pl. IV.b). As already mentioned, all features are to a certain degree deformed by solifluction, but they are overall well defined and preserved.

The next layer is AH 2.4, dated at ca. 26.000 cal. BP. Although rather poor in finds (Pl. V.a), the layer can most likely be assigned to a (very) Late Gravettian<sup>78</sup>. Nevertheless, two exceptionally well-preserved and partially overlapping combustion structures were identified here (in T4/2019, T5/2021, and T6/2022). The older one is represented by a circular feature (max. dimensions of 0.86 m x 0.7m, surface of 0.47 m<sup>2</sup>), lined with sandstone slabs (Pl. V.c), with a thickness of around 0.06 m. The content mainly consisted of charcoal. The upper structure has an oval shape (max. dimensions of 0.98 m x 0.7m, surface of 0.53 m<sup>2</sup>) and it overlapped the southern edge of the previous hearth (**Pl. V.b**). However, it did not have any further modifications and it consisted only of a slightly burnt base and a charcoal lens, which suggest that it was not intensively used. Also, a vertical shift slightly affected the feature.

AH 2.3, dated at ca. 24.000 cal. BP, is considered as the first Epigravettian presence at the site<sup>79</sup>. As the previous archaeological horizon, it does not contain a lot of artefacts, but it did preserve a very interesting combustion feature, the largest hearth discovered at the site so far (max. dimensions of 1.52 x 1.35 m, surface of 1.57 m<sup>2</sup>, thickness of 0.07m) (Pl. VI.a). The feature clearly shows two fully overlapped firing events. The rather irregular shape of this feature might be due, in fact, to post depositional processes, as vertical shifts and cracks are well documented, as well as other

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<sup>75</sup> ANGHELINU *et al.* 2021b: 210-229.

<sup>76</sup> TRANDAFIR *et al.* 2015: 487-492.

<sup>77</sup> ANGHELINU *et al.* 2021b: 210-229; ANGHELINU *et al.* 2022: 11-29.

<sup>78</sup> ANGHELINU *et al.* 2021b: 210-229; ANGHELINU *ET AL.* 2023: 15-33

<sup>79</sup> ANGHELINU *et al.* 2021b: 210-229; ANGHELINU *ET AL.* 2023: 15-33.

periglacial processes (Pl. VI.b). Most likely, the concentration of small fragments of charred bones in and around the hearth can be related to the selective conservation of accidentally calcinated (and thus stabilized) faunal remains, rather than their use as fuel (Pl. VI.c).

Approximately 10 cm above the previous layer, another Early Epigravettian layer was identified, dated at ca. 22.000 cal. BP. At the moment, AH 2.2 is the densest archaeological horizon in Bistricioara-*Lutărie III* in terms of knapped lithic artefacts<sup>80</sup>, with a collection of over 10.000 pieces. A large quasi-rectangular structure covers most of the southern part of the systematically excavated area (Pl. VII.a), with maximum dimensions of ca. 4.5 x 2.5 m (surface of 9.4 m<sup>2</sup>). It was revealed as a thick (0.06 to 0.1 m) cover of dark sediment, very rich in charcoal, brown burnt sediment, knapped lithics, small fragments of calcinated bones, ochre pigments, and sandstone fragments. Nevertheless, it does not present a clear, heavily burnt base, as it would be the case with a hearth. Moreover, the size and the density of unburnt knapped lithics (Pl. VII.b) found within the structure point towards a different interpretation, possibly as a burnt down light shelter.

The topmost layers (AH. 2.1 and 1.1) at Bistricioara-*Lutărie III* are most affected by post-depositional processes, especially older (PS1) and younger (S0) bioturbation events, which actually made it difficult to clearly segregate the two layers. In addition to knapped lithics, scattered charcoals are encountered, but no structures were preserved, falling in line with the trend observed in other sites located in the Ceahlău Basin.

Therefore, the excavated combustion related features in Bistricioara-*Lutărie III* are fairly well preserved, despite some visible post-depositional occurrences (slope processes, periglacial phenomena, cracks and vertical shifts). In the near future, pending laboratory analyses will supplement the preliminary data presented here, in hopes of better understanding all aspects, such as used fuels, burning temperatures, construction and maintenance elements, etc.

