



Thinking Outside the Box at Open-Air Archeological Contexts: Examples From Loess Landscapes in Southeast Romania

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Stratified, well preserved sites preserving unambiguous geological and archeological data from which human-environmental interactions can be reconstructed, are rare. More commonly we must test our hypotheses based on extrapolation of the few available sites, particularly in regions with high sedimentation rates. Here we test the idea of aggregating “off-sites”—human traces which provide isolated evidence of activity in an area—to maximize the information which can meaningfully be extracted from Paleolithic open-air contexts. We present two case studies from the sediment-rich loess steppe of southeast Romania, Lipnița and Dealul Peșterica. Both off-sites preserve low density, undiagnostic lithic assemblages which may otherwise be overlooked in favor of more impressive sites. We constrain the timing of occupation at these two localities to c. 61 and 34–41 ka at Lipnița and Dealul Peșterica, and show that people were present near a river bank and on loess slopes respectively. Aggregation of data from the region suggests repeated visitation of riverine landscapes; additionally people likely ranged across landforms, particularly where raw material for making stone tools was plentiful. Our case studies demonstrate that empirical, incremental findings may still be generated from sites traditionally thought to be of little value. We argue that this approach is highly applicable to investigating the human implications for landscape context from archeological traces in sediment-rich, open-air situations.

Keywords: loess, archeological prospection, catena, Dobrogea, Romania, Danube

INTRODUCTION

In the investigation of interactions between people and their habitats over deep time, we seek a convergence of archives with which we can reconstruct past settings wherein ancient people lived, and gain insights into their survival strategies and adaptations under such conditions. This represents a manifold challenge. Sites may be rare, poorly preserved or fragmentary, evidence may be ambiguous, or sites may simply not yet have been discovered due to lack of survey efforts or challenging physical or political environments (Versaggi and Hohman, 2008; Verhagen et al., 2013; Iovita et al., 2014; Tourloukis, 2016). Optimal sites, which preserve uneroded, superposed

stratigraphic layers containing unambiguous geological and archeological data, occur seldom. All too often we are forced to test our hypotheses based on extrapolation from small numbers of key sites. This problem is particularly acute in regions with substantial sediment supply, where high sedimentation rates often obscure traces of human activity (e.g., Morgan et al., 2011; Romanowska, 2012; Krajcarz et al., 2016; Iovita et al., in press). The reconstruction of human-environmental interactions in such landscapes becomes a case of “finding a needle in the haystack”; conventional approaches involving the excavation, analysis and dating of previously identified or surveyed stratified deposits, are rarely feasible.

In cases when the information which can be extracted out of a landscape appears minimal or suboptimal, it pays to think “outside the box.” Here we consider the idea of “off-sites” (Bintliff, 2000), human traces which provide scattered, isolated or non-permanent evidence of activity in an area, as an alternative way to extract data. This approach offers an unprejudiced means of interpreting evidence which may not be optimal but nevertheless provides aggregate archeological and paleoenvironmental datasets, so producing incremental discoveries.

There are often compelling reasons for exploring challenging sediment-rich contexts for the information they provide about the human past. The lower Danube River basin provides a case in point. The Danube is, and has long been, a conduit for human migration and trade, from the Orient Express railway to the Byzantine and Ottoman invasions (e.g., Babinger, 1961; Stephenson, 1999), to the Neolithic expansions of the Holocene (Davison et al., 2006). The role of the Danube as a corridor for prehistoric humans into Europe remains an intriguing hypothesis. However, this concept is based on a small handful of sites at geographic endpoints of the proposed route (Conard and Bolus, 2003; Chu, 2018), coupled with paleoenvironmental data suggesting that the region represented a relatively mild refuge during glacial phases (Fitzsimmons et al., 2012; Obrecht et al., 2017). Substantial and widespread volcanic ash deposits in the lower Danube catchment (Anechitei-Deacu et al., 2014; Veres et al., 2013), deriving from the Campanian Ignimbrite eruption coeval with modern human arrival into Europe and projected Neandertal extinction (Fedele et al., 2008), have further sparked animated debate (Lowe et al., 2012; Fitzsimmons et al., 2013). Despite recent attempts to locate additional archeological sites in the Danube corridor (Richter et al., 2012; Sitlivy et al., 2012; Iovita et al., 2014; Chu, 2018; Hauck et al., 2018; Mihailović, 2020), optimal sites in the conventional sense have been few (Schmidt et al., 2013; Schmidt et al., 2020) and have added little to substantiate the Paleolithic corridor hypothesis.

