Peer Community Journal
Section: Archaeology

Research article

Published
2025-04-23

Cite as
Sara Daffara, Carlo Giraudi, Gabriele L.F. Berruti, Sandro Caracausi and Francesca Garanzini (2025) *First evidence of a Palaeolithic occupation of the Po plain in Piedmont: the case of Trino (north-western Italy)*, Peer Community Journal, 5: e42.

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Peer-review
Peer reviewed and recommended by PCI Archaeology,
https://doi.org/10.24072/pci.archaeo.100421

First evidence of a Palaeolithic occupation of the Po plain in Piedmont: the case of Trino (north-western Italy)

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Volume **5** (2025), article e42

https://doi.org/10.24072/pcjournal.551

Abstract

The Trino hill is an isolated relief located in north-western Italy, close to Trino municipality. The hill was subject of multidisciplinary studies during the 1970s, when, because of quarrying and agricultural activities, five concentrations of lithic artefacts were recognized and referred to a Palaeolithic occupation of the area. During the 1980s and the 1990s, surface collections continued, but the lithic finds have never been subject of specific studies. Even if most of the lithic assemblages count a few lithic implements, four collection areas (3, 13 E, 13 W and 14) have significative lithic assemblages, representing the most important evidence of a Palaeolithic frequentation of the Po plain in north-western Italy. The present work, in the limits imposed by a surface and not systematic collection, propose a technological study of the lithic artefacts from the Trino hill, with the aim to define the main features of the technological behaviour of the human groups that occupied the area. The results obtained allow to clearly identify a Middle Palaeolithic occupation of the Trino hill, characterized by the exploitation of vein quartz and other local raw materials; allochthonous varieties of chert were used in the next frequentation phases to produce blades and bladelets. Even if part of the laminar production can be referred to Neolithic, most of that remains of indeterminate chronology and could be the result of both an Upper Palaeolithic and Neolithic human presence. The systematic and inclusive approach to the study of the Paleolithic of the Piedmont region proposed here has made it possible to obtain a first and realistic overview of the Paleolithic of the region. The methods used for the technological study are similar to those used for other sites in the region and have made it possible to link Trino's surface collections with data from sites systematically investigated in recent years.

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Peer Community Journal is a member of the Centre Mersenne for Open Scientific Publishing
http://www.centre-mersenne.org/

e-ISSN 2804-3871

Introduction

The characteristics and dynamics of the Palaeolithic frequentation of Piedmont (north-western Italy) and of the western part of the southern margin of the Alps are barely known. As of today, the only reliable data come from the Ciota Ciara cave (Borgosesia – VC) concerning Middle Palaeolithic (Daffara et al., 2014; Berto et al., 2016; Buccheri et al., 2016; Daffara, 2018; Angelucci et al., 2019) and from Castelletto Ticino – Via del Maneggio (NO) for Upper Palaeolithic (Berruti et al., 2017). The main aim of the proposed research is to contribute to the increasing of the knowledge about Middle Palaeolithic lithic technology from the western alpine region. When examinig the alpine and sub-alpine region (Figure 1), information regarding the Middle Palaeolithic is not uniform: for some areas such as northeastern Italy and the French side of the Alps where there are numerous and well-documented contexts, there are others where data are extremely scarce.

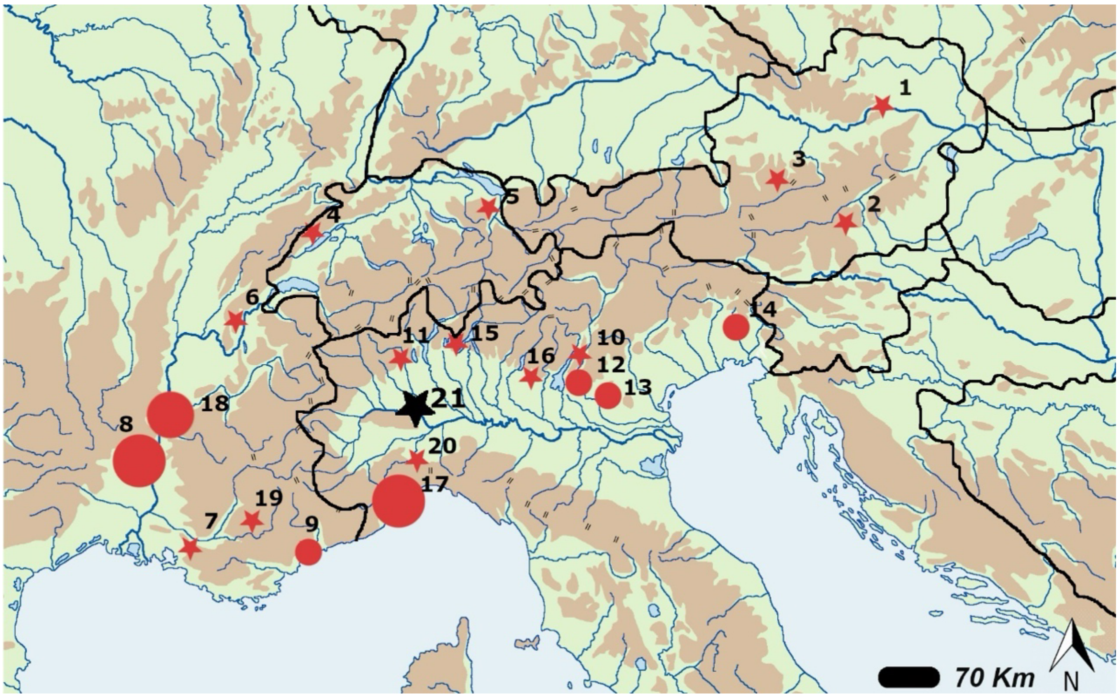


Figure 1 - Map showing the main Middle Palaeolithic sites of the alpine (brown) and sub-alpine region (green). The black star (21) indicates the location of the Trino area. Red stars indicate single sites; red dots indicates groups of sites; the size of the dots is proportional to the number of sites represented. Austria: (1) Gudenus cave (2) Repoulust cave; (3) Salzofen. Switzerland: (4) Cotencheler cave; (5) Wildkirchli cave. France: (6) Grotte Chenelaz; (7) La Combette; (8) Grotte Mandrin, Grotte de Néron, Abri Moula, Grotte du Figuier, Orgnac 3, Barasses II, Abri de Pêcheurs, St. Marcel; (9) Grotte du Lazaret (18) Abri du Maras, Payre, Baume des Peyrards, Bau de l'Aubesier; (19) Grotte de la Baume Bonne. Italy: (10) Monte Baldo; (11) Ciota Ciara cave; (12) Fumane cave; Tagliente rock-shelter; Mezzena rock-shelter; (13) San Bernardino cave, Stria Cave, Brojon rock-shelter, Nadale cave; (14) Rio Secco cave; Pradis caves; (15) Generosa cave; (16) Monte Netto; (17) Grotta del Principe, Madonna dell'Arma, Grotta di Santa Lucia superiore, Arma della Manie, Grotta del Colombo, Grotta delle Fate, Barma Grande; (20) Arma Veirana

North of the alpine chain, in Austria an Switzerland, few archaeological sites are known (Figure 1, numbers from 1 to 5 refers to most important and studied ones) (Bächler, 1940; Ehrenberg, 1958; Bernard-Guelle, 2004; Bednarik, 2008; Brandl et al., 2011; Cartonnet & Combier, 2018). A very different situation can be observed in France, in particular in the Rhône valley and the Mediterranean area on the bordering Italy. Dozens of Middle Palaeolithic sites (caves and rock-shelters) are known in these areas (in Figure 1 we illustrate just the most important ones, numbers 6, 7, 8, 9, 18 and 19) and the multidisciplinary studies carried out in the last decades demonstrate in detail the modalities of site-occupation, intra-site space organization, hunter-gatherer mobility, relationships among different sites and, in general, dynamics and changes of human frequentation of the area during Middle Palaeolithic (Slimak et al., 2004; Moncel, 2005; Fernandes et al., 2008; Moncel et al., 2008a; Moncel et al., 2008b; Slimak, 2008; Hardy & Moncel, 2011; Moncel & Daujeard, 2012; Daujeard et al., 2012, 2016; Mathias, 2016; Wilson et al., 2018; Daffara et al., 2019a) . The southern margin of the alpine region in northern Italy, show a similar scenario, with several Middle Palaeolithic sites in the eastern and in the Mediterranean area and just a few sites in the north-western regions (Figure 1). In the eastern Alps, caves and rock-shelters attest an intense occupation of the area during Middle Palaeolithic with an abundance of good-quality lithic resources outcropping at the lower margin of the alpine chain. Multidisciplinary studies show a quite clear and detailed knowledge about the modalities of occupation, mobility, strategies of exploitation of natural resources and technological behaviour for each of the main archaeological contexts (Figure 1) (Dalmeri et al., 2008; Giunti & Longo, 2010; Peresani, 2011; Peresani et al., 2011, 2014, 2019; Picin et al., 2013; Jequier et al., 2015; Arnaud et al., 2017; Delpiano et al., 2018; Berruti et al., 2020). The same can be said for the Mediterranean area of the Italian sub-alpine region, where several caves are known and have been systematically investigated during the 20th century and in the last decades (Figure 1, numbers 17 and 20) (Cauche, 2002, 2012; Eixea, 2018; Holt et al., 2019; Marciani et al., 2020).

On the other hand, the Middle Palaeolithic of the south-western margin of the Alps is poorly investigated. Besides some non-systematic surface collections known since the 19th century, systematic investigations rarely took place in this area. As of today this area has just four Middle Palaeolithic archaeological sites (Figure 1, n° 11, 15, 16, 21) (Fedele, 1985; Angelucci et al., 2019; Delpiano et al., 2019; Daffara et al., 2021).

Ciota Ciara cave (Figure 1, n° 11) in the Piedmont, has been under systematic excavation since 2009. These investigations resulted in chronological placement of the site occupation to the second half of Middle Pleistocene. Multidisciplinary research has also provided detailed understanding of the modalities of site occupation, as well as the techno-economic behaviour of the human groups frequenting the site (Daffara, 2018). Castelletto Ticino – Via del Maneggio represents the only Upper Palaeolithic lithic assemblage from systematic archaeological excavations that has recently undergone a new technological study ascribing the lithic industry to the Late Epigravettian (Berruti et al., 2017). Other evidence consist in patchy surface finds or archaeological excavations and surveys, mainly conducted with non-systematic methodologies (Fedele, 1976, 1990; Giacobini, 1976; D'Errico & Gambari, 1983; Giraudi & Venturino Gambari, 1983; Forno & Mottura, 1993; Mottura, 1994; Guerreschi & Giacobini, 1998).

The slow pace of the Palaeolithic studies in Piedmont is probably due to the perspective that the area was inhospitable during Pleistocene (Fedele, 1985), but in the last ten years, the new archaeological investigations at the Ciota Ciara cave peeked the interest in Palaeolithic studies with new research projects and the re-examination of old data (Rubat Borel et al., 2013, 2016; Berruti et al., 2016).

The present work concerns the technological study of the lithic assemblages found during survey activities carried out between the 1970s and the 1990s in the Trino area and in particular at *Rilievo Isolato di Trino* (RIT), a small hill located in the north western part of the Trino territory (Figure 2) and result of a sequence of Pleistocene fluvial terraces (GSQP, 1976). Today, these lithic assemblages represent the only considerable evidence of a Palaeolithic occupation of the Po plain in Piedmont. Even in the absence of clear stratigraphic data, and therefore of a precise chronological framework, the proposed analysis aims to outline the technological characteristics of Trino lithic assemblages. The location of the collection areas is known (Figure 2), however the original environment has been strongly affected by agricultural activities that destroyed most of the areas were lithic artefacts were collected. Considering the scarcity of data for this portion of the southern alpine arc, it is important to deal with the study of these lithic assemblages, currently representing the only evidence of a Palaeolithic occupation of this sector of the Po plain.

Based on a technological approach, the objective of this paper is to present a report of each lithic assemblage, update the knowledge about this area and discuss the importance of the considered lithic industries in the regional context. In fact, despite the importance of the Trino lithic assemblages in the field of Palaeolithic studies in north-western Italy, they have never been published in detail and no review have ever been reported since the original studies completed in the 1970s and concerning just a small part of the lithic industries of the Trino collection (Fedele, 1974; GSQP, 1976).

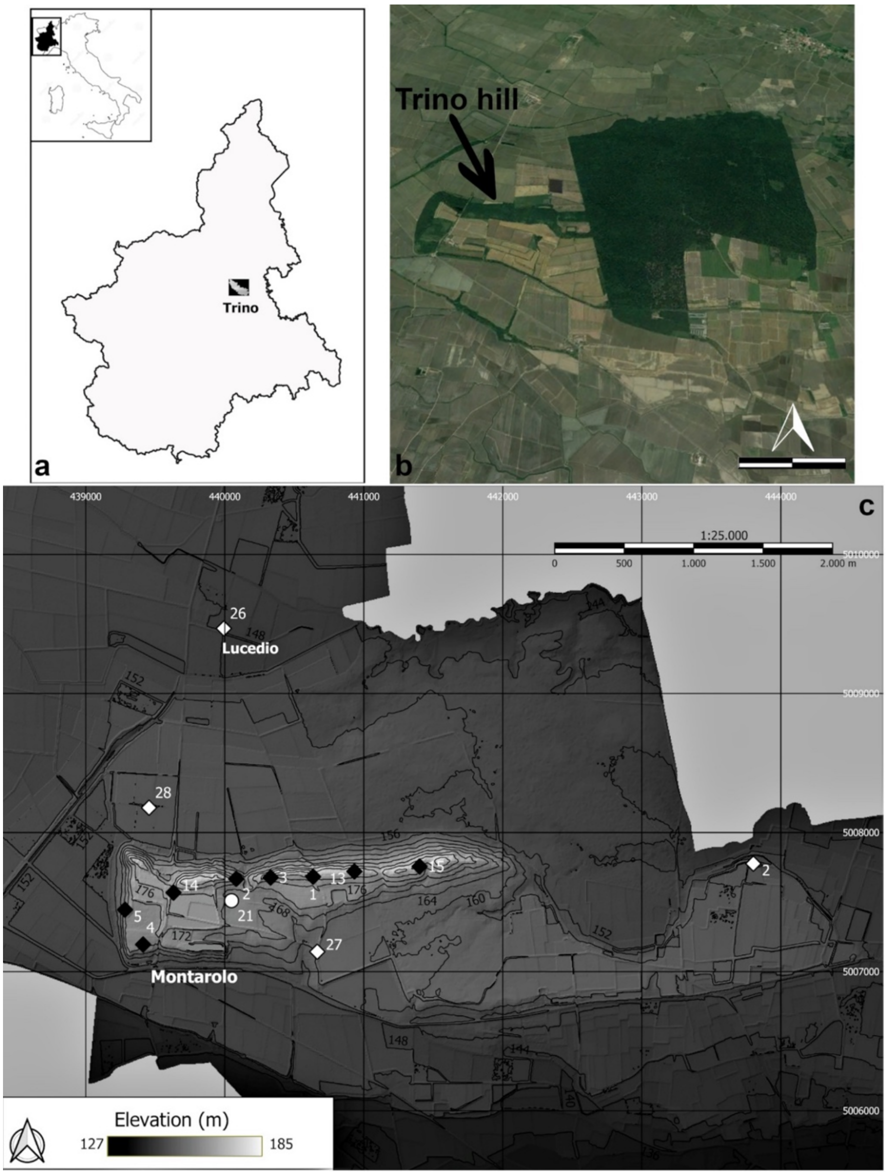


Figure 2 - Geographic location of Piedmont and Trino (a); aerial view of the Trino hill (modified from Google Earth) showing evidence of agricultural activity effecting the area in the last decades; the woods on the right is the natural reserve of *Bosco della Partecipanza* (the scale bar is 1 Km) (b); location of the areas where archaeological materials were collected (c): black squares = lithic assemblages; white squares = protohistoric, roman or Medieval archaeological materials (not considered in the present study); white dot = collection area of the bifacial tool recently found (Figure 3). The map has been created with QGIS software, using DTM 5 meters and it is based on "Geo Portale Piemonte" data set (http://www.geoportale.piemonte.it/geocatalogorp). The Geographic Coordinate Reference Systems are EPSG: 4326 – WGS 84. The numbering of the collection areas follows that of the maps present at Museum "*G. Irico*". Concerning the lithic assemblages, the location is not known for some of the collection areas reported in the text.