### 3. DISCUSSION AND CONCLUSION

As expected, the investigated Upper Palaeolithic sites of Eastern Romania show various states of preservation. While some did conserve discrete archaeological layers with visible structures, others have certainly been more intensely affected by a wide range of post-depositional processes. The site of Ripiceni-*Izvor*, for instance, where a huge surface of ca. 4000 m<sup>2</sup> was excavated, lacks any recognizable *in situ* features (with the exception of a potential hearth found in the so-called *Aurignacian Ib* layer)<sup>81</sup>. In addition to uneven preservation, the absence of proper reporting and/or uncertainties regarding the discovery context make it difficult to assess potential diachronic patterns relating to combustion features over the millennia. Nevertheless, new excavations, coupled with appropriate documentation /investigation techniques and dating, can bring about a heap of fresh data, allowing for a better understanding of Upper Palaeolithic pyrotechnology in Eastern Romania.

With all the acknowledged shortcomings, however, there are multiple records regarding various types of Upper Palaeolithic combustion structures in Eastern Romania. In some cases, such as the combustion traces associated with unit G3 in Bistricioara-*Lutărie III* or the base of unit G2 in Bistricioara-*Lutărie I-II* and Dârțu, it is yet unclear if they represent intentional uncontained

<sup>80</sup> ANGHELINU *et al.* 2021b: 210-229.

<sup>81</sup> PĂUNESCU 1993: 137.

burning events. Same can be assumed for the massive combustion lenses (AH 3.0 and AH 3.1) in Bistricioara-*Lutărie III*, although in this instance, the presence of humans in the proximity is fairly well attested. There have been various interpretations regarding these features, either as natural fires, hunting tactics or land-management strategies<sup>82</sup>.

Contained combustion features are, nevertheless, the most common occurrences in archaeological contexts. Their state of preservation varies significantly due to a wide range of factors. While some are partially and/or poorly preserved, others are quite intact, retaining many of their original components. Reworked combustion features are frequently mentioned in the literature. On the Bistrița Valley, over 100 *burnt patches* (usually under 0.5 m in diameter) are mentioned in several sites, commonly interpreted as washed-out hearths. Nevertheless, there is some ambiguity relating to the aspect of such features, as the used terminology can describe both patches of burnt sediment, as well as clusters of charcoals and/or ashes.

Regarding recognizable hearths, the approximate number<sup>83</sup> of such features seems to be directly proportional with the number of known sites/layers for each chronological interval. For the Aurignacian (attested with certainty in only one site), 19 combustion features are mentioned, fitting into two types: flat (15 cases) and with prepared burning surfaces (4 cases). Nevertheless, the numbers grow exponentially for the Gravettian. At least 110 hearths are associated with Gravettian (or Middle Upper Palaeolithic) contexts. Apart from flat hearths, which still constitute the most common type (ca. 90 cases), prepared surfaces (ca. 9 cases) and pit structures (ca. 9 cases) also are described. In addition, overlapping hearths or multiple burning events are noticed, as well as hearths associated with nearby pits (the latter usually filled with debris resulted from the combustion process), all suggesting a more complex approach towards fire use. However, no elaborate fire installations are known. For the Epigravettian, over 170 combustion structures are recorded, falling into the types described for the previous timeframe. Simple open hearths remain the most recurrent type (over 150 cases). Prepared surfaces (with stone slabs and even flat bones) are mentioned in 11 cases, while fire pits are described in 6 cases. Hearths with multiple phases were documented in at least 2 cases.

It is particularly interesting to notice that Late Gravettian and Early Epigravettian sites with preserved combustion features account for most occurrences. Therefore, a striking dissonance when compared with the European trend is the high number of such features associated with LGM occupations, especially in the Bistrița Valley, reinforcing the idea of the Eastern Carpathians as a climatic/seasonal refugium. When available, analyses on faunal remains suggested occupations during colder seasons (Buda, Lespezi, Poiana Cireșului, Bistricioara-*Lutărie III*). This, perhaps combined with a steady source of fuel in the more sheltered river valleys of the Eastern Carpathians, may explain the divergence from other areas. However, the *gap* noticed in the European record may be partly explained also by selective access to the literature, especially older sources often redacted in national languages.

Details regarding the size, shape and content of such features are generally sparse. Overall, most hearths are described as oval or circular, although irregular shapes are frequently mentioned as well. Their sizes vary significantly, from ca. 0.5 m to ca. 1.7 m on the long axis. The burnt bases of

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<sup>82</sup> MOGOȘANU 1959: 459-461; NICOLĂESCU-PLOPȘOR *et al.* 1966: 5-114; PĂUNESCU 1998.

<sup>83</sup> The values presented here represent a minimum count, as some sources do not give an exact number, using instead terms such as several or many.

such features (based on thickness and colour) suggest different fire intensities and/or time of use, potentially relating to various functionalities. However, in depth studies on burning temperatures and exposure intervals are not available at the moment. Also, botanical remains were analysed in only a couple of cases.