The aim of this study is to examine whether aggregating data from off-sites provides a useful perspective on sites of apparent little value, adding aggregate data to our understanding of this highly strategic area. We focus on two localities in Dobrogea loess steppe, located east and south of the lower Danube **Figure 1B**. Rather than interpreting the sparse lithic assemblages occurring at these sites, we view the human implications for the landscape

context of their traces, and constrain the timing of human presence.

MATERIALS AND METHODS

Localities, Survey and Test Pits

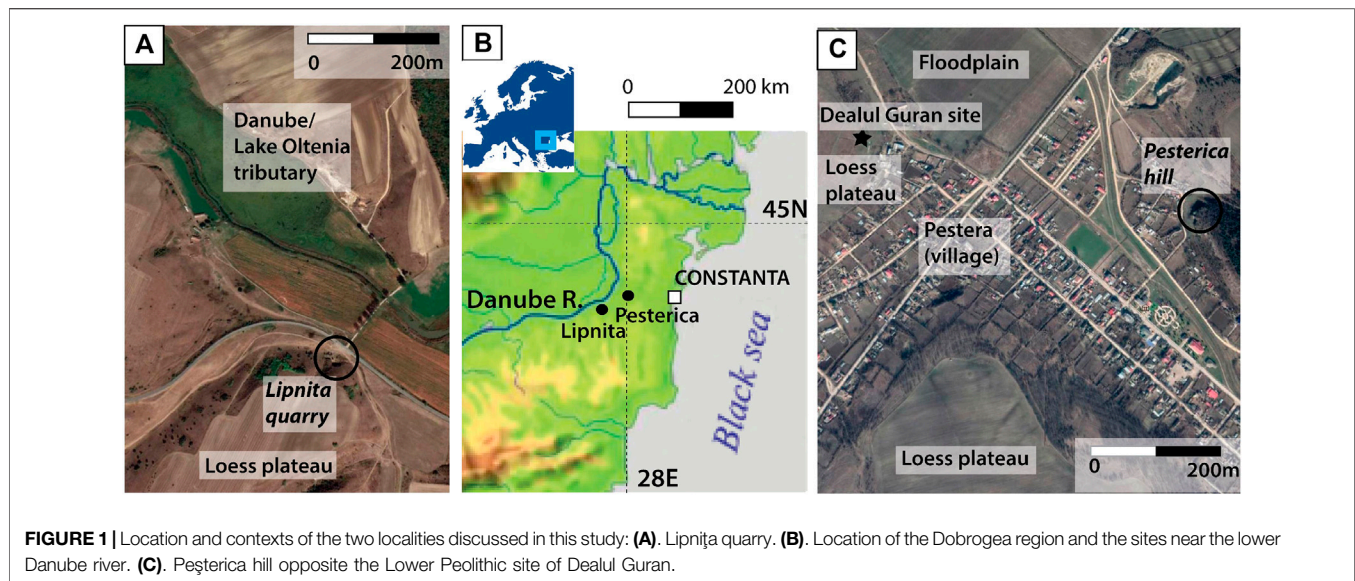
The two localities discussed here, Lipnița and Dealul Peșterica (DP), represent examples of archeological surveys undertaken in a landscape with thick sediment cover (Iovita et al., 2014). Small test pits (sondages) were dug to test the prospectivity of individual localities.

Lipnița is a new locality (Iovita et al., 2014), previously unknown in the archeological literature with the exception of Neolithic tumuli found within the village of the same name (Papasima, 1993). The locality is a north-facing loess quarry northeast of the village and immediately south of the presently dry lower catchment of the Suha Reka (Bulgarian: “dry river”), which at this point forms an ephemeral channel (Canaraua Fetii; Telteu and Zaharia, 2012) linking three lakes connected to the Danube River (**Figure 1A**). Lipnița lies at c. 30 m above sea level and 20 vertical meters above the Danube. Surface survey at this site identified a c. 50 cm diameter block of sediment which had detached from the lower part of the quarry profile. Since the consolidated block comprised two identifiable sediment types, its stratigraphic context could be related to the *in situ* sequence, providing confidence in the setting of two lithic fragments excavated from the block (**Supplementary Figures 1 and 2**). No sondages were dug at Lipnița since permits were not available.