History of research and geologic setting

Research in the Trino area started in the 1970s when quarries and agricultural activity took place at the Trino hill. Terracing works over an area of about 200 m^2 in the north-eastern part of the hill affected different archaeological layers (Fedele, 1974). Geological surveys in 1974 recovered the first assemblage of lithic artefacts at the top of the hill; subsequent surveys collected approximately 300 artefacts from an area of about 90x20 m^2, named TR1. The first technological study demonstrated the homogeneity of the general state of preservation and the technological features of the assemblage. The technological features included intensive exploitation of local vein quartz, followed by chert of probable non-local provenience, and the presence of frequent cores and of Levallois technology. Based on technological criteria, different phases of human occupation were recognized and attributed to Middle and Upper Palaeolithic, while for some of the TR 1 (i.e., Trino area n°1) lithic artefacts a Lower Palaeolithic attribution was also proposed (Fedele, 1974). In the subsequent two years, systematic survey campaigns took place in the area and led to the identification of four other lithic assemblages (TR 2 = 10 lithic artefacts; TR 3 =30 lithic artefacts; TR 4 = 10 lithic artefacts; TR 5 = 2 lithic artefacts), in addition to the finding of further lithic artefacts from TR 1 (GSQP, 1976). Despite the presence of Levallois technology, an element that conventionally marks the beginning of the Middle Paleolithic, based on the preferential use of local raw materials (vein quartz) and the inaccurate appearance of the lithic production, the Trino assemblage was attributed mainly to the Lower Palaeolithic (GSQP, 1976).

In 2016, during the cataloguing of the archaeological materials at *Museo Civico G. Irico*, a huge lithic assemblage was found in the museum storage room. The assemblage is the result of further survey activities that took place in the last decades and that has never been considered for a technological study. Indeed, other concentrations of archaeological materials have been identified at the Trino hill and some of them consist of Palaeolithic lithic artefacts. What is known about these surface collections is that they were conducted by different people in different localities following agricultural activities that distrubed the hill in the last decades (personal communication by members of *TRIDINUM – Associazione per l'Archeologia, la Storia e le Belle Arti*). Of these collections we only sometimes have the approximate location of the area (Figure 2), but no indication of the criteria of collection protocols. During recent field leveling for a rice field, a 4-5 m thick stratigraphic succession was exposed in an area not previously excavated. In the lower part of the sediments, a shaped tool manufactured on metamorphic rock was found at the base of the exposed stratigraphy (Figure 3) (Daffara & Giraudi, 2020).

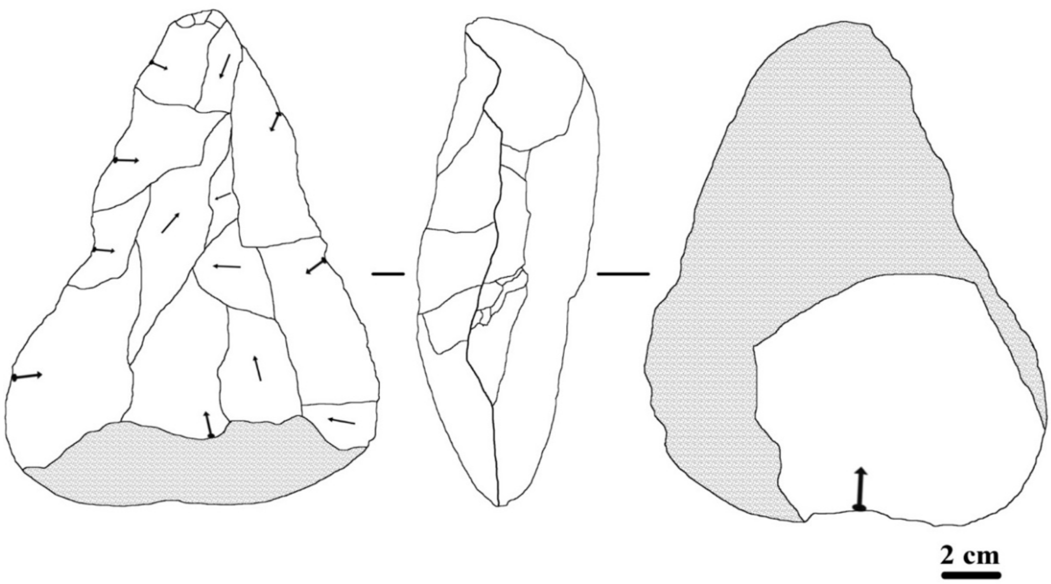


Figure 3 - Shaped tool on a metamorphic rock pebble recently found at the Trino hill (Figure 2 – white dot). One side show just one invasive removal aimed to the thinning of the base. On the other side big, invasive removals are visible in the mesial and distal portion, while the proximal part is a natural surface. (Daffara & Giraudi, 2020)

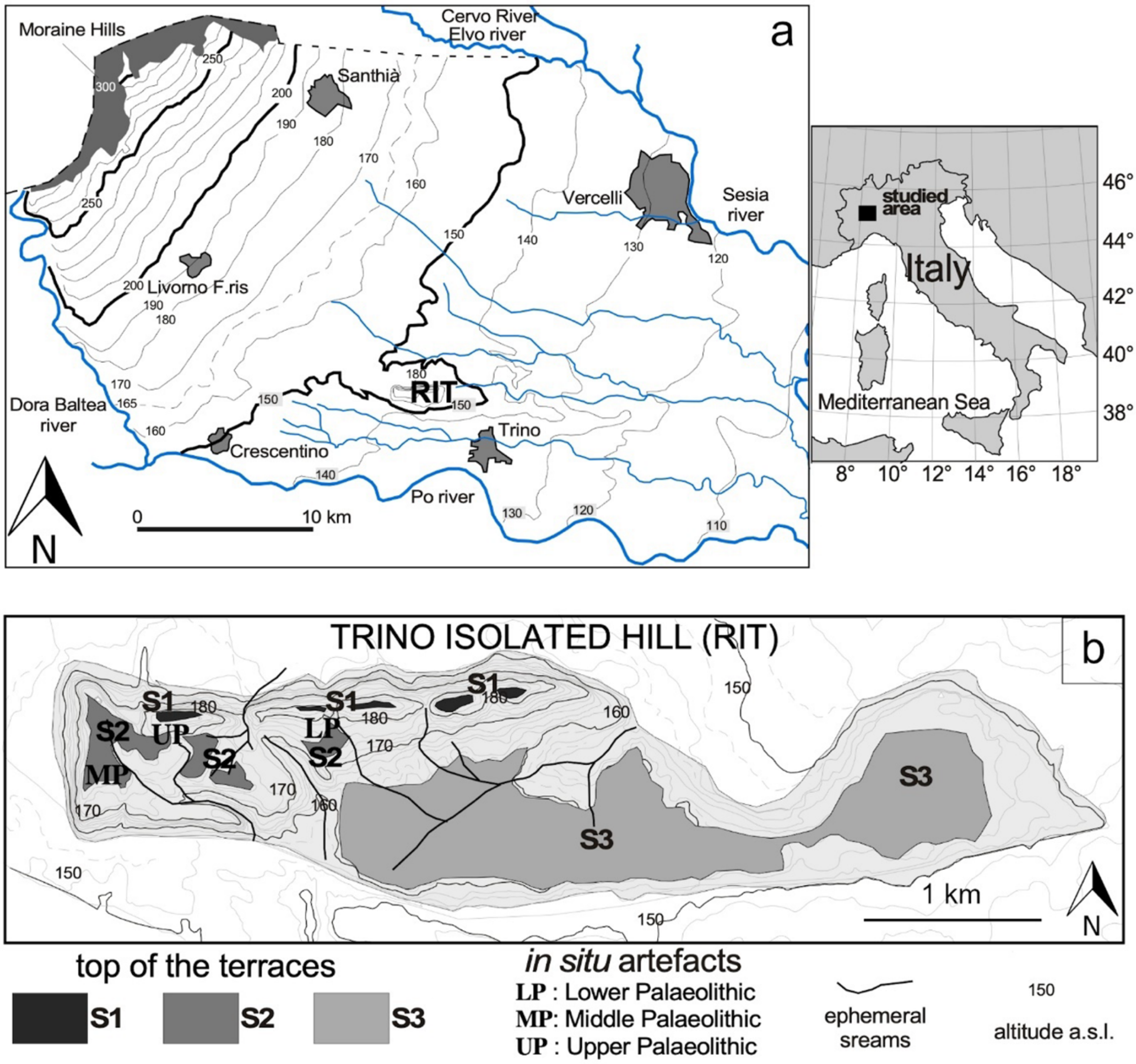


Figure 4 - (a) Topographic map of the Vercelli plain (NW Italy) with the location of the Trino hill (RIT); (b) the terraces that form the RIT and their shape. The artefacts indicated in the figure with Middle Palaeolithic (MP) and Upper Palaeolithic (UP) correspond to the collection areas of the 1970s and for which the exact location is known. Lower Palaeolithic (LP) refers to the recently found bifacial tool (Figure 3).

The Trino isolated hill (RIT) is a peculiar morphological feature present in the low Vercelli plain, reaching an altitude of about 190 m a.s.l., surrounded by fluvioglacial and fluvial terraces that reach maximum altitudes of 150-155 m a.s.l. (Figure 4). During the research carried out in the 1970s (GSQP, 1976), in which one of the authors (CG) took part, many artifacts were found. Most of the artifacts were collected in plowed soil and quarry materials, while a few artifacts were *in situ*, among the pedogenic aeolian sediments that form the top of the terraces.

Trino isolated hill is formed by a core of tertiary marine sediments, similar to those outcropping in the nearby Monferrato hills, covered by fluvioglacial and aeolian deposits (Servizio Geologico d'Italia, 1969; GSQP, 1976; Giraudi, 2014).

The fluvioglacial deposits of the RIT form three terraces (S1, S2, S3): of these terraces (Figure 4B), S1 is preserved in a thin and discontinuous ridge oriented W-E, S2 forms a wide area in the western RIT but it disappears towards the east, while S3 is much larger and limited to the eastern portion of the hill. While the western portion of the S1 and S2 areas of the RIT was subject to deforestation, levelling for agricultural use and quarrying, the easternmost portion does not show traces of recent anthropogenic impact as it has been occupied, since the Middle Ages, by the wood known as *Bosco della Partecipanza di Trino* (Figure 2). The quarrying operations and rice field levelling formed scarps exposing RIT stratigraphy. Furthermore, as part of ENEL's studies on the Po1 nuclear site (ENEL, 1984), cores with continuous sampling were drilled and a trench about 200 m long and about 7 m deep was dug on the higher surface of the RIT.

Sandy gravel and sand characterize the buried S1, S2 and S3 terraces, and exhibit different degrees of pedogenesis. Three levels of clearly distinguishable aeolian loess overlie the terraces surfaces with the oldest being a yellowish-red soil, the intermediate a brown soil, and the younger a yellowish-brown. Based on the correlation between fluvioglacial sediments and moraines (Carraro et al., 1991; Gianotti et al., 2008), formed by the Dora Baltea glacier, and their degree of pedogenesis, Giraudi (2014) determined that the deposits overlying the terraces S1, S2 and S3 of the RIT date back to the final phases of the Lower Pleistocene and to a part of the Middle Pleistocene (MIS 22 - 12, between 870.000 and 424.000 years ago). Similarly, according to the morphological and stratigraphic correlations between fluvioglacial and morainic deposits, developed by Giraudi (2014), also supported by the dating of volcanic minerals, the two oldest loess are chronologically attributable to the late Middle Pleistocene, while the youngest and more discontinuous was sedimented in the Upper Pleistocene. From the top to the bottom, the stratigraphy of the sediments visible in the scarp between S1, S2 and S3 is characterized by (Figure 5): 1) thin and discontinuous layers of the same loess present on the terraces top; and 2) mainly silty and sandy colluvium interbedded with gravelly-sandy; the colluvium is interfingered with the fluvioglacial deposits that form the terraces S2 and S3.

The shaped tool recently found at the base of the stratigrapic section exposed by agricultural activity (Figure 3) is the only lithic artefact that on technological and stratigraphic basis can be placed within a Lower Palaeolithic occupation of the Trino hill. The tool was found below the surface of the S2 terrace, not far from the base of the terrace scarp that separates it from S1, in a sandy gravel of fluvioglacial origin, colour red 2.5 YR from the Munsell Soil Colour Chart (MSCC) (Figure 5). From the top of this level the stratigraphy observed is the following:

- sand and gravelly sand of alluvial origin, with a colour between red 2.5 and yellowish red 5YR MSCC;
- lower silty loess, colour yellowish red 5 YR MSCC;
- compact clay that forms the infilling of a narrow erosion surface that cuts the oldest loess;
- intermediate silty loess, colour brown 7.5 YR MSCC, like that which, in other exposures, contains, near the bottom and the top, Middle Palaeolithic artefacts;
- upper silty loess, colour yellowish brown 10 YR MSCC, like that which, in other exposures, contains Upper Palaeolithic artefacts;
- silt that fills a small incision that cuts the upper loess.

According to the known chronology (Servizio Geologico d'Italia, 1969; GSQP, 1976; ENEL, 1984; Giraudi, 2014), the age of the sandy gravel containing the shaped tool, that is, the age of the sandy gravel that form S3 terrace, is between 870.000 years ago (MIS 22 – beginning of the sedimentation of the gravels) and 478.000/424.000 years ago (MIS 12).

In the 1970s, Middle Palaeolithic artefacts (RIT 4 – the artefacts are not yet present at the museum but were analysed by GSQP, 1976) were found *in situ* in a quarry located in the western area of the S2 surface (Figure 4). The stratigraphic sequence (Figure 5) consists of (from the bottom to the top):

- medium and fine sandy gravel, strongly weathered, colour red 2.5 YR MSCC, 1-2 m thick;
- lower silty loess, yellowish-red 5 YR MSCC, about 3 m thick;
- intermediate silty loess, brown colour 7.5 YR MSCC, with a maximum thickness of about 1 m.

Middle Palaeolithic lithic artefacts were found both in the lower and in the upper part of the intermediate loess. According to the stratigraphic position, the lower loess is earlier than MIS 6 and is possibly attributable to MIS 8 (300.000-243.000 BP), while the age of the intermediate loess is between MIS 6 and MIS 4.

Upper Palaeolithic tools (RIT 1, 2 and 3) were found in a small outcrop located on the S2 surface (Figure 4), near the base of the scarp on the S1 terrace (Figure 5). The stratigraphic sequence, from the bottom to the top is the following:

- weathered silty loess, brown 7.5 YR MSCC that can be correlated to the intermediate loess described above;
- upper loess, i.e. a discontinuous layer lying on the intermediate loess with a maximum thickness of about 30 cm, slightly pedogenic, yellowish-brown 10 YR MSCC.