The recent investigations in Bistricioara-Lutărie III highlighted the need to apply high-resolution excavation methodologies. Apart from the more straightforward data (such as type, size, dimensions, content), the combustion features excavated here offered a textbook medium to observe and study site formation processes. Many of the sync- and post-depositional processes recorded here were particularly made visible by the burnt sediment interfaces (cracks, vertical displacements, polygonal structures, ice wedges, solifluction etc.). Completed in the near future by laboratory analyses, the combustion related structures at Bistricioara-Lutărie III hold a great potential in better understanding the Upper Paleolithic pyrotechnology.

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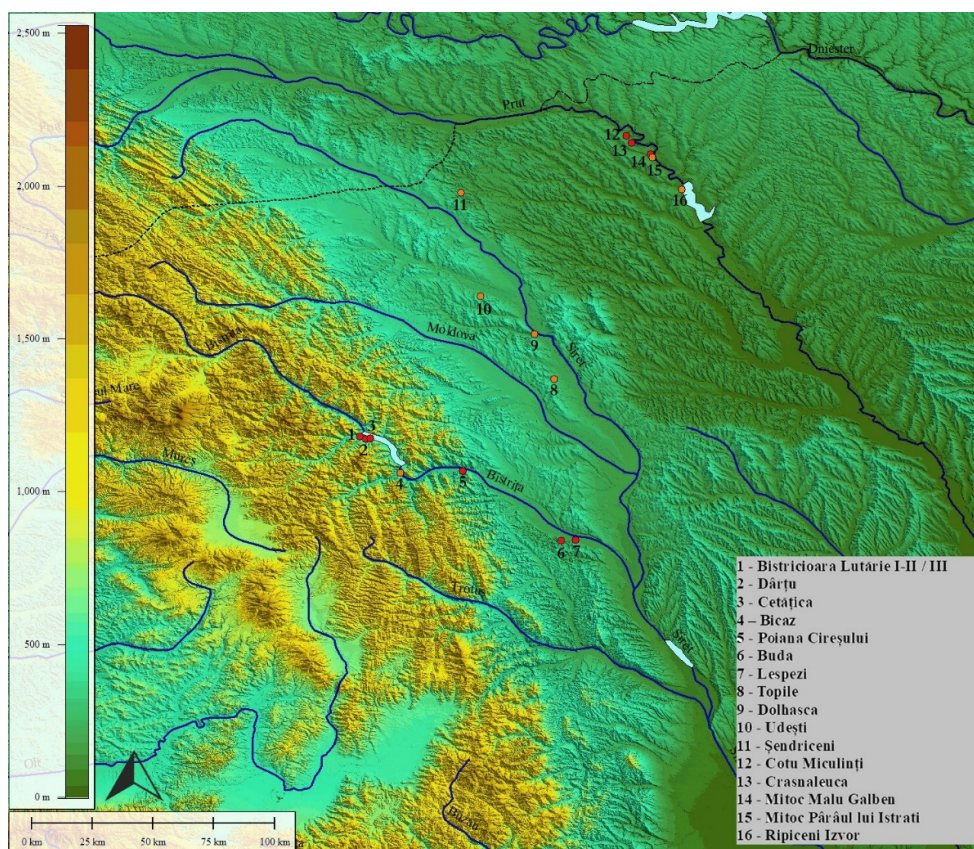
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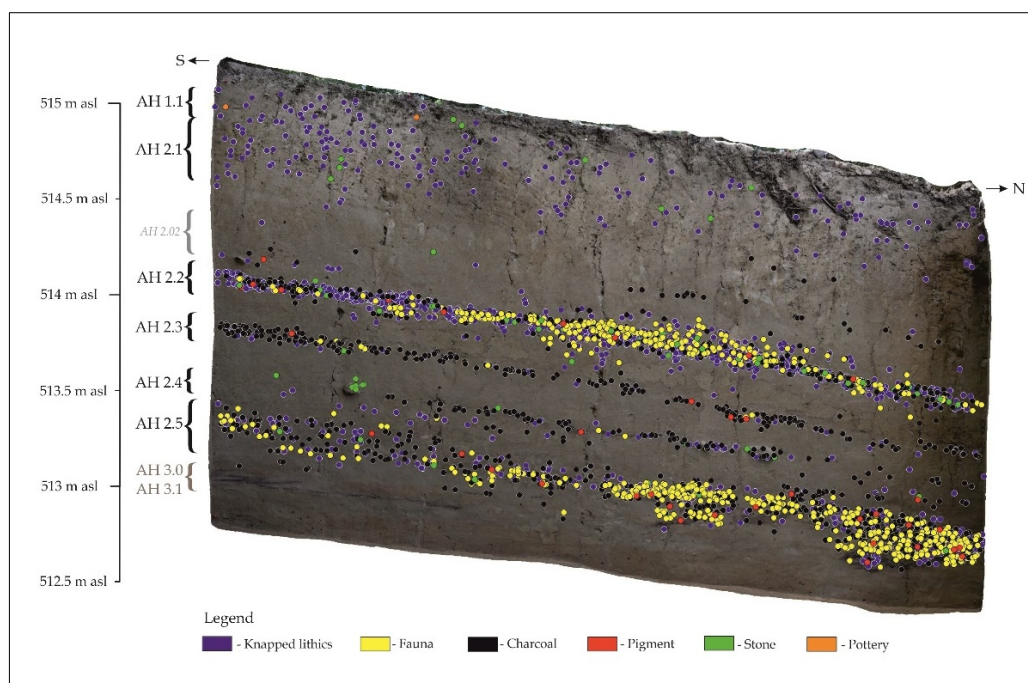
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Pl. I. Map of Upper Paleolithic investigated sites in Eastern Romania (in red: sites with preserved combustion features).