DP is a previously reported site (Nicolăescu-Ploșșor et al., 1959; Păunescu et al., 1972; Păunescu, 1999) located in central Dobrogea, close to the watershed of a tributary flowing west into the Danube and adjacent the village of Pesterica (**Figure 1C**). The altitude of this location (c. 39 m above sea level) is comparable with that of Lipnița 40 km west-southwest. The Lower Paleolithic workshop site of Dealul Guran, which contains evidence for Upper Paleolithic exploitation of surface-exposed limestone flints (Iovita et al., 2012), is located on the hill opposite. The DP locality encompasses the west-facing hillslope and is a complex of small rockshelters, sandstone and limestone bluffs overlain by mixed loess and colluvium of variable thickness. Since lithic assemblages had been documented at this site and sediment had been removed from most of the exposed rockshelters through recent use, our study focused on Paleolithic hominin traces within the sediments. Four sondages were excavated in a transect along the slope to document catenary change in the sediments, stratigraphic marker horizons such as the Campanian Ignimbrite tephra, and the occurrence of lithic artifacts.

Lithic Finds

In this study we are primarily interested in the incidence of artifacts as evidence of human presence in the landscape. We summarize what is known about the lithic assemblages at the two sites in *Sedimentary Context of the Lipnița Locality, and Antiquity of the Lithic Fragments* and *Age and Sedimentary Context of the Dealul Peșterica Finds*.



At Lipnița, only the two flakes found within the sediment block were identified. Both were embedded within red pedogenic sediment near the underlying contact with the basal fluvial gravels. Both lithics had relatively fresh surfaces, but were otherwise undiagnostic. No other lithics were found near the profile or on the surface of the loess plateau.

At DP, 187 lithic pieces (including 70 tools) collected from the surface by Păunescu (1999) were analyzed by Doboș (2010). Most of the retouched tools are non-cortical simple scrapers and thereby undiagnostic, although 3% bear similarity to Levallois technology. Artifacts found within the DP test excavations were recorded individually using measuring tape.

Luminescence Dating

Luminescence dating was undertaken to constrain the antiquity of the localities in question and, additionally at DP, to gain insight into the potential for relationships between artifacts along the catena. At DP, samples were collected by driving 10 cm long, 4 cm diameter stainless steel tubes horizontally into the excavated walls as close as possible to *in situ* lithics. The sediments in the shallow sondages three and four were unsuitable for dating due to bioturbation and were therefore not sampled. At Lipnița, the block containing the lithic fragments was wrapped in plaster and transferred to the field station (Supplementary Figures 1 and 2), where the sediment was subsampled into blocks >10 cm in diameter for preparation in the laboratory. An additional, *in situ* tube sample was collected from the *in situ* lower red sediments directly in the profile at the stratigraphic equivalent of the block.

Samples were prepared for equivalent dose (D_e) measurement at the Max Planck Institute for Evolutionary Anthropology (Leipzig) under subdued red light. The sandy samples from Lipnița were processed to extract the 180–212 μm quartz fraction for single-grain analysis according to published protocols (Fitzsimmons et al., 2014). The loessic DP sediments were processed to extract the

4–11 μm fine-grained fraction; the polymineral component was extracted following published protocols (Iovita et al., 2012), from which subsamples were etched to extract purified quartz (Timar et al., 2010). Further details relating to sample preparation and measurement can be found in the Supplementary. Dose rates were calculated based on beta counting, high resolution germanium gamma spectrometry (measured at VKTA in Dresden), published alpha dose-rate values (Rees-Jones and Tite, 1997) and cosmic ray dose rate formulae (Prescott and Hutton, 1994).

RESULTS

Luminescence Dating at Dealul Peșterica and Lipnița

The quartz fine-grained samples from DP appear suitable for dating using the SAR protocol (Supplementary Figures 6 and 7; Supplementary Table 1) and yield OSL characteristics comparable with loess in the Dobrogea region (Timar et al., 2010; Fitzsimmons and Hambach, 2014; Constantin et al., 2015). By contrast, the polymineral fine-grained DP samples were less well suited to the pIR-IRSL protocol and likely subject to signal fading (further details in Supplementary). Consequently the pIR-IRSL age for the sondage one sample (EVA1192) is assumed to give a minimum estimate; quartz ages were used for the other DP samples (Table 1).