Lithic artefacts attributed on a techno-typological basis to the Upper Palaeolithic were found in the upper loess (Figure 5) that can be dated to the Upper Pleistocene, probably MIS 3-2.

Neolithic artefacts have never been found in a clear stratigraphic position.

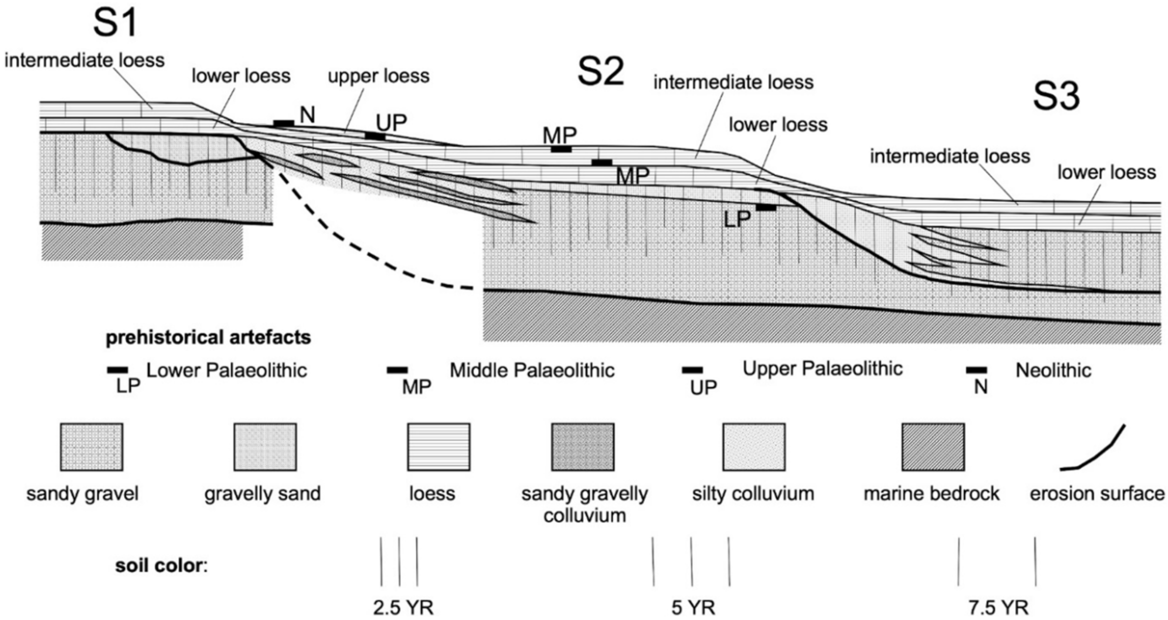


Figure 5 - Schematic section of the terraces of the Trino hill with stratigraphic position of the bifacial tool (LP) and of the Middle and Upper Palaeolithic artefact found during the investigations completed in the 1970s

Materials and Methods

Materials

The lithic assemblages with a total of 1964 items that are currently located at the *Museo Civico G.Irico* (Trino, VC) are the subject of the present technological study. The assemblages originate from uncontrolled surface collections made in the last few decades on the Trino hill and other locations within the Trino municipality (Table 1). The different collection areas are named with a progressive number preceded by the acronym “RIT”. All the other localities listed in Table 1 are placed in the immediate surroundings, but the precise location of the areas where lithics were collected is unknown. Although these localities are not located on the Trino hill, it seemed appropriate to include their materials in the study so as to provide for the first time a complete picture of the lithic industries found in the Trino area.

Sites from RIT 1 to RIT 4 correspond to the collection areas documented in the 1970s. A portion of the lithic assemblages from RITs 1 and 4—which once contained over 300 and 10 objects, respectively—are no longer at the Museum, and we haven't been able to determine why they are absent from the collection; because of this, it has not been possible to deal with a complete technological study of this assemblages. The 83 lithic artefacts here considered for RIT 1 are a small part of the original lithic assemblage, while for RIT 4 just one lithic artefact is still kept in the Museum. On the other hand, the lithic assemblages from RIT 2 and 3 that, after the collections completed in the 1970s, were composed by 10 and 30 findings respectively, have had an increase thanks to the surface collections carried out in recent years and currently count 19 and 137 lithics respectively (Tab. 1).

Table 1 - General composition of the considered lithic assemblages grouped by collection area. RIT (= Rilievo Isolato di Trino). RIT X includes the lithic artefacts from the Trino hill, but without any precise information about the location of the collection area. Name sites not preceded by "RIT" refers to localities in the surroundings of the Trino hill: B.P.T. = Bosco della Partecipanza; C.A. = Cascina Ariosa. The available documentation about the location of the different collection areas does not allow to refer each of them to a specific terrace of the Trino hill.

Locality		Cores	Flakes/ Blades	Core maintenance	Retouch flakes	Retouched tools	Debris	Polished axes	Tot.
RIT 1	N°	8	52	5	3	6	9	-	**83**
	%	9.6%	62.7%	6.0%	3.6%	7.2%	10.8%	-%	4%
RIT 2	N°	-	16	1	-	1	1	-	**19**
	%	-%	84.2%	5.3%	-%	5.3%	5.3%	-%	**1.0%**
RIT 3	N°	11	110	5	2	3	6	-	**137**
	%	8.0%	80.3%	3.6%	1.5%	2.2%	4.4%	-%	**7.0%**
RIT 4	N°	1	-	-	-	-	-	-	**1**
	%	100%	-%	-%	-%	-%	-%	-%	**0.1%**
RIT 7	N°	-	5	-	-	-	1	-	**6**
	%	-%	83.3%	-%	-%	-%	16.7%	-%	**0.3%**
RIT 8	N°	-	12	-	-	-	-	-	**12**
	%	-%	100%	-%	-%	-%	-%	-%	**0.6%**
RIT 10	N°	1	-	-	-	-	-	-	**1**
	%	100%	-%	-%	-%	-%	-%	-%	**0.1%**
RIT 13 E	N°	12	75	18	2	7	8	-	**122**
	%	9.8%	61.5%	14.8%	1.6%	5.7%	6.6%	-%	**6.2%**
RIT 13 W	N°	13	100	4	1	2	1	-	**121**
	%	10.7%	82.6%	3.3%	0.8%	1.7%	0.8%	-%	**6.2%**
RIT 14	N°	63	960	150	19	41	87	-	**1320**
	%	4.8%	72.7%	11.4%	1.4%	3.1%	6.6%	-%	**67.2%**
RIT 15	N°	2	10	-	-	-	1	-	**13**
	%	15.4%	76.9%	-%	-%	-%	7.7%	-%	**0.7%**
RIT 16	N°	-	4	2	-	-	1	-	**7**
	%	-%	57.1%	28.6%	-%	-%	14.3%	-%	**0.4%**
RIT X	N°	3	28	1	-	6	-	-	**38**
	%	7.9%	73.7%	2.6%	-%	15.8%	-%	-%	**1.9%**
CASOTTO DIANA	N°	2	25	-	1	-	-	-	**28**
	%	7.1%	89.3%	-%	3.6%	-%	-%	-%	**1.4%**
CANTONE	N°	-	-	-	-	-	-	1	**1**
	%	-%	-%	-%	-%	-%	-%	100%	**0.1%**
B.P.T.	N°	6	10	9	-	1	7	1	**34**
	%	17.6%	29.4%	26.5%	-%	2.9%	20.6%	2.9%	**1.7%**
C.A.	N°	2	13	1	-	-	-	-	**16**
	%	12.5%	81.3%	7.7%	-%	-%	-%	-%	**0.8%**
RONSECCO	N°	-	-	-	-	2	-	1	**3**
	%	-%	-%	-%	-%	66.7%	-%	33.3%	**0.2%**
TRICERRO	N°	-	-	1	1	-	-	-	**2**
	%	-%	-%	50.0%	50.0%	-%	-%	-%	**0.1%**
Total	N°	**124**	**1420**	**197**	**29**	**69**	**122**	**3**	**1964**
	%	**6.3%**	**72.3%**	**10%**	**1.5%**	**3.5%**	**6.2%**	**0.2%**	**100.0%**

Methods

The Trino hill lithic assemblages are studied following the *chaîne opératoire* approach, including all the technical procedures necessary to satisfy specific needs and implemented by the knappers according to their own skills (Leroi-Gourhan, 1964; Tixier, 1978; Pelegrin et al., 1988; Geneste, 1991). Cores are analysed considering the number of flaking surfaces, the presence or not of a hierarchical configuration of the surfaces and the direction of the detachments. The description of S.S.D.A. (*Système par surface de débitage alterné,* i.e. each platform created by one or more previous removals in turn serves as a striking surface for a new unipolar series of flakes) and opportunistic cores is based on Forestier (Forestier, 1993) and on Carpentieri & Arzarello (2022).

The Levallois and discoid methods are identified and described according to the criteria defined by Boëda (1993, 1994) and considering further works regarding their variability and definitions (Dibble & Bar-Yosef, 1995; Chazan, 1997; Peresani, 2003; Lombera-Hermida et al., 2016; Moncel et al., 2020). The analysis of laminar cores and products refers to Tixier et al. (1984) and Pelegrin (2000). For flakes, different technological features have been considered: presence and position of natural surfaces (cortex, neocortex), characteristics of the butts, sizes, direction of the negatives on the dorsal face, presence of knapping accidents, presence and characteristics of retouch. The identification of the knapping technique is based upon the criteria listed by Inizan et al. (1995). For vein quartz artefacts we refer to specific works about the identification of the knapping scars and rate and modalities of fragmentation (Mourre, 1996; Colonge & Mourre, 2006; Di Modica & Bonjean, 2009; Lombera-Hermida, 2009; Tallavaara et al., 2010; Driscoll, 2011; Manninen, 2016). Retouched tools are distinguished following Bordes (1961) typological list. The term debris is here referred to lithics with traces of knapping scars but whose role in the *chaîne opératoire* cannot be determined, regardless their size.

The surface nature of Trino hill assemblages, required that the first step in the analysis define a set of criteria useful to assign each lithic artifact to a proper time period (Figure 6). The knapping methods and techniques are useful characteristics for temporal differentiation of lithic assemblages. Even if opportunistic, S.S.D.A. and discoid reduction strategies are documented from Lower Palaeolithic to Bronze age (Carbonell et al., 1999; Peresani, 2003; Vaquero & Carbonell, 2003; Stout et al., 2010; Picin & Vaquero, 2016), including other criteria such as raw material, enabled us to assign the Trino assemblages to general time periods.

Typological characteristics were used for retouched tools as a chronological indicator. Following these criteria, we define the Middle Palaeolithic on the basis of Levallois method, discoid and opportunistic/S.S.D.A. cores and flakes obtained through direct hard hammer percussion and manufactured from local raw materials (e.g., vein quartz). As shown in the Results section, chert is mainly exploited through laminar method: we can then assume that the presence of this raw material in the assemblage is linked to the most recent occupation of the area. Chert artefacts manufactured by Levallois reduction strategies are also placed in the Middle Palaeolithic assemblage, while the attribution to this chronology for discoid and opportunistic chert implements is uncertain even if based on the identification of similarities in technologies between these artefacts and those absolutely belonging to Middle Palaeolithic. According to the data available, in Piedmont the exploitation of vein quartz appears to be strongly linked to Middle Palaeolithic (Daffara et al., 2023). This certainly does not derive from the lack of knowledge of other raw material sources, since it is known, especially at Ciota Ciara, that the exploitation of radiolarites from nearby Lombardy (about 35 km) occurred during the same period (Daffara et al., 2019b). Our hypothesis is that during the Middle Palaeolithic human groups moved between Piedmont and Lombardy; during the probable seasonal movements towards Piedmont, a region lacking in outcrops of good quality lithic raw materials, some tools/cores of Lombard radiolarite were transported. During occupation of Piedmont sites the dominant lithic raw material becomes vein quartz since it is the lithic resource that is most available locally. In contrast, the scant data available at the regional scale from the Upper Palaeolithic indicate a strong increase in the presence of imported raw materials from Lombardy and other neighbouring areas while vein quartz becomes a secondary lithic resource (Daffara et al., 2023). We do not have enough information to make concrete assumptions, but it is possible to speculate that in the transition between Middle and Upper Palaeolithic, Piedmont regional and interregional mobility changed substantially making the exploitation of imported raw materials more favourable. This does not mean that vein quartz stopped being exploited in Piedmont from the Upper Paleolithic onward, but its presence becomes sporadic. Our hypothesis that vein quartz exploitation is related to the Middle Palaeolithic is to be considered valid only for the regional context under consideration and cannot be generalized.

Laminar cores and products have been referred to Neolithic when realized through the pressure technique or on a typological basis (e.g., sickle elements). Laminar cores and products cannot be referred to a specific chronology and they have been assigned to occupation of the area from Upper Palaeolithic to Neolithic. Also with regard to laminar production by direct percussion, the technological characteristics of the cores and products found at Trino allow us to rule out their attribution to the Middle Palaeolithic (Révillion, 1995; Blaser et al., 2012; Fontana et al., 2013; Peresani et al., 2013). Upper Palaeolithic is clearly recognizable just on a typological basis (i.e., retouched tools); therefore, its importance could have been underestimated.

For the aim of this work, we decided to present a complete technological study for the assemblages with at least one hundred lithic artefacts, while smaller assemblages as well as sporadic findings are described in the text to give a complete picture of the Trino area, but the interpretation of the general technological features is based on the most abundant lithic assemblages.

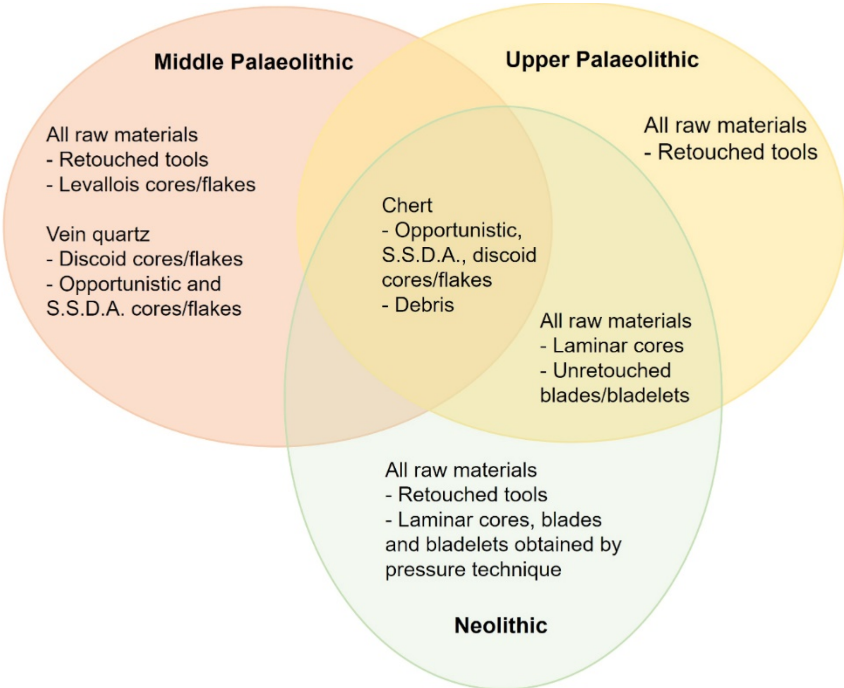


Figure 6 - Graphical representation of the criteria used for the study of the lithic artifacts from Trino

Results

The Trino hill lithic assemblages, general overview

According to Fedele (Fedele, 1974; GSQP, 1976), the first lithic assemblages of Rilievo Isolato di Trino were collected in situ and slightly affected by the terracing activities that exposed archaeological levels (they correspond to the assemblages RIT 1, RIT 2, RIT 3 and RIT 4). No precise data are available concerning the lithic assemblages collected in subsequent years, but it is likely to suppose that the collections took place following further agricultural activity (personal communication by members of TRIDINUM – Associazione per l'Archeologia, la Storia e le Belle Arti). It can be assumed that the circumstances of these last surface collections are like those in the 1970s, with archaeological layers affected by terracing or quarry activities. This hypothesis is supported by the post depositional surface modifications present on the lithic artefacts (Table 2): pseudo-retouch and other alterations of mechanical origin are rare (10 findings – 0.5%), thus suggesting that the agricultural and the quarry activities did not cause intense re-modeling of the archaeological materials. Most of the surface alterations are due to water circulation and are represented by roundings and white patina. On the other hand, 51.1% of the lithic implements do not show strong post depositional surface modification (Table 2 - NA).