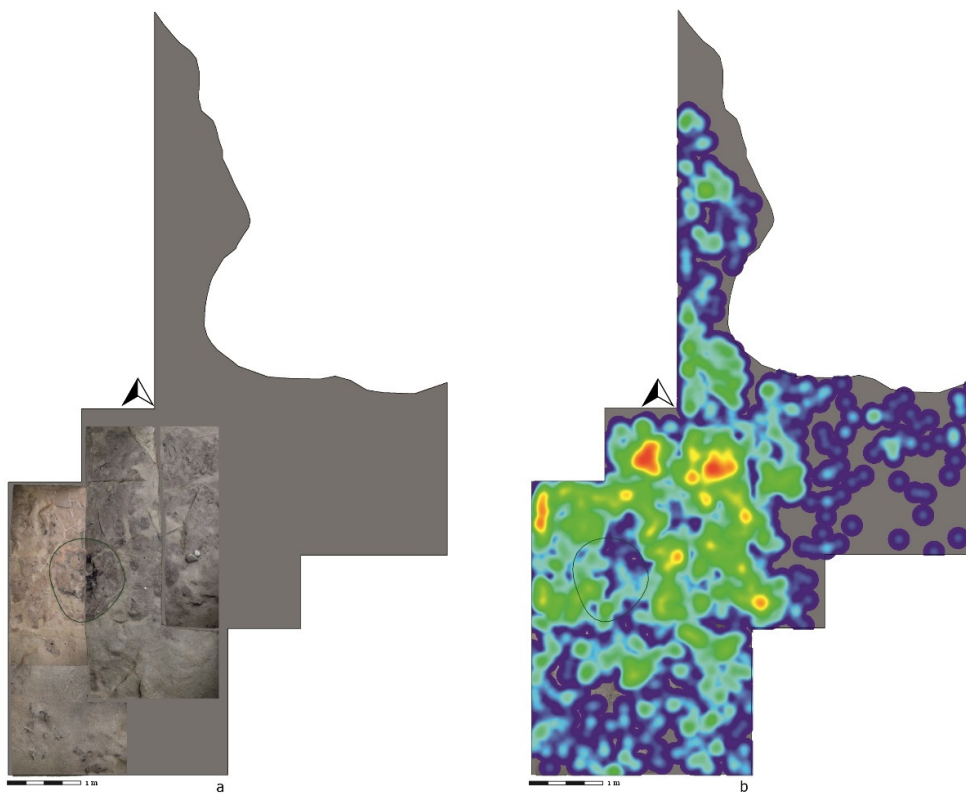


Pl. II. The current archaeological sequence at Bistricioara-Lutărie III (West profile of T6/2022).