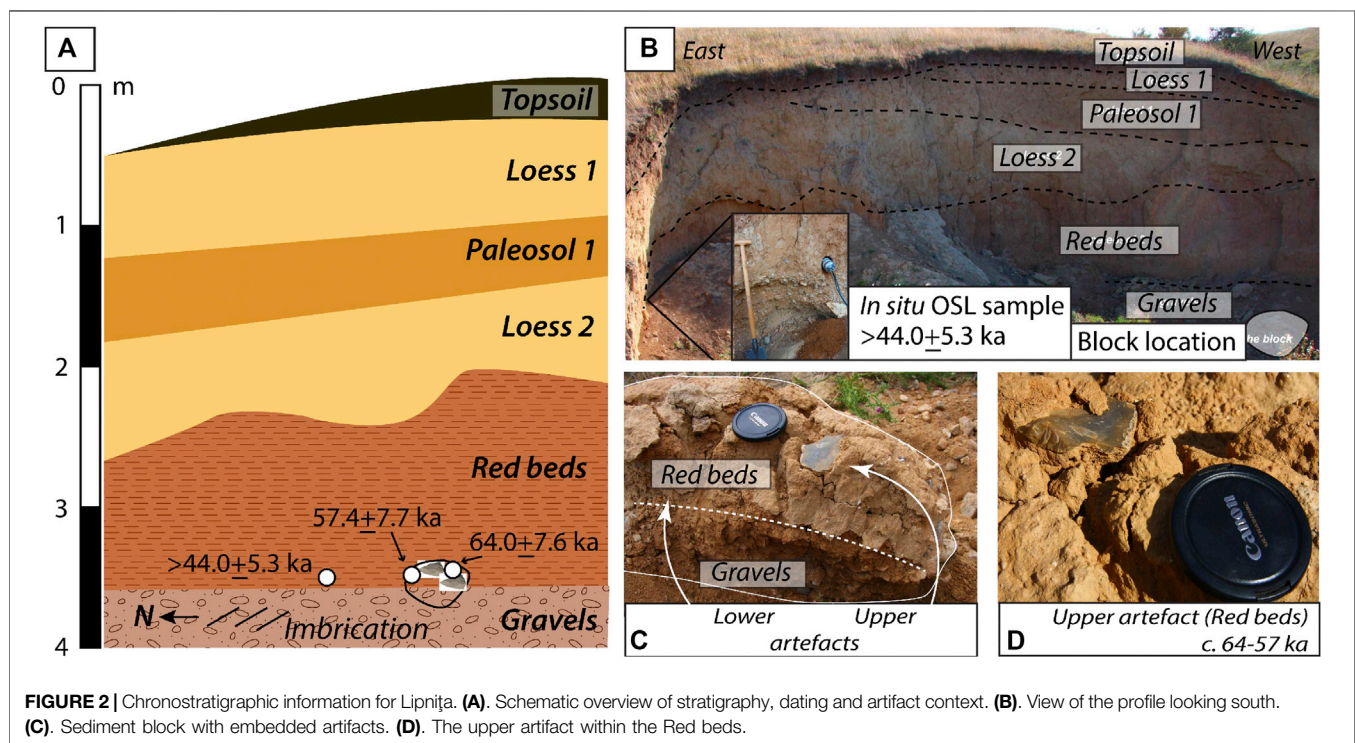
Sandy sediments from Dobrogea have rarely yielded reliable luminescence ages (Iovita et al., 2012; Anechitei-Deacu et al., 2014). However, the Lipnița quartz sands produced good results (see Supplementary Material) which may be explained by a difference in sediment source from those investigated previously.

Table 1 summarizes the luminescence ages for the two localities. At DP, the age of the unit containing the lithic finds

TABLE 1 | Luminescence dating supporting data and age estimates for the sondages at Dealul Peșterica and both block and *in situ* samples from Lipnița. Equivalent doses calculated using pIR-IRSL measurements on polymineral fine-grains (Buylaert et al., 2012) are shown in italics; those in plain text were measured using the SAR protocol on fine-grained quartz.