Thermal alteration is present on chert implements, mainly those from laminar knapping methods, thus of Upper Palaeolithic or Neolithic occupations of the area.

The vein quartz of local origin is predominant in all the lithic assemblages (75,6%), followed by non-local raw materials, such as radiolarite and different kinds of chert, representing 7.8% and 15.4% of the total, respectively. Other allochthonous sedimentary and volcanic rocks have been exploited to produce flakes, blades and polished axes, such as jasper (0.4%), limestone (0.3%), porphyry, quartzite and various metamorphic rocks (0.6%). Due to post depositional alterations, the raw material of a a small portion of the lithic artefacts (0.5%) is undetermined (Table 3).

Looking at the general composition of the lithic assemblages from Trino (Table1), i.e., presence of cores, knapping products, mangement/shaping flakes and some debris, it seems that for the main collection areas (RIT 3, RIT 13 E, RIT 13 W and RIT 14), the reduction sequences can be considered as complete. The presence of several cores, debris and core maintenance flakes, knapping is assumedd to have taken place in the area. Dealing with surface collection, the composition of the lithic assemblage is strongly affected by the visibility conditions and by other factors that are not easy to quantify (Schiffer et al., 1978; Banning et al., 2017): for example, the amount of debris and small flakes is probably underrepresented.

Table 2 - Post depositional surface modifications present on the lithic assemblages from Trino, grouped by collection areas. WP = white patina; R = roundings; P = pseudo-retouch; TA = thermal alteration; NA = no alterations

Locality		WP	WP+R	WP+P	WP+TA	R	R+P	P	TA	TA+R	NA	Tot.
RIT 1	N°	7	-	-	-	17	-	1	2	-	56	**83**
	%	8.4%	-%	-%	-%	20.5%	-%	1.2%	2.4%	-%	67.5%	
RIT 2	N°	1	-	-	-	7	-	-	-	-	11	**19**
	%	5.3%	-%	-%	-%	36.8%	-%	-%	-%	-%	57.9%	
RIT 3	N°	4	2	1	-	42	-	-	1	1	86	**137**
	%	2.9%	1.5%	0.7%	-%	30.7%	-%	-%	0.7%	0.7%	62.8%	
RIT 4	N°	-	-	-	-	1	-	-	-	-	-	**1**
	%	-%	-%	-%	-%	100%	-%	-%	-%	-%	-%	
RIT 7	N°	-	-	-	-	2	-	-	-	-	4	**6**
	%	-%	-%	-%	-%	33.3%	-%	-%	-%	-%	66.7%	
RIT 8	N°	1	-	-	-	4	-	-	-	-	7	**12**
	%	8.3%	-%	-%	-%	33.3%	-%	-%	-%	-%	58.3%	
RIT 10	N°	-	-	-	-	-	-	-	-	-	1	**1**
	%	-%	-%	-%	-%	-%	-%	-%	-%	-%	100%	
RIT 13 E	N°	8	-	-	-	57	-	2	1	-	54	**122**
	%	6.6%	-%	-%	-%	46.7%	-%	1.6%	0.8%	-%	44.3%	
RIT 13 W	N°	1	-	-	-	36	-	-	-	-	84	**121**
	%	0.8%	-%	-%	-%	29.8%	-%	-%	-%	-%	69.4%	
RIT 14	N°	52	9	3	1	613	6	6	12	-	618	**1320**
	%	3.9%	0.7%	0.2%	0.1%	46.4%	0.5%	0.5%	0.9%	-%	46.8%	
RIT 15	N°	-	-	-	-	7	-	-	-	-	6	**13**
	%	-%	-%	-%	-%	53.8%	-%	-%	-%	-%	46.2%	
RIT 16	N°	-	-	-	-	1	-	-	1	-	5	**7**
	%	-%	-%	-%	-%	14.3%	-%	-%	14.3%	-%	71.4%	
RIT X	N°	3	-	-	-	13	1	-	-	-	21	**38**
	%	7.9%	-%	-%	-%	34.2%	2.6%	-%	-%	-%	55.3%	
CASOTTO DIANA	N°	-	-	-	-	18	-	-	-	-	10	**28**
	%	-%	-%	-%	-%	64.3%	-%	-%	-%	-%	35.7%	
CANTONE	N°	-	-	-	-	-	-	-	-	-	1	**1**
	%	-%	-%	-%	-%	-%	-%	-%	-%	-%	100%	
B.P.T.	N°	3	1	-	-	4	-	-	-	-	26	**34**
	%	8.8%	2.9%	-%	-%	11.8%	-%	-%	-%	-%	76.5%	
C.A.	N°	-	-	-	-	5	-	-	-	-	11	**16**
	%	-%	-%	-%	-%	31.3%	-%	-%	-%	-%	68.8%	
RONSECCO	N°	-	-	-	-	1	-	1	-	-	1	**3**
	%	-%	-%	-%	-%	33.3%	-%	33.3%	-%	-%	33.3%	
TRICERRO	N°	-	-	-	-	-	-	-	-	-	2	**2**
	%	-%	-%	-%	-%	-%	-%	-%	-%	-%	100%	
Total	N°	**80**	**12**	**4**	**1**	**828**	**7**	**10**	**17**	**1**	**1004**	**1964**
	%	**4.1%**	**0.6%**	**0.2%**	**0.1%**	**42.2%**	**0.4%**	**0.5%**	**0.9%**	**0.1%**	**51.1%**	**100%**

Table 3 - Lithic raw materials present at Rilievo Isolato di Trino, grouped by collection areas. Others = different rocks sporadically attested in the lithic assemblages, i.e., porphyry, quartzite, metamorphic rocks.

Locality		Vein quartz	Radiolarite	Chert	Limestone	Jasper	Others	Indet.	Tot.
RIT 1	N°	53	10	19	-	-	-	1	**83**
	%	63.9%	12%	22.9%	-%	-%	-%	1.2%	
RIT 2	N°	15	-	2	2	-	-	-	**19**
	%	78.9%	-%	10.5%	10.5%	-%	-%	-%	
RIT 3	N°	117	9	8	1	-	2	-	**137**
	%	85.4%	6.6%	5.8%	0.7%	-%	1.5%	-%	
RIT 4	N°	1	-	-	-	-	-	-	**1**
	%	100%	-%	-%	-%	-%	-%	-%	
RIT 7	N°	2	2	1	-	-	-	1	**6**
	%	33.3%	33.3%	16.7%	-%	-%	-%	16.7%	
RIT 8	N°	10	-	1	1	-	-	-	**12**
	%	83.3%	-%	8.3%	8.3%	-%	-%	-%	
RIT 10	N°	1	-	-	-	-	-	-	**1**
	%	100%	-%	-%	-%	-%	-%	-%	
RIT 13 E	N°	75	16	29	2	-	-	-	**122**
	%	61.5%	13.1%	23.8%	1.6%	-%	-%	-%	
RIT 13 W	N°	117	-	3	-	-	1	-	**121**
	%	96.7%	-%	2.5%	-%	-%	0.8%	-%	
RIT 14	N°	993	107	202	-	6	6	6	**1320**
	%	75.2%	8.1%	15.3%	-%	0.5%	0.5%	0.5%	
RIT 15	N°	13	-	-	-	-	-	-	**13**
	%	100%	-%	-%	-%	-%	-%	-%	
RIT 16	N°	-	2	3	-	1	-	1	**7**
	%	-%	28.6%	42.9%	-%	14.3%	-%	14.3%	
RIT X	N°	31	1	6	-	-	-	-	**38**
	%	81.6%	2.6%	15.8%	-%	-%	-%	-%	
CASOTTO DIANA	N°	28	-	-	-	-	-	-	**28**
	%	100%	-%	-%	-%	-%	-%	-%	
CANTONE	N°	-	-	-	-	-	1	-	**1**
	%	-%	-%	-%	-%	-%	-%	-%	
B.P.T.	N°	3	5	25	-	-	1	-	**34**
	%	8.6%	14.3%	71.4%	-%	-%	2.9%	-%	
C.A.	N°	16	-	-	-	-	-	-	**16**
	%	100%	-%	-%	-%	-%	-%	-%	
RONSECCO	N°	-	-	2	-	-	1	-	**3**
	%	-%	-%	66.7%	-%	-%	33.3%	-%	
TRICERRO	N°	-	1	1	-	-	-	-	**2**
	%	-%	50.0%	50.0%	-%	-%	-%	-%	
Total	N°	**1475**	**153**	**302**	**6**	**7**	**12**	**9**	**1964**
	%	**75.6%**	**7.8%**	**15.4%**	**0.3%**	**0.4%**	**0.6%**	**0.5%**	**100%**

RIT 1

Collection area RIT 1 is the location where, in the 1970s, first evidence of a Palaeolithic occupation of the Trino hill was found. According to the works of Fedele (Fedele, 1974; GSQP, 1976), the lithic assemblage consists of approximately 300 implements. Just 83 lithic artefacts from RIT 1 are in *Museo Civico G. Irico* (Table 1). They are made on vein quartz (n=53), radiolarite (n=10) and chert (n=19). The raw material of one opportunistic core is undetermined because of post depositional alterations (Table 3). On a technological basis, we can distinguish between a Middle Palaeolithic and an Upper Palaeolithic/Neolithic occupation of the area. Debris (n=9), retouch flakes (n=3), flakes issued from maintenance and shaping of laminar cores (n=3) and fragmented flakes not referable to any knapping method (n=6), in the absence of stratigraphic data, have not been assigned a chronological position.

The Middle Palaeolithic assemblage is the largest, with 53 lithic artefacts (Table 4) mainly manufactured on vein quartz (n=48). Opportunistic, Levallois (preferential and recurrent centripetal) and discoid reduction strategies are interpreted from cores and flakes, while just three opportunistic flakes are retouched (1 vein quartz side scraper – Figure 7h, 1 chert notch and 1 radiolarite notch – Figure 7i-l). Opportunistic flakes have unipolar, bipolar, orthogonal, or crossed negatives on the dorsal face, thus demonstrating the frequent exploitation of different core surfaces during production. Looking at the cores (2), one of them shows the exploitation of three adjacent striking platforms to produce medium-sized and non-standardized flakes. Vein quartz rounded pebbles are used as Levallois cores both for the lineal and the recurrent centripetal methods. In one case, the striking platform is natural, while for the two preferential Levallois cores, the detachment of the predetermined flake is preceded by the shaping of the core convexities (Figure 7a-b). The discoid core is unifacial with a natural striking platform and centripetal removals aimed to the detachment of non-standardized flakes. For all these knapping methods the technique employed is freehand hard hammer percussion.

Table 4 - RIT 1 Middle Palaeolithic assemblage

Knapping method	Flakes	Cores	Retouched tools	Tot.
Opportunistic	25	2	3	**30 – 56.6%**
Levallois	11	3	-	**14 – 26.4%**
Discoid	2	1	-	**3 – 5.7%**
Indet	6	-	-	**6 – 11.3%**
Tot.	44	6	3	**53**
%	**83.0%**	**11.3%**	**5.7%**	**100%**

A chert laminar core (Figure 7c), four blades and two retouched tools on blade (1 scraper and 1 end-scraper) show the use of direct soft hammer percussion and can be assigned to the Upper Palaeolithic/Neolithic period. The core has two opposite striking platforms, it is exhausted, and it is aimed to the detachment of bladelets. A sickle element (Figure 7d) obtained through indirect percussion is the only lithic artefact securely belonging to the Neolithic period.

RIT 2

The lithic assemblage collected in RIT 2 between 1974 and 1976 includes ten lithic objects that were hypothesized to represent a Lower Paleolithic occupation (GSQP, 1976). RIT 2 currently has 19 lithic artefacts with technological characteristic suggesting different chronological periods, but mainly from the Middle Palaeolithic (13 flakes) (Figure 8). The predominant raw material is vein quartz (15 artefacts), while limestone (2 artefacts) and chert (2 artefacts) are also represented (Table 3). No cores are present in this small assemblage (Table 1). One of the laminar chert implements, is the only artefact from RIT 2 that can be attributed to Upper Palaeolithic or Neolithic periods. Vein quartz and limestone flakes are manufactured opportunistically by direct hard hammer percussion, as well as Levallois and discoid knapping strategies. The Levallois method is attested in the preferential and recurrent centripetal reduction strategies; opportunistic flakes show unipolar negatives on the dorsal face (7 flakes Figure 8 a, d) and natural or flat butts, thus suggesting the use of not prepared striking platforms and the exploitation of a natural convexity until its exhaustion. One vein quartz flake belongs to the shaping or maintenance of a centripetal core. Six fragmented flakes are indetermined concerning the knapping method. A vein quartz convergent scraper manufactured by an opportunistic reduction strategy is also present (Figure 8 b).

RIT 3

Following the surface collection carried out in the last thirty years, the lithic assemblage of RIT 3 has expanded, reaching 137 finds (Table 1) manufactured on different rocks: vein quartz, radiolarite, chert and limestone (Table 3). Some of the lithic artefacts form RIT 3 (i.e., debris and retouch flakes) have not been assigned to any phase of human occupation of the Trino hill (10), while a group of 125 lithic implements can be classified as Middle Palaeolithic (Table 5). The presence of two products made by a laminar reduction sequence suggests an occupation of this area in most recent times (i.e., Upper Palaeolithic or Neolithic).