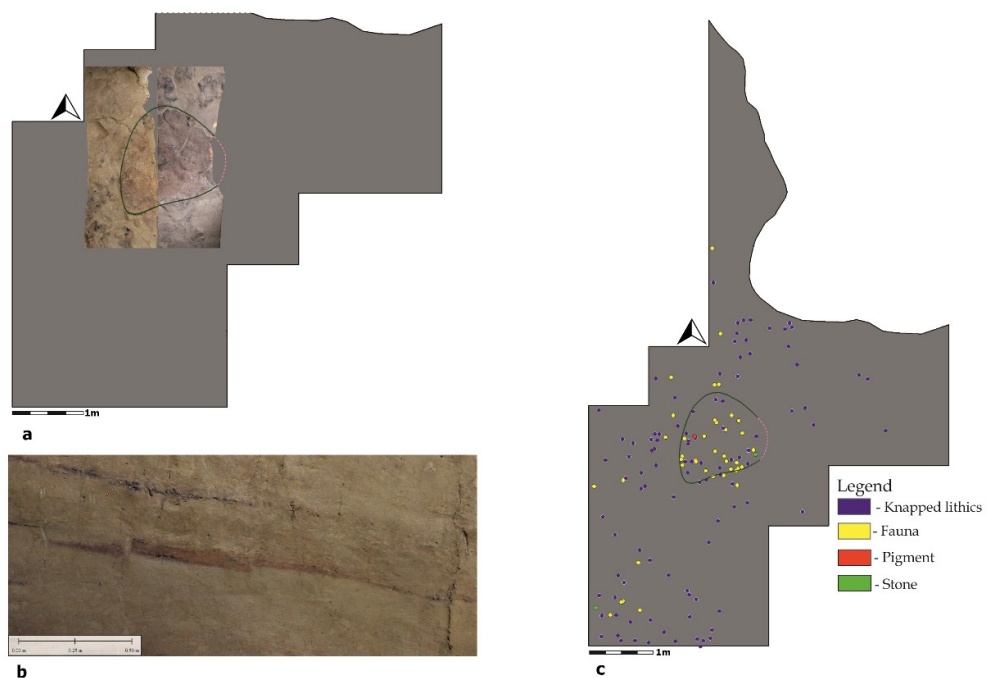
Pl. III. Details of combustion lenses (AH 3.0 and 3.1) at the base of unit G2 in Bistricioara-Lutărie III.



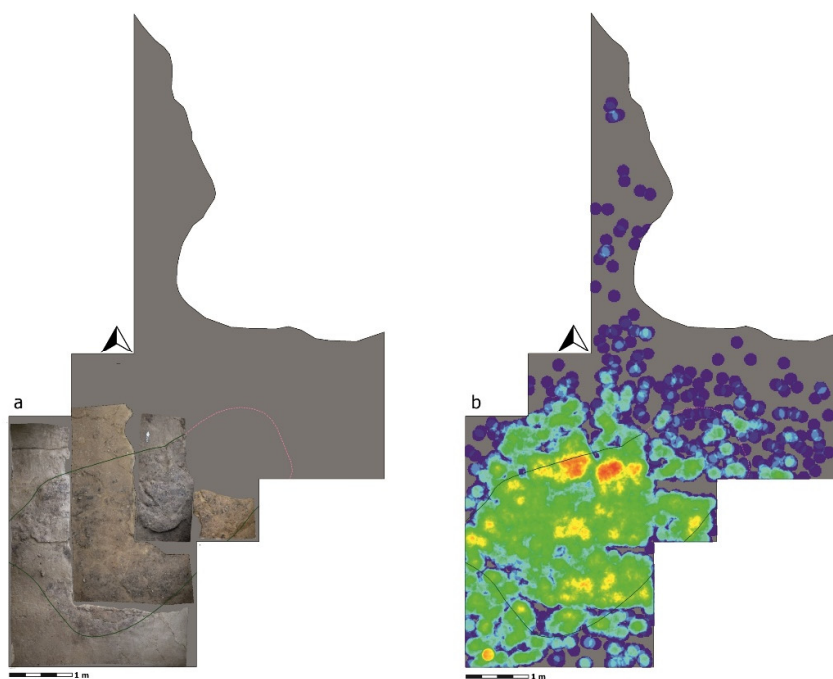
Pl. IV. Hearth with nearby pits (a) and artefact density map of AH 2.5 (b) in Bistricioara-Lutărie III.



Pl. V. Spatial distribution of knapped artefacts in AH 2.4 (a), oval upper hearth in AH 2.4 (b) and lower stone-lined hearth in AH 2.4 (c) in Bistricioara-Lutărie III.



Pl. VI. Multilayered hearth in AH 2.3 (a) with profile detail (b), and spatial distribution of finds in AH 2.3 in Bistricioara *Lutărie III*.



Pl. VII. Structure (a) and artefact density map of AH 2.2 (b) in Bistricioara-*Lutărie III*.