Sample code	Depth (m)	D_e (Gy)	Dose rates (attenuated; Gy/ka)				Age (ka)
			Beta	Gamma	Cosmic	Total	
Dealul Peșterica Sondage 1							
EVA1192	0.45 ± 0.05	172 ± 9	1.37 ± 0.14	0.99 ± 0.10	0.20 ± 0.03	3.33 ± 0.25	51.6 ± 4.7
Dealul Peșterica Sondage 2							
EVA1193	1.23 ± 0.05	142 ± 1	1.96 ± 0.20	1.27 ± 0.13	0.18 ± 0.01	3.91 ± 0.31	36.3 ± 2.9
EVA1194	0.87 ± 0.05	145 ± 2	1.99 ± 0.20	1.21 ± 0.12	0.19 ± 0.02	3.84 ± 0.28	37.8 ± 2.8
EVA1195	0.80 ± 0.05	145 ± 1	1.89 ± 0.19	1.22 ± 0.12	0.19 ± 0.02	3.76 ± 0.29	38.6 ± 3.0
Lipnița							
EVA1196	3.57 ± 0.10	144 ± 13 ^a	1.69 ± 0.17	1.03 ± 0.10	0.13 ± 0.01	3.28 ± 0.26	>44.0 ± 5.3*
EVA1197	3.57 ± 0.10	196 ± 21	1.77 ± 0.18	1.06 ± 0.11	0.13 ± 0.01	3.42 ± 0.28	57.4 ± 7.7
		221 ± 19					64.0 ± 7.6

^aSample EVA1196 was calculated as a minimum age.