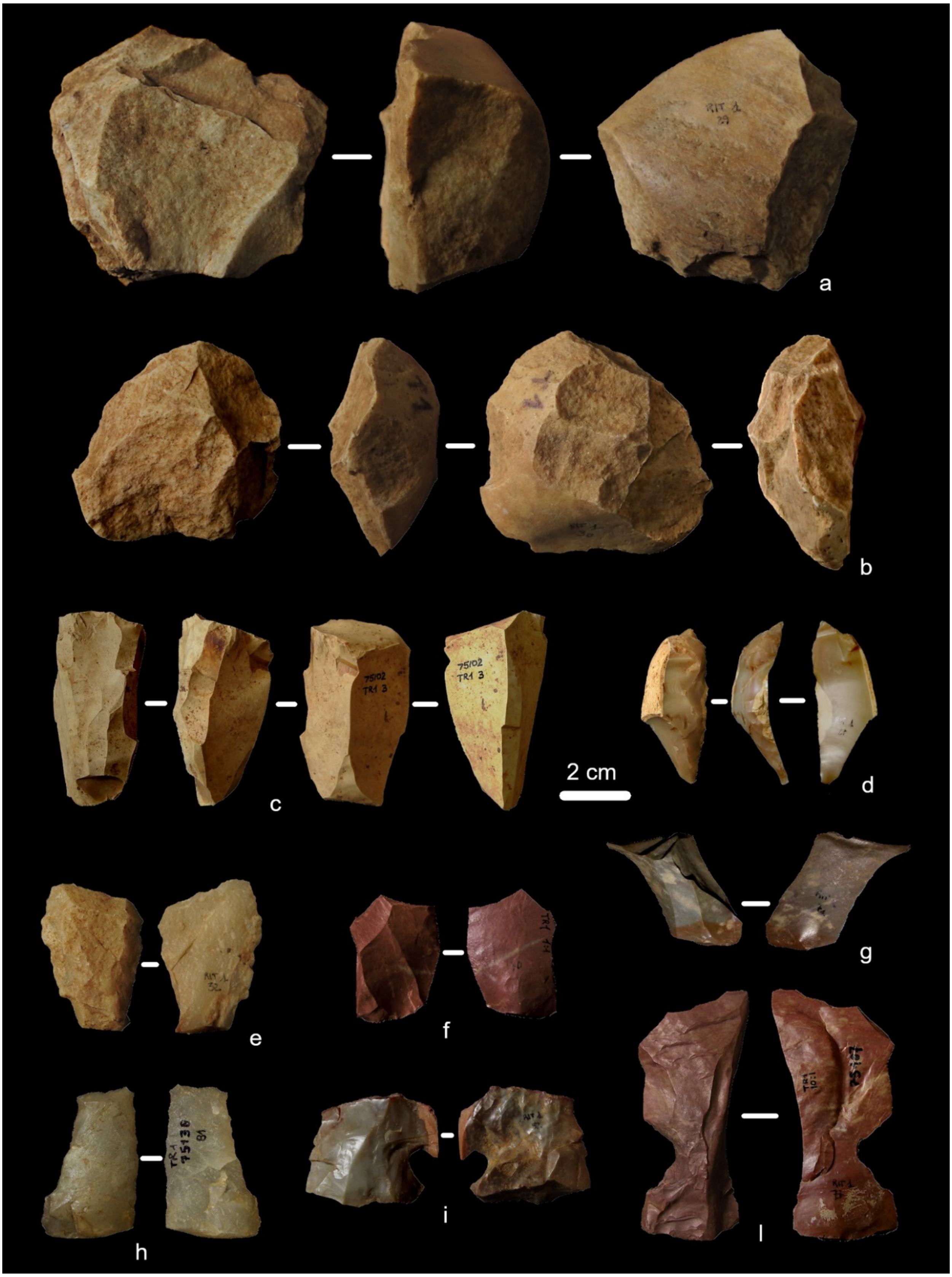
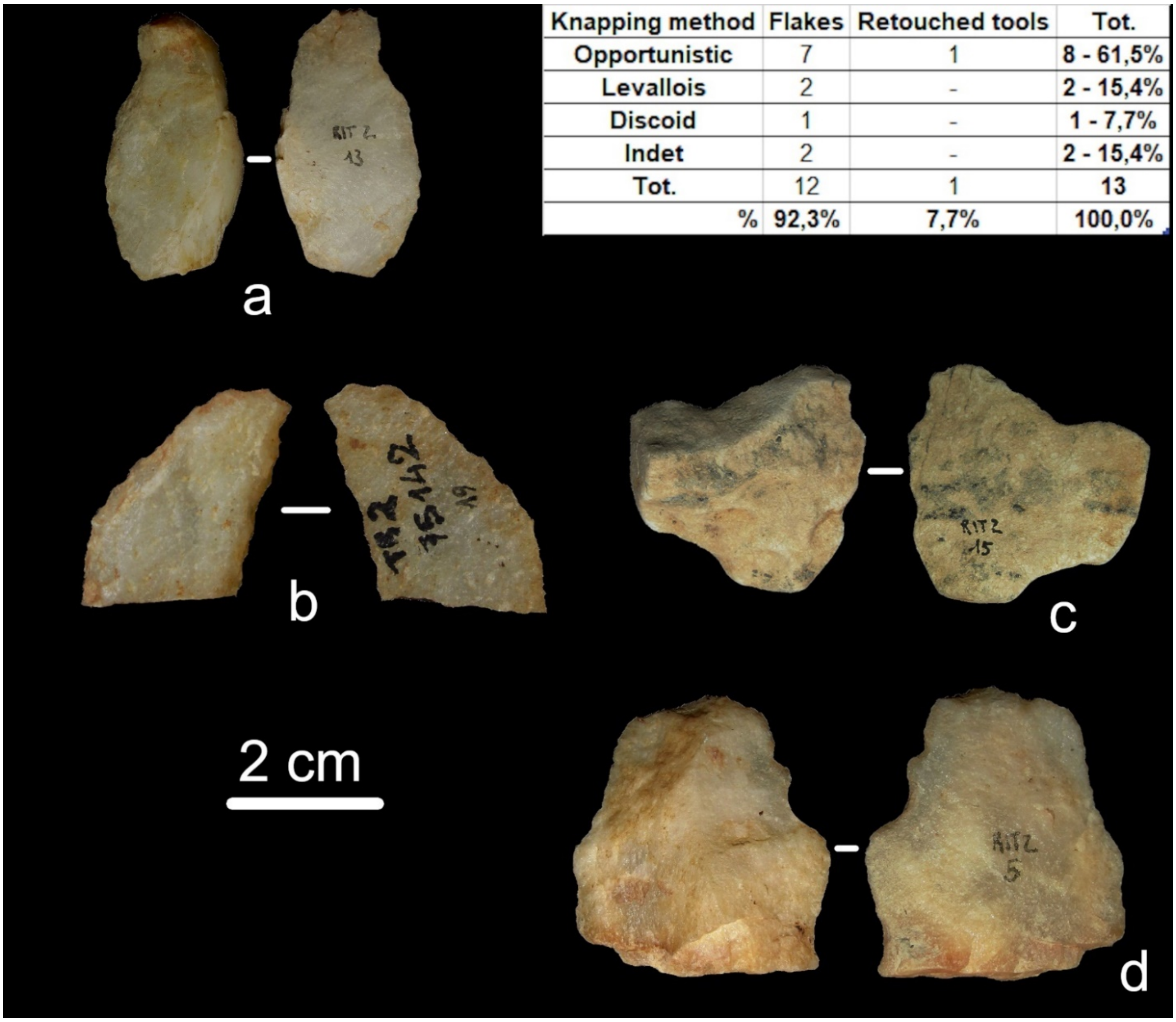


Figure 7 - Lithic artefacts from RIT 1: Levallois preferential cores (a, b); chert laminar core (c); Neolithic sickle element (d); Levallois flake (e); radiolarite recurrent centripetal Levallois flake (f); discoid flake (g); vein quartz sidescraper on opportunistic flake (h); chert and radiolarite notches (i, l)



Knapping method	Flakes	Retouched tools	Tot.
Opportunistic	7	1	8 - 61,5%
Levallois	2	-	2 - 15,4%
Discoid	1	-	1 - 7,7%
Indet	2	-	2 - 15,4%
Tot.	12	1	13
%	92,3%	7,7%	100,0%

Figure 8 - Lithic artefacts from RIT 2: opportunistic flakes with unipolar knapping scars on the dorsal face (a, d); limestone preferential Levallois flake strongly affected by roundings (c); convergent scraper (b). On the top right: Middle Palaeolithic flakes from RIT 2 grouped by knapping method

Table 5 - RIT 3 Middle Palaeolithic assemblage

Knapping method	Flakes	Cores	Core shaping/maintenance	Retouched tools	Tot.
Opportunistic	53	3	-	1	**57 – 45.6%**
Levallois	24	4	-	1	**29 – 23.2%**
Discoid	12	3	-	-	**15 - 12,0%**
Indet	20	-	4	-	**20 - 16%**
Tot.	109	10	4	2	**125**
%	**87.2%**	**8.0%**	**3.2%**	**1.6%**	**100%**

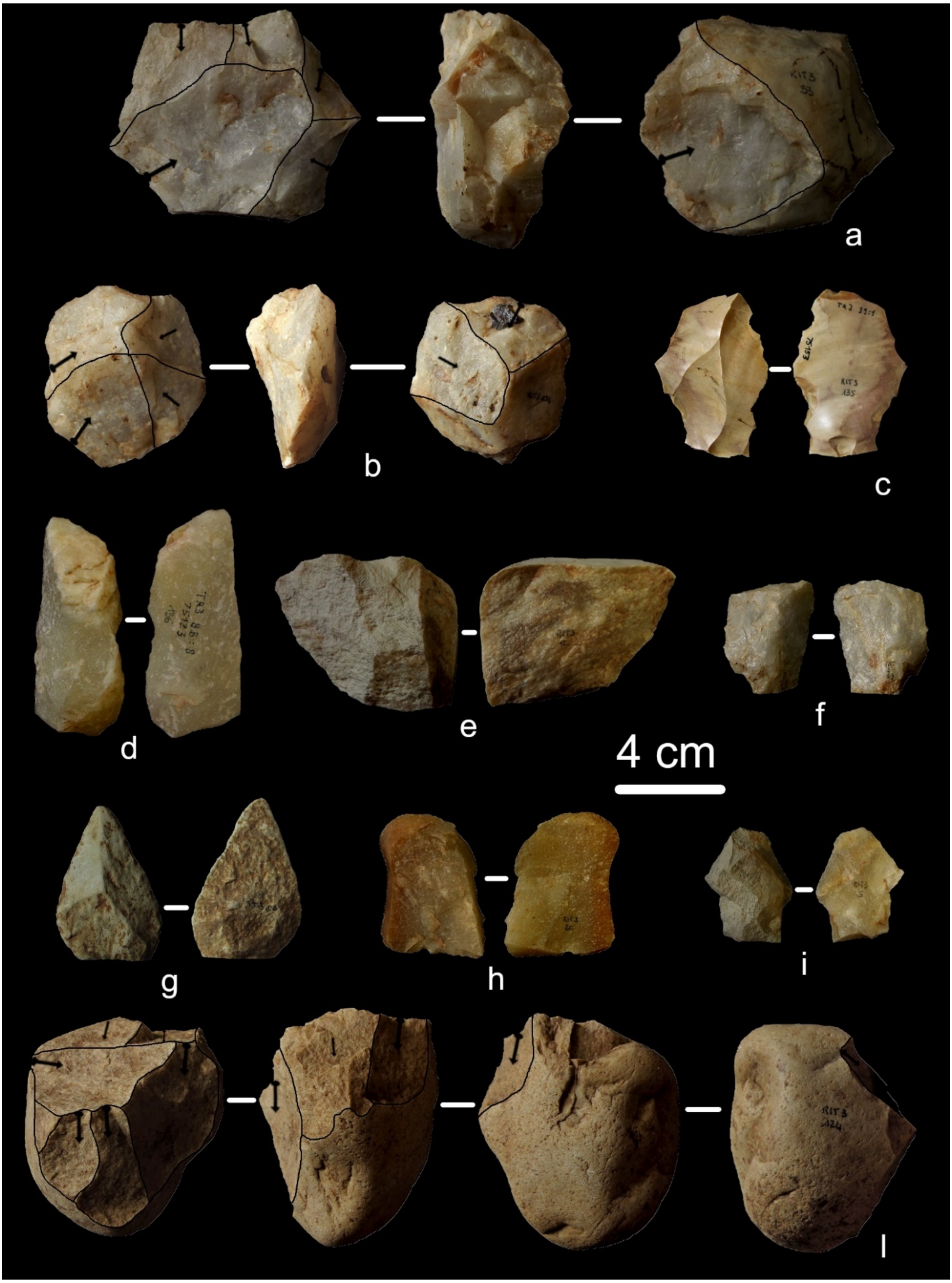


Figure 9 - Lithic artefacts from RIT 3: Levallois preferential core (a); discoid core (b); Levallois preferential flake on chert (c) and on limestone (g); sidescraper on opportunistic flake (d); discoid flake (e); opportunistic flakes (f, h); recurrent centripetal Levallois flake (i); opportunistic core on a vein quartz pebble (l)

The Middle Palaeolithic assemblage includes opportunistic, Levallois and discoid flakes and cores (Figure 9). Pesence of the Levallois method is based on preferential and recurrent centripetal cores and flakes. For both the modalities, cores are made from vein quartz pebbles with natural convexities already suitable for this kind of exploitation. The striking platforms correspond to the natural surface of the pebble or are prepared through a reduced number of detachments in a centripetal direction (Figure 9 a). In the same way, the lateral and distal convexities on the flaking surface are prepared through a low number of centripetal or chordal removals. All the Levallois cores are discarded before their complete exhaustion. Levallois reduction sequences are applied also on radiolarite, limestone and chert. The presence of a chert flake with faceted butt, suggests that on this raw material Levallois reduction strategies involve careful preparation of the striking platforms.

Discoid cores of vein quartz pebbles (Figure 9 b) are reduced unifacially or a bifacialy yielded short and wide flakes with variable dimensions (Figure 10). A radiolarite flake shows the use of discoid reduction strategy on this rock. Three opportunistic cores were made from vein quartz pebbles (n=2) and a small chert polygonal block (n=1). All the cores were abandoned before being exhausted and show unipolar exploitation of two adjacent or opposite surfaces.

Flakes from RIT 3 are mostly complete (57.4%) or present small fractures affecting less than (incomplete flakes – 19.1%). Cortical and neocortical surfaces are rarely visible on the dorsal faces of the flakes and usually are located on their lateral portion (lateral cortex = 10.4%; lateral and distal cortex = 6.1%; lateral and proximal cortex = 2.6%). The predominance of flat and natural butts confirms the data obtained from the observation of the cores: the production of opportunistic, discoid and Levallois flakes starts from the natural surfaces of the cores or after a short preparation of the striking platforms (Figure 10). Unipolar, orthogonal and bipolar removals on the dorsal faces are exclusively associated to opportunistic reduction sequences as well as convergent negatives are associated to the preferential Levallois method. On the other hand, centripetal negatives correspond to discoid or recurrent centripetal reduction strategies.

The dimensional analysis (Figure 10) shows that the discoid method is aimed for the production of short and wide products while Levallois flakes, both preferential and recurrent centripetal, seem to be more elongated. Concerning opportunistic reduction strategies, they are not standardized in shapes and dimensions and, according to the characteristics of the cores, their morphology appears as strongly influenced by those of the pebbles chosen as cores.

RIT 4

RIT 4 lithic assemblage consists of 10 artefacts (GSQP, 1976), but just one of them is present at Museo Civico G. Irico. The extant artifacts is an exhausted vein quartz core from which blades were removed through direct hard hammer percussion (Figure 11). The striking platform is natural (neocortical surface), and four detachments are visible on the knapping surface: one from the rough phase of core shaping and three from the production phase. The general core geometry and the standardization of the three detachments on the knapping surface suggests that this core is part of the laminar debitage assemblage with uncertain temporal attribution.

RIT 7

Four flakes, one blade and one debris constitute the RIT 7 lithic assemblage. The raw material consists of vein quartz, radiolarite, chert and an indetermined rock (Table 3). Flakes are produced by Levallois (n=1), discoid (n=1 – Figure 12b) and opportunistic (n=2) reduction strategies through direct percussion by hard hammer and are asignable to the Middle Palaeolithic (Figure 12). Levallois is shown by the preferential method by a distal fragment of a Levallois flake (Figure 12a); opportunistic flakes have unipolar knapping scars on the dorsal faces and natural or flat butts.

The blade is fragmented, and it is not possible to identify the knapping technique: in the absence of clear diagnostic elements, it is not possible to make hypothesis about its chronology (Figure 12c).

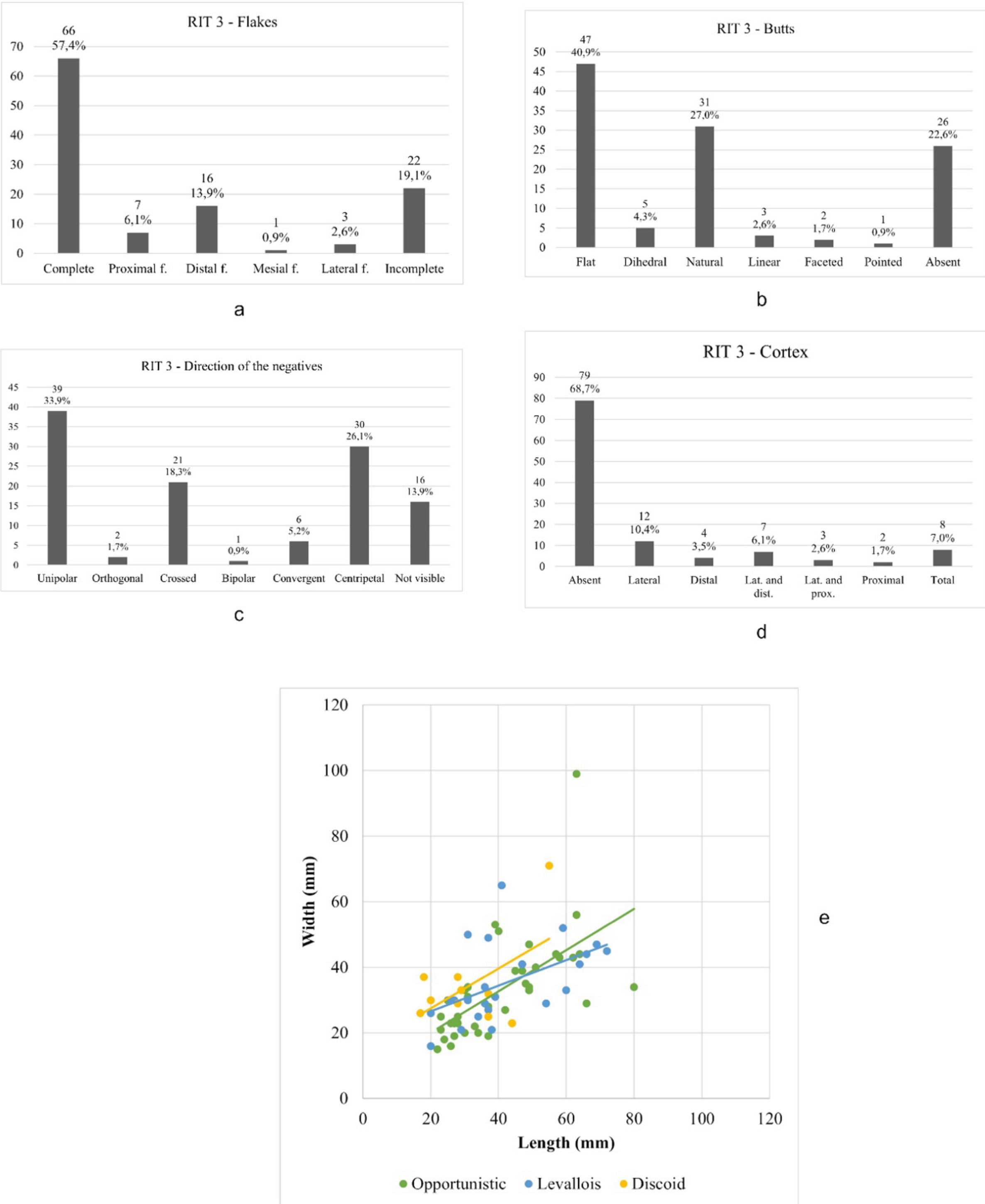


Figure 10 - The main technological characteristics of the RIT 3 Middle Palaeolithic lithic assemblage. Flakes (a); butts typology (b); direction of the negatives on the dorsal faces (c); presence and position of cortical and neocortical surfaces on the dorsal faces (d); dimensional analysis of complete and incomplete flakes grouped by knapping method (e)

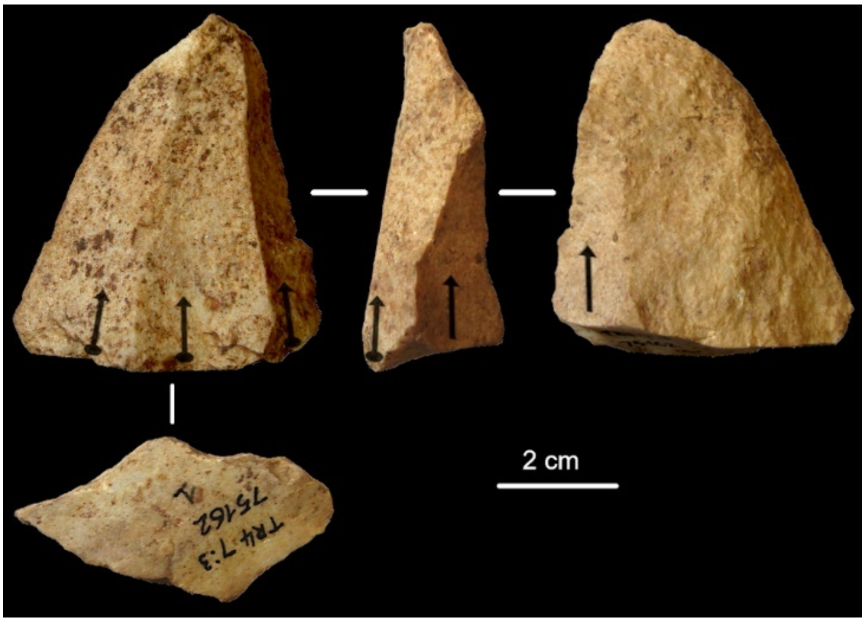


Figure 11 - Vein quartz laminar core with natural striking platform from RIT 4

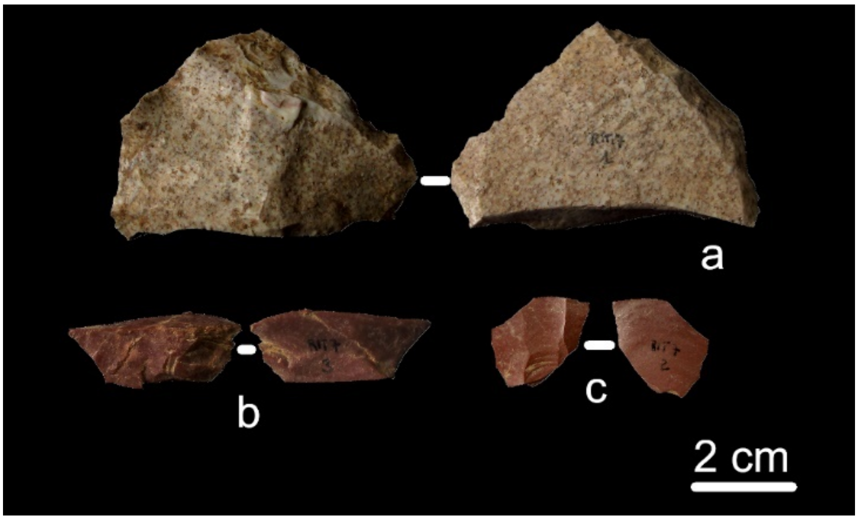


Figure 12 - Lithic artefacts from RIT 7: distal fragment of a Levallois preferential flake (a); radiolarite discoid flake (b); fragmented radiolarite blade (c)

RIT 8

The lithic assemblage from RIT 8 is composed by 12 flakes (Table 1) manufactured on vein quartz (n=10), limestone (n=1) and chert (n=1) (Table 3). Limestone and chert flakes have strong post depositional alterations, roundings and white patina respectively (Table 2), that prevent their technological interpretation. On the other hand, the vein quartz assemblage is less affected by post depositional alterations. Preferential Levallois, discoid and opportunistic reduction strategies are attested (Figure 13), thus suggesting a Middle Palaeolithic attribution for the vein quartz assemblage. The presence of orthogonal and crossed negatives on the dorsal faces of opportunistic flakes indicates that these reduction strategies develop through the exploitation of different core surfaces, probably demonstrating the S.S.D.A. knapping sequence. Negatives on the dorsal face are not visible for three vein quartz flakes for which the knapping method remains indeterminate.

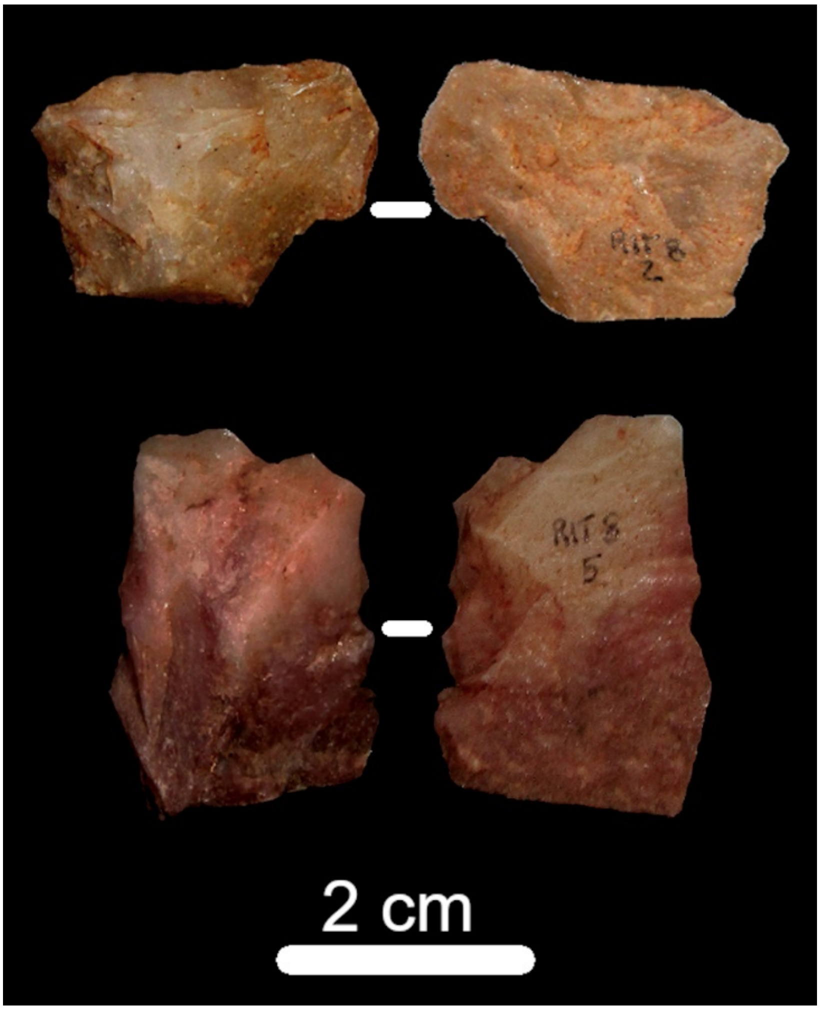


Figure 13 - Vein quartz flakes from RIT 8: discoid flake (top) and opportunistic flake with crossed negatives on the dorsal face (bottom)

RIT 10

Collection area RIT 10 yielded just one vein quartz pebble with detachments (Figure 14). The sequence of removals suggests that the goal of exploitation is not to obtain a sharp edge on the pebble, as they delineate a concave, irregular edge. It is therefore preferable to interpret the artifact as a partially exploited opportunistic core that produced non-standardized vein quartz flakes. The natural (i.e., neocortical) surface has been used as striking platform and the technique employed is direct percussion by hard hammer. The core was discarded before its exhaustion. A chronological attribution of this core, in the absence of clear stratigraphic data, is quite difficult.

RIT 13 East

The lithic assemblage from RIT 13 East consists of 122 lithic artefacts (Table 1) mainly manufactured from vein quartz (n=75) but also on radiolarite (n=16), limestone (n=2) and chert (n=29) (Table 3). Opportunistic, Levallois, discoid and laminar knapping methods are shown by cores, flakes and blades, mainly produced through direct percussion with hard or soft hammer and through indirect percussion. Due to post depositional modification or to the fragmentation of the lithic implements, the technique cannot be identified for 29 artefacts. The Middle Palaeolithic assemblage is composed by 83 lithic implements (Table 6), of which 71 are made on vein quartz, 2 on limestone, 8 on radiolarite and 2 on chert. Opportunistic, Levallois and discoid knapping sequences are shown by cores and flakes and three retouched tools are present (2 sidescrapers and 1 notch).

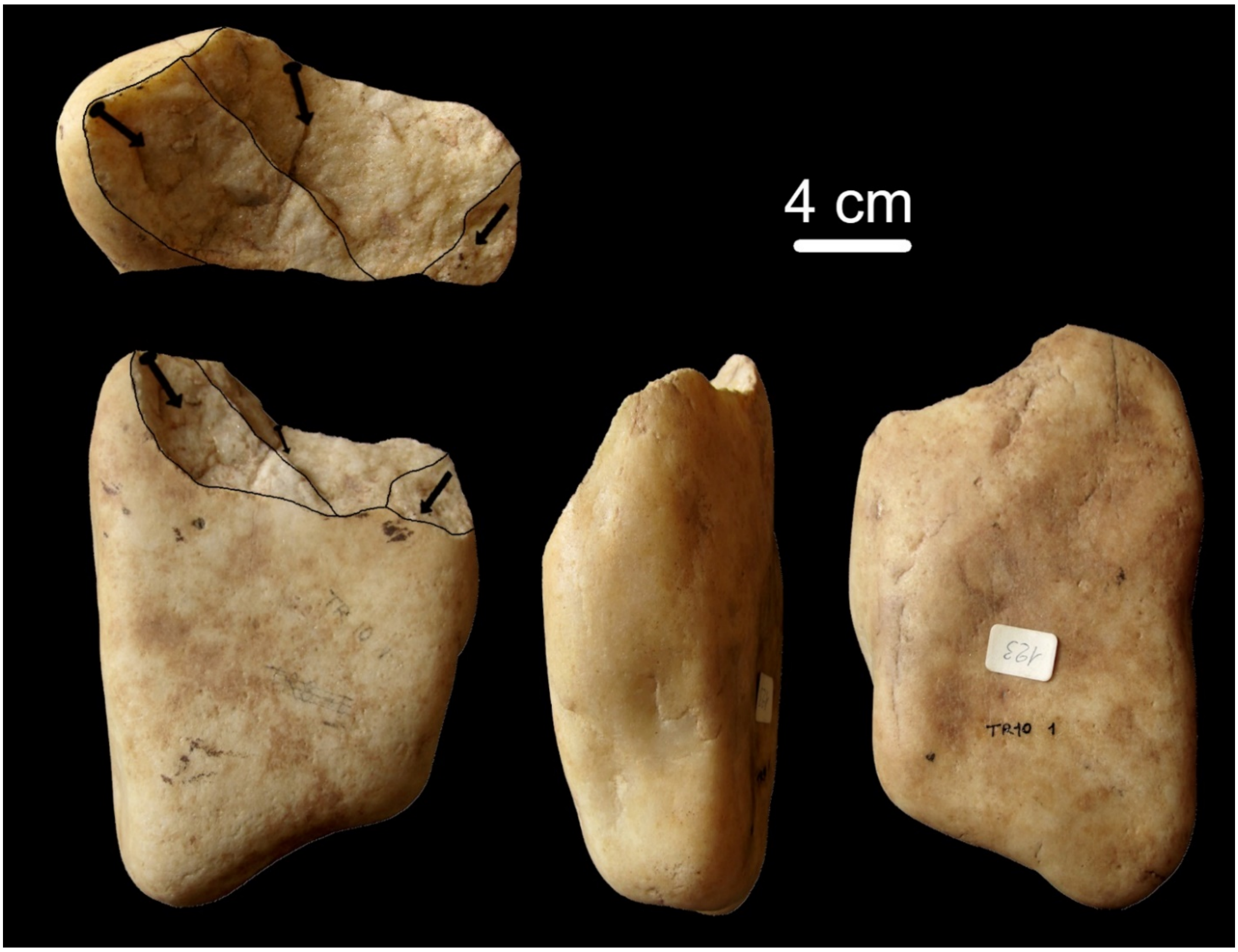


Figure 14 - Vein quartz opportunistic core from RIT 10

Table 6 - RIT 13 East Middle Palaeolithic assemblage

Knapping method	Flakes	Cores	Core shaping/maintenance	Retouched tools	Tot.
Opportunistic	48	6	-	1	**55 – 66.3%**
Levallois	6	1	2	2	**11 – 13.3%**
Discoid	4	2	-	-	**6 – 7.2%**
Indet	9	-	2	-	**11 – 13.3%**
Tot.	67	9	4	3	**83**
%	**80.7%**	**10.8%**	**4.8%**	**3.6%**	**100%**

The Levallois method is showen by the preferential and the recurrent centripetal reduction strategies. The only Levallois core identified is recurrent centripetal and it is manufactured on a vein quartz pebble (Figure 15 a). The striking platform is still in part natural and it is prepared through large-sized centripetal removals. Discoid cores show the development of the exploitation according to a bifacial reduction strategy to produce short, quadrangular flakes mainly through centripetal detachments. The opportunistic cores (2 on limestone and 4 on vein quartz pebbles) show the preferential unipolar or multidirectional exploitation of one core surface until the exhaustion of the natural convexity (Figure 15 f, o). Once the convexity is exhausted, the core is discarded. Just one core has three adjacent striking platforms with a debitage that develops according to an S.S.D.A. scheme.