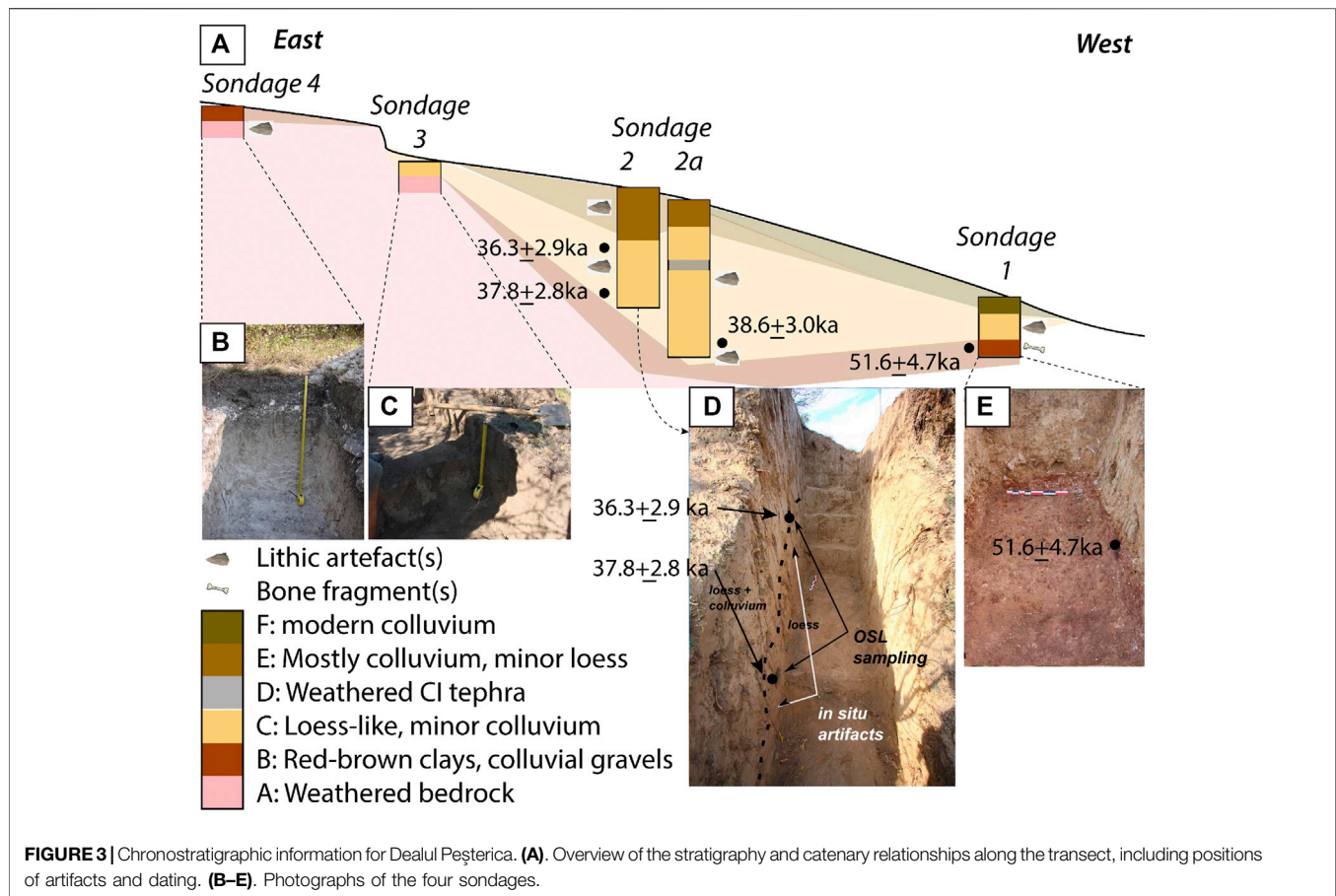


at sondage one is $<51.6 \pm 4.7$ ka; at sondage two the deposition of lithics can be constrained to c. 34–41 ka (1σ). The Lipnița artifacts are most likely c. 61 ka.

Sedimentary Context of the Lipnița Locality, and Antiquity of the Lithic Fragments

Lipnița is situated on the northern slope of a loess plateau adjacent the Suha Reka channel and its floodplain. Four major stratigraphic units, three of which include some degree of pedogenic development, are exposed within the profile (Figures 2A,B). Fluvial gravels at the base of the sequence include imbricated cobbles up to 7 cm diameter and indicate a northward flow direction, consistent with the present course of

the Suha Reka. The size of larger clasts indicates a higher energy river than exists presently. Fluvial clasts are dominated by quartz and limestone, including flint-bearing calcareous material (Petrov and Yankov, 2017), infilled with a reddish clayey silt matrix similar to the overlying unit which may have been deposited during the initial stages of its deposition. We describe the overlying reddish clayey silts as “Red beds” (to disambiguate from the term paleosol used in Iovita et al., 2014). These unconformably overlie the basal gravels and comprise massive reddish clayey silts, minor sands, gravels and cobbles with some pedogenic development. The Red Beds are likely to be predominantly water-lain, with some eolian input, and may originally be derived from remobilization of



Plio-Pleistocene clay-rich repositis found across the Danube Basin (Kovács et al., 2011). The Red Beds are unconformably overlain by two pale loess units, each with soil development, although there is nothing sufficiently distinctive about the loess or paleosols to justify correlation with the supra-regional stratigraphy (Fitzsimmons et al., 2012) without direct dating of the sediments. Unidentifiable bone fragments were observed at three places within the loess. The sequence at this locality indicates either progressive decrease in fluvial activity or lateral channel migration. The present-day ephemeral nature of the Suha Reka is due to deforestation within the catchment over 100 years ago; it now flows only during spring snow-melt or following major rainfall events (Telteu and Zaharia, 2012).

The two lithic fragments excavated from the block (Figures 2C,D) were found embedded within the Red beds just above the contact with the basal gravels. The profile sample yielded a minimum age of $>44.0 \pm 5.3$ ka, whereas the two subsamples collected from the block produced ages of 57.4 ± 7.7 and 64.0 ± 7.6 ka (Table 1). These ages fall within error of one another and indicate an antiquity for the lithics of c. 61 ka.

Age and Sedimentary Context of the Dealul Peșterica Finds

The hillslope surface at DP comprises several catenary sequences which assist in piecing together both stratigraphy and context of the archeological traces. The DP stratigraphy can be grouped into six stratigraphic units (Figure 3A; Supplementary Tables 5–9).

The underlying bedrock, comprising Cretaceous calcareous sandstones and limestones (Avram et al., 1993), is exposed between sondages 3 and 4, and was observed in weathered form at both test pits (Figures 3B,C).

At the top and bottom of the hill, the bedrock is overlain by clays of varying color (unit B), most likely representing a still more weathered, unconsolidated component of *in situ* regolith. At the top of the hill, this unit is pale, with a higher proportion of sand derived from the glauconitic sandstones. By contrast, unit B at sondage 1 is reddish-brown, with a higher clay component and substantial inmixing of slope-deposited colluvium. Genetically, however, the two are related and can be linked in a catena downslope. Lithics and raw material are scattered on the surface and within unit B at the top of the slope. While flint chips are common in unit B at sondage 1, none could be clearly attributed to human agency. Two undiagnostic bone fragments

were also found in Unit B. This unit dates to at least 51.6 ± 4.7 ka (Figure 3E).

The mid-slope is dominated by pale, massive beige loess-like sediment, thicker on the northern slope than on the west and south, with colluvial clasts of flint and sandy limestone increasing in density downslope. This unit (C) dominates the sondages at position 2, and is thinner, and more colluvium-rich, in sondages 1 and 3 due to slope aspect and position along the slope. Flint fragments were found at low density within this unit, including five which could be confidently attributed to human activity at sondage 2, and four in sondage 1. Three ages, spanning 38.6 ± 3.0 to 36.3 ± 3.9 ka (Figures 3A,D), indicate rapid deposition of sediment at this time. At a side trench (sondage 2a), a thin, discontinuous weathered tephra was observed, interpreted to be the Campanian Ignimbrite; its known age (39.28 ± 0.11 ka; De Vivo et al., 2001) lies within uncertainty of the OSL ages.

Unit C is overlain at sondage 2 by a darker beige stratum (unit E) comprising a mix of colluvium and loess, dominated by the former. Two lithics attributed to human activity were observed within this unit, although evidence for substantial bioturbation in unit E prevented reliable luminescence sampling. The uneven contact between Units C and E suggests a short-lived erosional event followed by increasing dominance of slope deposition. Mass movement continues on the lower slopes as demonstrated by c. 20 cm of modern colluvium at Sondage 1.

DISCUSSION

Human use of Riverine Landscapes, but Not as Early as Thought: Lipnița

According to conventional archeological thinking, the occurrence of two lithic artifacts at Lipnița barely qualifies it as a site, although the actual artifact density could be much greater following future excavation. Through the unprejudiced perspective of off-sites, we may draw a number of conclusions from Lipnița.

We may deduce that humans were present in the riparian landscape of the Suha Reka approximately c. 61 kyr ago. The artefact-bearing Red beds indicate a lower energy stream or swampy environment deposited during cool stadial conditions of marine isotope stage (MIS) 4, which succeeded a warm, wet interglacial. Transition from a high to lower energy stream is visible in the stratigraphy at Lipnița, and is compatible with reduced hydrologic activity associated with the MIS4 stadial. In southeastern Romania, there is evidence at this time for spatially discontinuous peaks in loess accumulation (Timar-Gabor et al., 2011; Vasiliniuc et al., 2011; Constantin et al., 2014; Fitzsimmons, 2017), although dust deposition at Lipnița initiated later.

The fresh surfaces of and lack of patina on the two lithics suggest that the artifacts were not fluviially transported but rather either discarded *in situ* (e.g., Delpiano et al., 2019), or transported only a very short distance. Given that flint cobbles up to 7 cm diameter are present in the basal gravels, it is possible that these provided the raw material for flake production, although flint outcrops are common in the karst gorge upstream.

The c. 61 ka age of the Lipnița lithics is younger than anticipated. The paleosol preserved between the two loess units bears similarity to MIS5 interglacial loess soils (Fitzsimmons et al., 2012), and Iovita et al. (2014) surmised that deposition of the Red beds, and their artifacts predated MIS5. In this respect we can only emphasize the importance of direct dating.

We cannot infer much more about human behavior in this area without further excavation, however we can aggregate information about the distribution of people across the landscape at a given time. Another open-air locality of similar antiquity, yielding ca. 1,300 surface lithics, is Cuza Vodă E (Păunescu, 1999), 60 km northeast of Lipnița. *In situ* lithic material at Cuza Vodă, also found at the contact with fluvial red beds, date to c. 95–55 ka (Iovita et al., 2014). Intriguingly, both environmental context and age are similar. Cuza Vodă site lies just north of the palaeo-Carasu River, another Dobrogea tributary of the Danube (Zaharia and Pisota, 2003). At this stage there are no other known localities of this age in Dobrogea, but incremental aggregation of datasets like these may eventually yield more useful information about human habitat preferences.

The Human Catena, and Life in Open-air Contexts: Dealul Peșterica

Unlike Lipnița, DP is a reported site with at least 70 tools, albeit very few of which resemble known technocomplexes (Doboș, 2010). Our sondages confirmed a further nine lithics altered by human agency along the slope, further establishing human presence in the area in the deep past. Through an orthodox archeological lens, however, the density of lithics is low and more consistent with an off-site. Considering these traces nevertheless provides new avenues for understanding human use of the landscape.