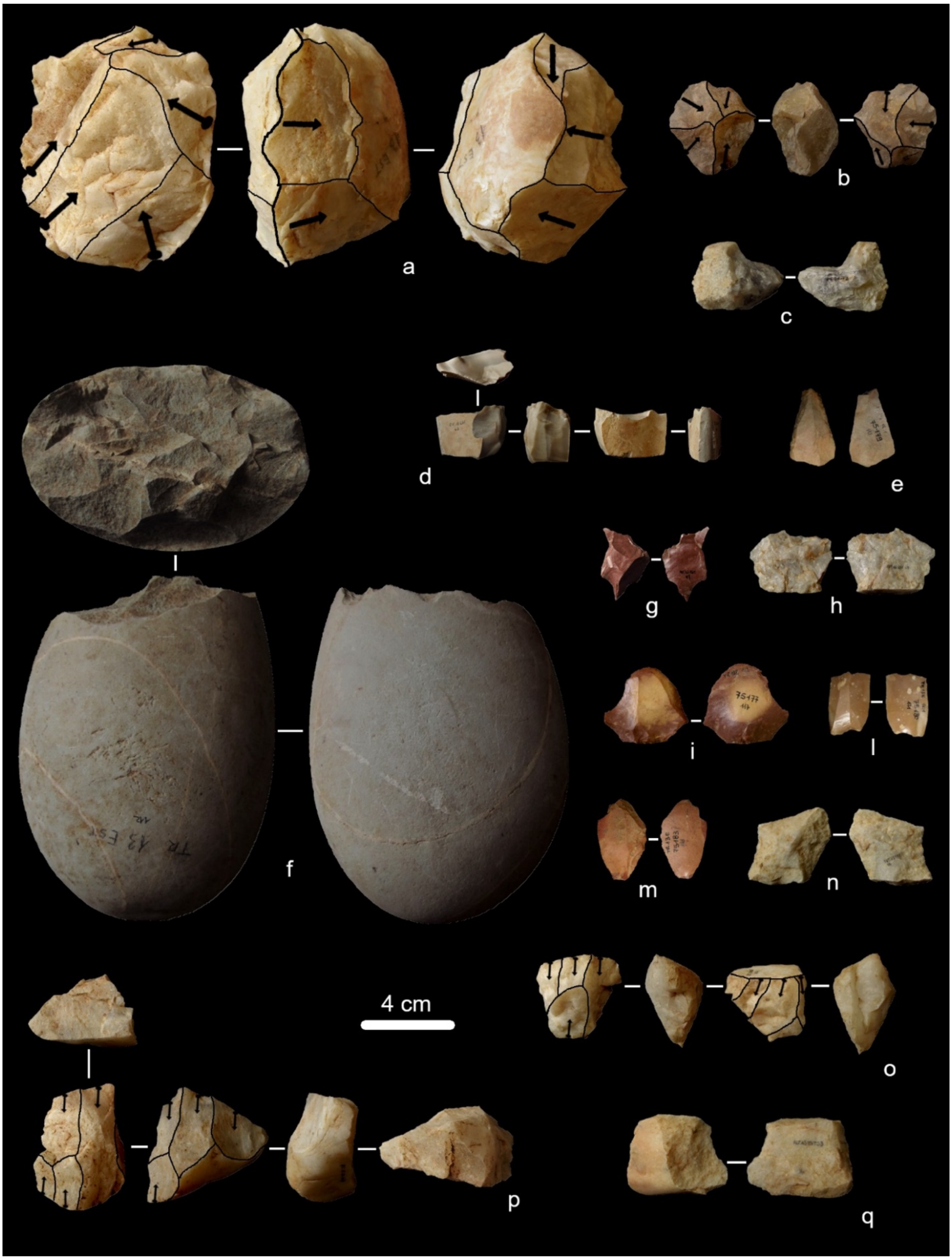


Figure 15 - Vein quartz and chert artefacts from RIT 13 East. Recurrent centripetal Levallois core (a); vein quartz discoid core (b); notch on an opportunistic vein quartz flake (c); chert laminar core (d); radiolarite blade with abrupt and short retouch on both edges (e); opportunistic core on a big limestone pebble with removals mainly following a centripetal direction (f); radiolarite and vein quartz discoid flakes (g, n); recurrent centripetal Levallois flake (h); radiolarite sidescrapers on recurrent centripetal Levallois flakes (i, m); sickle element (l); vein quartz opportunistic core (o); vein quartz laminar core (p); opportunistic flake with lateral neocortical surface (q)

Debitage products are mostly complete (70.3%) and fractures are usually not very developped (incomplete flakes: 16.2%) (Figure 16). Fifty-five percent of the flakes do not have cortex or neocortex on the dorsal face: it means that, regardless the knapping method, the production starts directly from the natural core surfaces. According to what is observed on the opportunistic cores, the significative proportion of lateral cortex and neocortex (lateral = 21.6%; lateral and distal = 5.4%), the predominance of unipolar negatives on the dorsal faces (45.9%) and the frequency of natural and flat butts (41.9% and 40.5% respectively) suggests that the knapping sequences started from the natural surfaces of the cores and they preferably followed a unipolar direction.
Orthogonal negatives (2.7%) are linked to a multidirectional opportunistic core exploitation, while crossed negatives (25.7%) were identified both on opportunistic products and on flakes belonging to the shaping of Levallois cores (Figure 16). The dimensional analysis (Figure 16) shows that no clear differences are visible regarding the dimensions of the products manufactured by different Middle Palaeolithic knapping sequences.

The use of vein quartz is shown by the most recent phases of site occupation (Upper Palaeolithic/Neolithic) by three laminar cores exploited through direct hard hammer percussion. Even for the laminar method, the production of blades starts from natural striking platforms and vein quartz pebbles with suitable morphologies are chosen as cores. Core shaping is quite rough and produced by a reduced number of detachments, while for the maintenance of the core convexities a second striking platform, opposite to the first one, is sometimes exploited (Figure 15 p).

Laminar production on chert and radiolarite is shown by one core (Figure 15 d) and 13 products. Of the products just two are from the phase of plein debitage, while 11 are maintenance flakes. According to the characteristics of the butts and of the ventral faces, the main technique employed for the laminar production is direct percussion with soft hammer. In the absence of further diagnostic data their chronology remains uncertain, and they could be either Upper Palaeolithic or Neolithic. Two laminar products are retouched (1 notch and one point). A sickle element and two incomplete blades made by indirect percussion are assigned to the Neolithic period (Figure 15 l).

RIT 13 West

RIT 13 West consists of 121 lithic implements (Table 1), 117 of which are made on vein quartz, 3 on chert and 1 on an indeterminate rock (Table 3). Opportunistic, Levallois, discoid and laminar reduction strategies are shown by a considerable number of cores (n=13) and knapping products (n=107) while two retouched tools (denticulates) have also been identified (Table 1). The main knapping technique direct hard hammer percussion.

Three chert specimens were manufactured by a direct soft hammer percussion, a blade, a core-maintenance flake, and a retouch flake. Together with a vein quartz blade, these artefacts can be attributed to either the Upper Palaeolithic or to the Neolithic periods. Due to fractures or post-depositional alterations, the technique remains indeterminate for four vein quartz flakes. Based on their technological features, 115 flakes and cores can be attributed to the Middle Palaeolithic assemblage of the Trino hill (Table 7).

Table 7 - RIT 13 West Middle Palaeolithic assemblage

Knapping method	Flakes	Cores	Core shaping/maintenance	Retouched tools	Tot.
Opportunistic	67	5	-	2	**74 – 64.3%**
Levallois	14	4	-	-	**18 – 15.7%**
Discoid	5	4	-	-	**9 – 7.8%**
Indet	13	-	1	-	**14 – 12.2%**
Tot.	**99**	**13**	**1**	**2**	**115**
%	**86.1%**	**11.3%**	**0.9%**	**1.7%**	**100%**

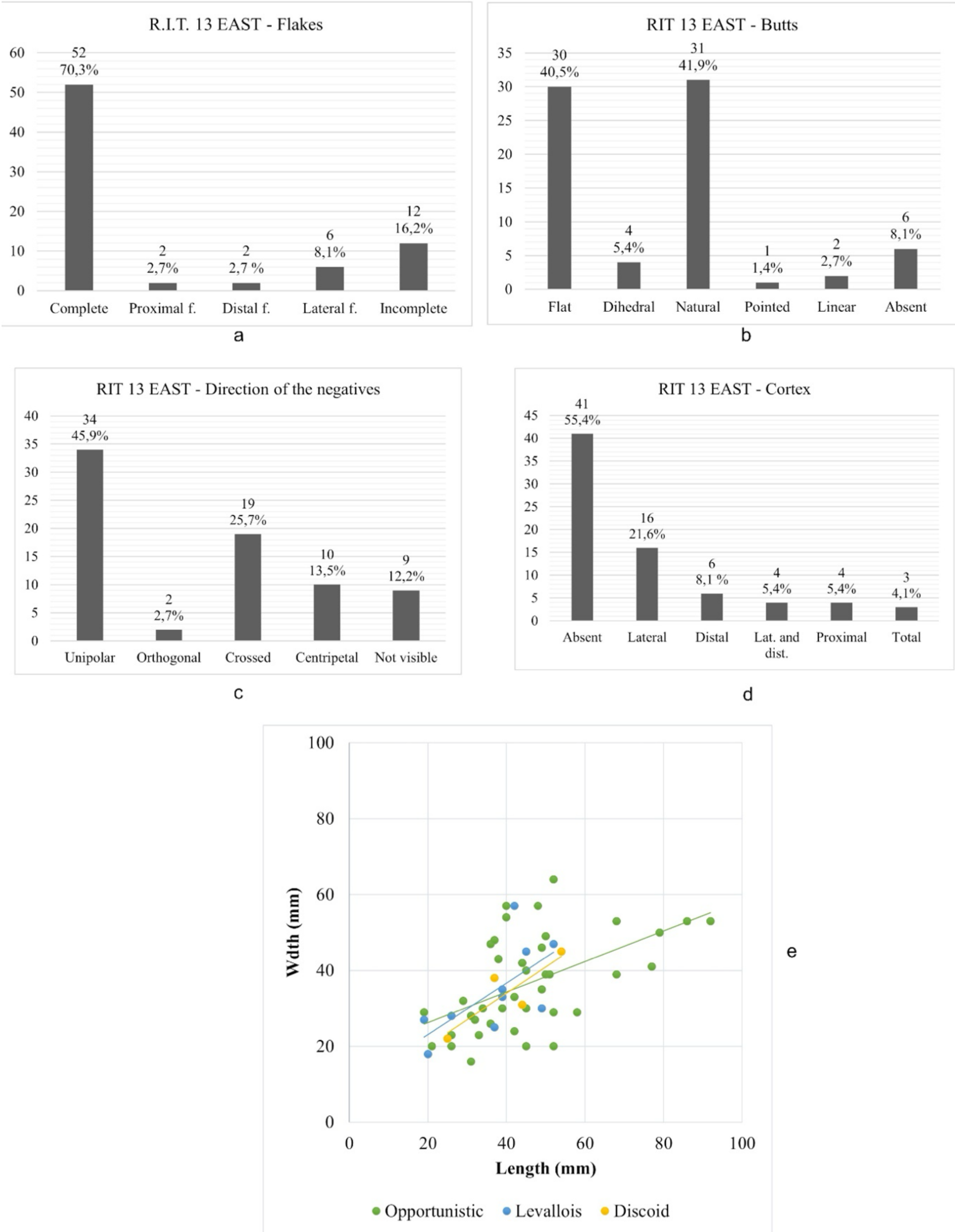


Figure 16 - Charts showing the main technological characteristics of the RIT 13 E Middle Palaeolithic lithic assemblage. Flakes (a); butts typology (b); direction of the negatives on the dorsal faces (c); presence and position of cortical and neocortical surfaces on the dorsal faces (d); dimensional analysis of complete and incomplete flakes grouped by knapping method (e)

The Levallois method is shown in the recurrent centripetal and in the lineal alternatives and it is represented by 4 cores (2 lineal and 2 recurrent centripetal) and 14 flakes (8 lineal and 6 recurrent centripetal). The cores are manufactured on vein quartz pebbles and for all the modalities the production of predetermined flakes starts after a short phase of core shaping, recognized through 4 or 5 detachments. In one case the striking platform is natural (i.e., neocortical surface) (Figure 17 h). Discoid cores show a bifacial (3) (Figure 17 g) and a unifacial (1) exploitation. Three of them are utilized until complete exhaustion and for the discoid exploitation starts always directly from the natural surfaces of the vein quartz pebbles. For the discoid reductions strategies, the desired products are small, short and wide flakes, while the Levallois debitage produced elongated flakes (Figure 18). The opportunistic method is aimed to the production of flakes of various shapes and dimensions, with the general morphology dependent on the characteristics of the cores (Figure 18), which were pebbles or polygonal block of medium dimension. Three of the cores have one striking platform exploited in a unipolar direction, one core has two orthogonal striking platforms (Figure 17 i) and one shows a bipolar exploitation with two opposite striking platforms. Two opportunistic flakes show a modification of the edges and can be classified as denticulates (Figure 17 a, e).