Here we invoke the catena concept for understanding the stratigraphy at DP, its archeological traces, and their antiquity. A catena is a sequence of soil profiles of varying characteristics that occur down a slope, and sometimes contains Paleolithic finds (Łanczont et al., 2015). At least two catenas can be identified at DP: units B and C. Unit B is discontinuous, since it was observed only at the top and bottom of the slope. We conclude that the bone and lithic fragments in unit B at the base of the hill, dated to 51.6 ± 4.7 ka (or possibly slightly older), are likely the same age as those found in its equivalent on the hilltop. Although none of the artifacts found *in situ* within this unit are recognisable tools, and they are certainly lithic manuports, it is interesting that the timing of deposition of this unit closely postdates human presence at Lipnița.

Greater meaning can be derived from in the overlying loessic unit C. The character of this unit likewise varies along slope, nevertheless its stratigraphic position remains consistent. We can argue that unit C dates to c. 41–34 ka, within interstadial MIS3. Furthermore, at least two visits by people—demonstrated by two lithics found below the tephra—shortly predate the Campanian Ignimbrite super-eruption which may have substantially impacted on people in the region (Fitzsimmons et al., 2013). As yet, there are few known archeological sites in Dobrogea dating to this time, with the exception of Cheia-La Izvor, which dates to c. 40 kcal BP (Păunescu, 1999). Most of the Paleolithic finds in Dobrogea

(>100 loci) derive from surface find spots, ranging from 1 to >100 pieces (Păunescu, 1999; Doboş et al., 2005; Iovita et al., 2014). The few sites with stratigraphy vary in assemblage size, depending on the site function. In the absence of ideal sites, an incremental approach which places human presence on the map (e.g., Delpiano et al., 2019) removes some uncertainty regarding human occupation at the gateway to Europe at this critical time.

Our approach allows tentative steps toward understanding the nature of Paleolithic mobility and taskscape (Ingold, 1993). The entire hillslope of DP yields evidence for human presence. Sub-millimeter air pockets within unit C at the mid-slope indicate rapid deposition; coupled with low artifact density, we may infer infrequent visitation of the area by people rather than continuous occupation. Examinations of vast surface records in Australia (Holdaway and Davies, 2019) and Egypt (Olszewski et al., 2010) have shown that many activities involving the use of stone tools takes place off-“site,” although such loci of activity are rarely captured in environments with high sedimentation rates. One could argue that rather than confining themselves to a defined occupational area, people ranged over landscape scales, particularly where raw material for making stone tools was plentiful (e.g., Iovita et al., 2012). Such observations, while intuitive, are rarely supported by evidence (but see Zerboni et al., 2015; Delpiano et al., 2019, for a similar case in northern Italy). At DP, we may start to build a case for this hypothesis.

Applicability of Off-Sites to Geoaerchology in Challenging Open-air Situations

In reality, few sites provide all details sought for meaningful integration between paleoenvironmental and archeological datasets. However, in the search for localities, information from less impressive, ephemeral contexts may be overlooked (see also Foley, 1981; Glauberman, 2006). Here we argue for more careful consideration of the latter. Understanding Paleolithic mobility at landscape scales requires both nodes of dense interaction (sites) and networks of taskscape traces (Rezek et al., 2020).

Using case studies from the understudied, yet highly strategic region of Dobrogea, we demonstrate that empirical, incremental conclusions may still be drawn from sites typically thought to be of little value. Geochronology is an essential tool both for marking the presence of people at key times and for refuting chronologies inferred from regional correlations. Particularly in sediment-rich open-air contexts, people likely ranged over large areas particularly when raw material for making stone tools was widespread as in Dobrogea. We suggest that aggregating information from off-sites can further help us understand the human implications for landscape context through their traces.

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DATA AVAILABILITY STATEMENT

The datasets generated by this study can be found in Edmond, the Open Access Data Repository of the Max Planck Society (<https://edmond.mpg.de>).

AUTHOR CONTRIBUTIONS

KF conceived of the presented ideas in this study; RI developed the Lower Danube Survey for Paleolithic Sites project as a whole. RI and AD oversaw the archeological fieldwork, which was undertaken by AD, MP, and RI. Interpretation of the archeological results was undertaken by AD and RI. KF undertook the geological fieldwork and laboratory analyses. KF wrote the first draft of the manuscript. All authors contributed to manuscript revision, read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feart.2020.561207/full#supplementary-material>

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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NOMENCLATURE

D_e equivalent dose

DP Dealul Peșterica (locality)

OSL Optically stimulated luminescence

pIR-IRSL Post-InfraRed InfraRed Stimulated Luminescence