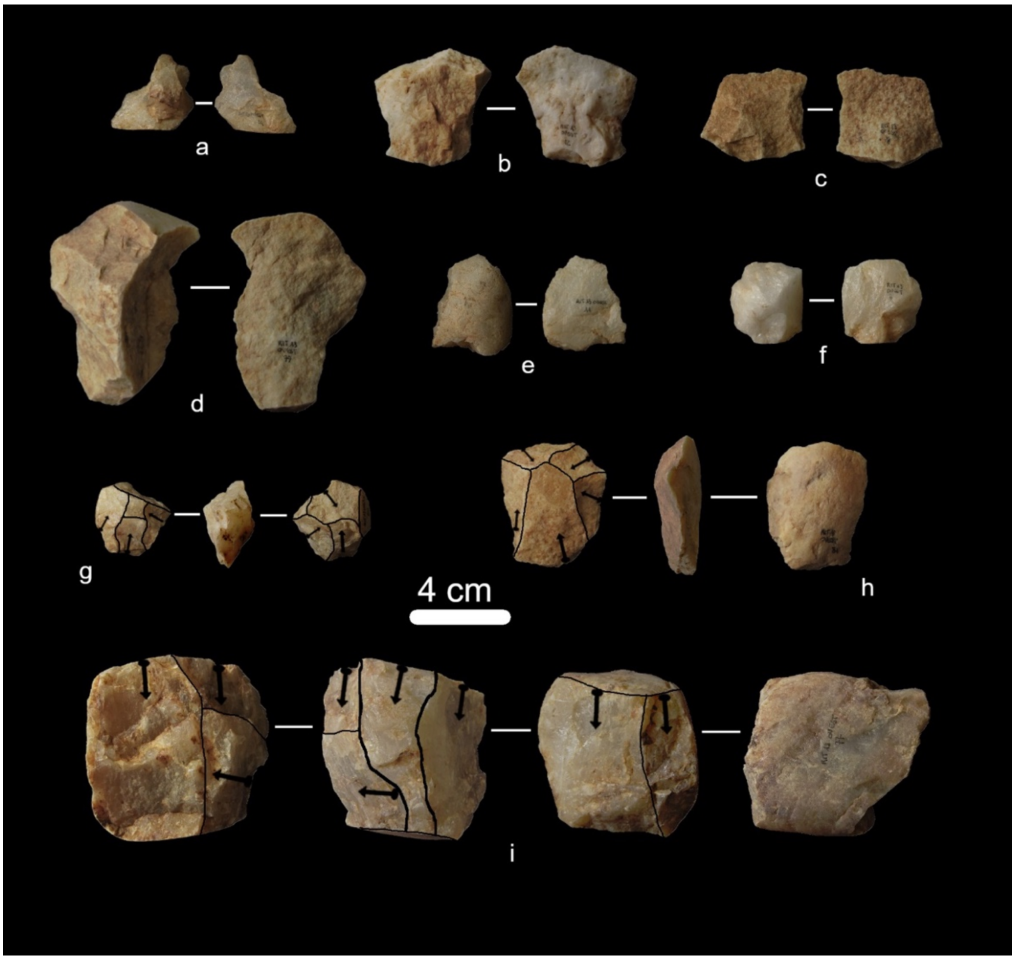


Figure 17 - Lithic artefacts from RIT 13 W. Denticulates on opportunistic flakes (a, e); Levallois preferential flake (b); Levallois recurrent centripetal flake (c); opportunistic flake (d); discoid flake (f); bifacial discoid core (g); preferential Levallois core (h); opportunistic core (i)

Fifty-seven percent of the debitage products are complete, while 23.5 % are incomplete flakes (Figure 18). Most of the flakes do not have cortex or neocortex on the dorsal face (69.6%); when present, natural surfaces are mainly on the lateral portion of the dorsal face (lateral = 17.6%; lateral and distal = 1%) (Figure 18).

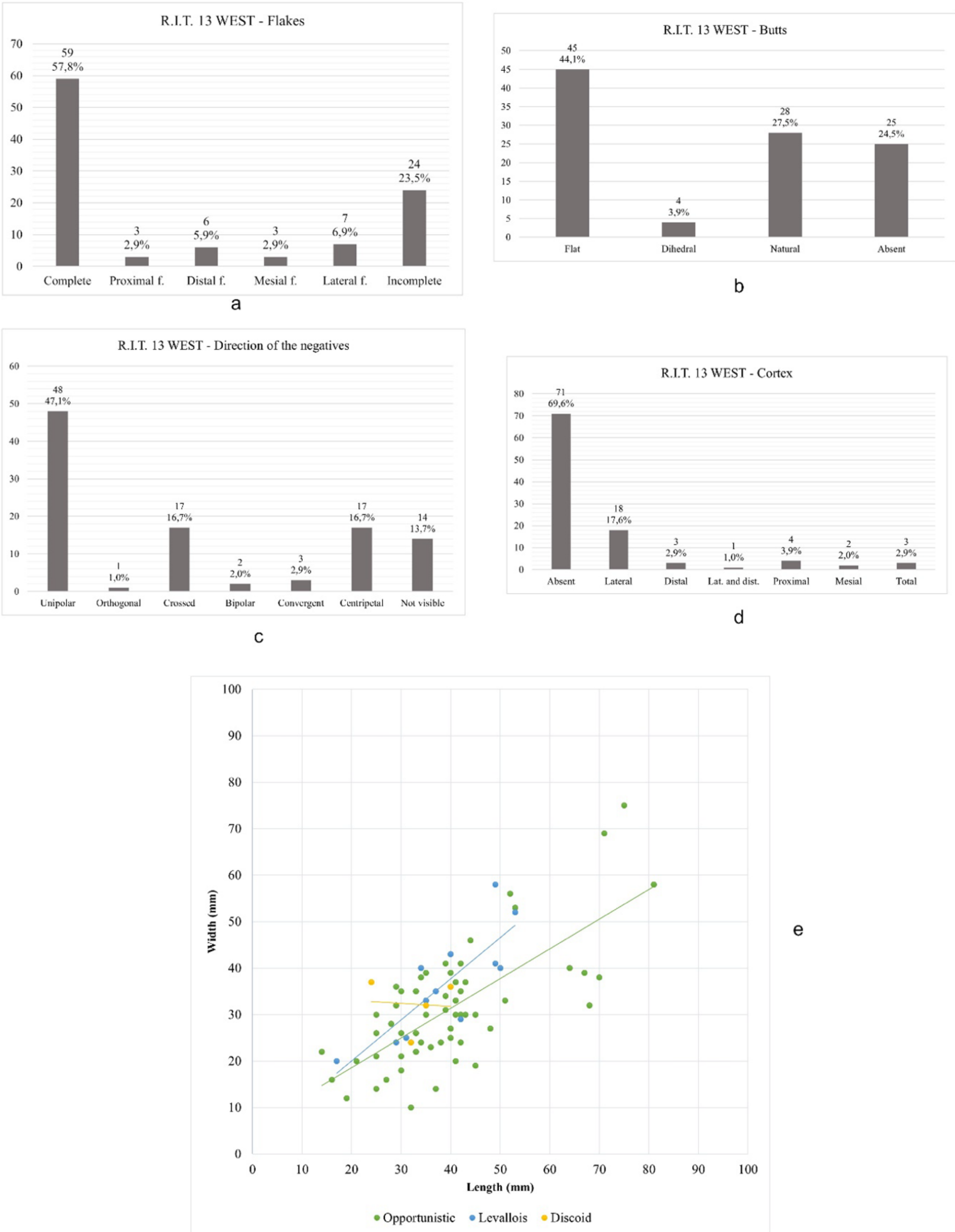


Figure 18 - Charts showing the main technological characteristics of the RIT 13 W Middle Palaeolithic lithic assemblage. Flakes (a); butts typology (b); direction of the negatives on the dorsal faces (c); presence and position of cortical and neocortical surfaces on the dorsal faces (d); dimensional analysis of complete and incomplete flakes grouped by knapping method (e)

Opportunistic reduction sequences together with the predominance of flat (44.1%) and natural (27.5%) butts and of unipolar negatives on the dorsal faces (47.1%) confirms that generally the exploitation begins with core surfaces naturally suitable for knapping or after the detachment of a big flake to open a striking platform. The sequence usually follows a unipolar direction. However, the presence of a flake with orthogonal negatives and of two flakes with bipolar negatives confirms that othogonal and bipolar reduction strategies were also employed. Crossed negatives are also present on opportunistic flakes (16.7%) and demonstate the use of multidirectional knapping sequences (Figure 18). Centripetal (16.7%) and convergent (2.9%) negatives are exclusively linked to Levallois and discoid products. The dimensional analysis shows no clear differences among the products manufactured from the different Middle Palaeolithic knapping sequences (Figure 18). As As shown with the RIT 13 East lithic assemblage, we suggest that the dimensions of the products are determined by the use of pebbles or polygonal blocks selected to be core. Chronological placement is not possible for a vein quartz debris and for a vein quartz flake.

RIT 14

Collection area 14 is in the northern part of the Trino hill (Figure 2 C). This area yielded the most important lithic assemblage, consisting of 1320 lithic implements. The technological analysis allows us to distinguish a Middle Palaeolithic assemblage of 962 artefacts (Table 8). The main raw material is vein quartz (925 artefacts) but also radiolarite (16 artefacts), chert (14 artefacts) and other rocks (11 artefacts) are present (Table 3). One hundred and fifty-five lithic implements are manufactured by laminar knapping sequences: 30 of them likely assignable to the Neolithic occupation of the area are cores, blades and retouched tools (3 sickle elements and a notch) manufactured by pressure or indirect percussion. Even if an Upper Palaeolithic attribution can be proposed, on a typological basis, for 15 retouched tools, all the other laminar elements do not present technological characteristics that allowing clearly reference to a certain period. Thegroup of the laminar elements is formed by 58 core maintenance flakes manufactured by direct hard or soft hammer percussion, 42 unretouched blades manufactured by direct soft hammer or indeterminate percussion technique and 10 laminar cores exploited through direct percussion. Neolithic, Upper Palaeolithic and laminar implements with uncertain chronology are mainly manufactured on chert and radiolarite (144 artefacts), to a lesser extent on vein quartz and other rocks (11 artefacts). Chronology remains uncertain for debris, retouch flakes and for flakes affected by post-depositional modification that prevent their technological assessment.

Table 8 - RIT 14 Middle Palaeolithic assemblage

Knapping method	Flakes	Cores	Core shaping/maintenance	Retouched tools	Tot.
Opportunistic	492	16	2	13	**523 – 54.4%**
Levallois	149	14	12	3	**178 – 18.5%**
Discoid	59	12	-	1	**72 – 7.5%**
Indet	140	3	43	3	**189 – 19.6%**
Tot.	**840**	**45**	**57**	**20**	**962**
%	**87.3%**	**4.7%**	**5.9%**	**2.1%**	**100%**

In the Middle Palaeolithic assemblage, opportunistic, Levallois and discoid knapping sequences are well examplifeid by cores and flakes. Retouched tools are quite rare and are represented by sidescrapers (n=7), convergent scrapers (n=2), a double scraper, a transversal scraper, a Mousterian point, notches (n=3) and denticulates (n=5). Recurrent centripetal and preferential Levallois reduction sequences are documented by 13 cores, mainly manufactured from vein quartz pebbles and with a neocortical striking platform (Figure 19 a, f, h). The shaping of the convexities on the knapping surface consists in a reduced number of removals in a centripetal or chordal direction. Two preferential Levallois cores are on chert and exhibit a prepared striking platform. Despite the raw material, cores are discarded before their exhaustion, thus avoiding the re-shaping of the core surfaces. One vein quartz core shows a recurrent unipolar Levallois knapping sequence and the production of predetermined flakes, preceded by a careful preparation of the core surfaces.

The discoid method is applied to vein quartz, radiolarite and chert pebbles to produce short, quadrangular flakes (Figure 20). Both the bifacial and the unifacial reduction strategies are present: in the unifacial the striking platform mostly correspond to a neocortical surface. The discoid flakes show a predominance of flat (35) and natural (8) butts, thus confirming that the cores were usually not prepared. The removals visible on the cores indicate that most of the discoid production is completed through centripetal removals, with no regards for the maintenance of the core convexities. Discoid cores are indeed discarded after short production phases.

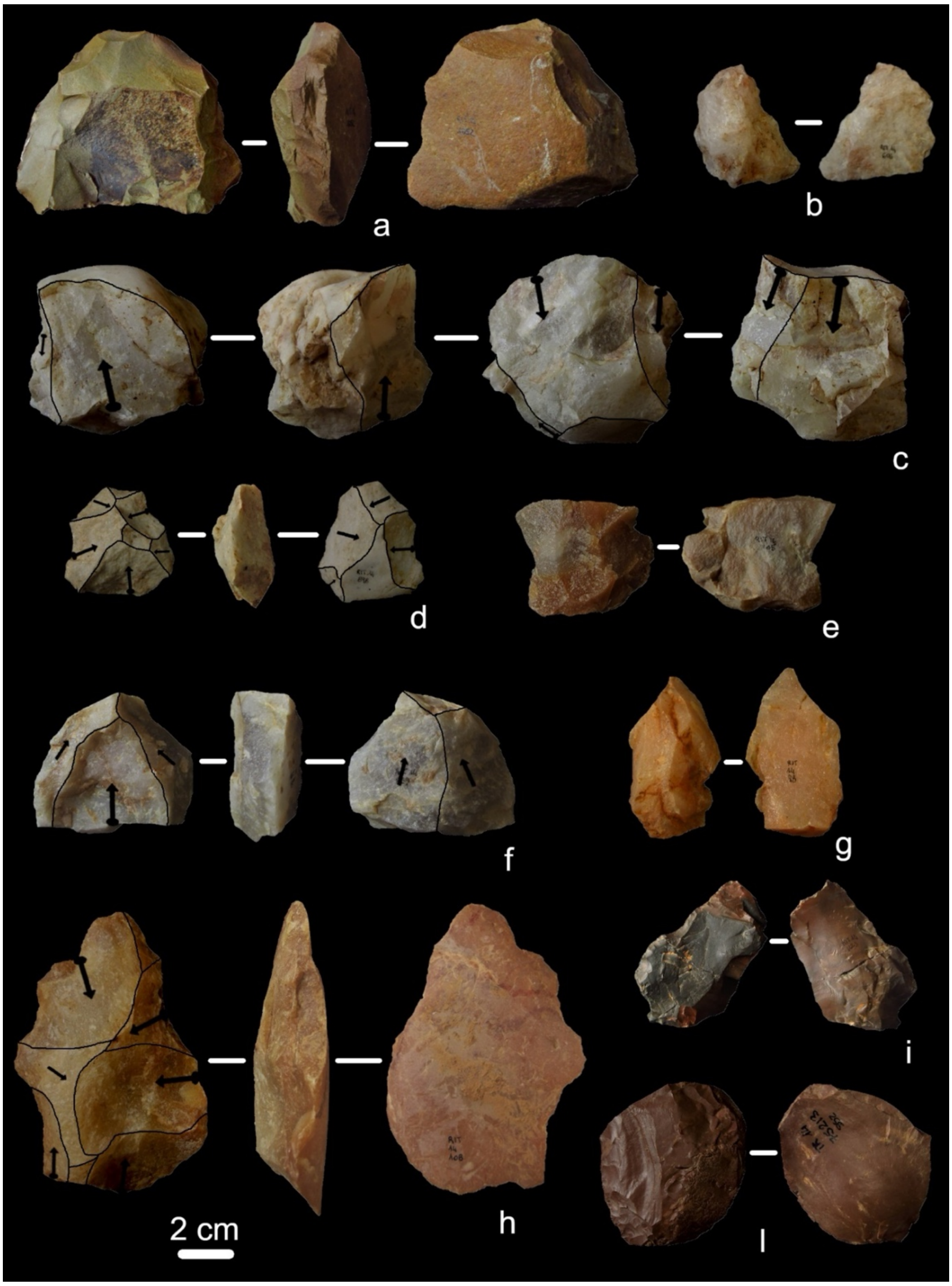


Figure 19 - Middle Palaeolithic lithic artefacts from the RIT 14. Preferential Levallois core on chert (a); discoid flake (b); opportunistic core on a vein quartz pebble (c); bifacial discoid core (d); preferential Levallois flake (e); preferential Levallois core on vein quartz (f); opportunistic flake with unipolar removals on the dorsal face and lateral neocortical surface (g); recurrent centripetal Levallois core (h); jasper (i) and radiolarite (l) sidescrapers on opportunistic flakes

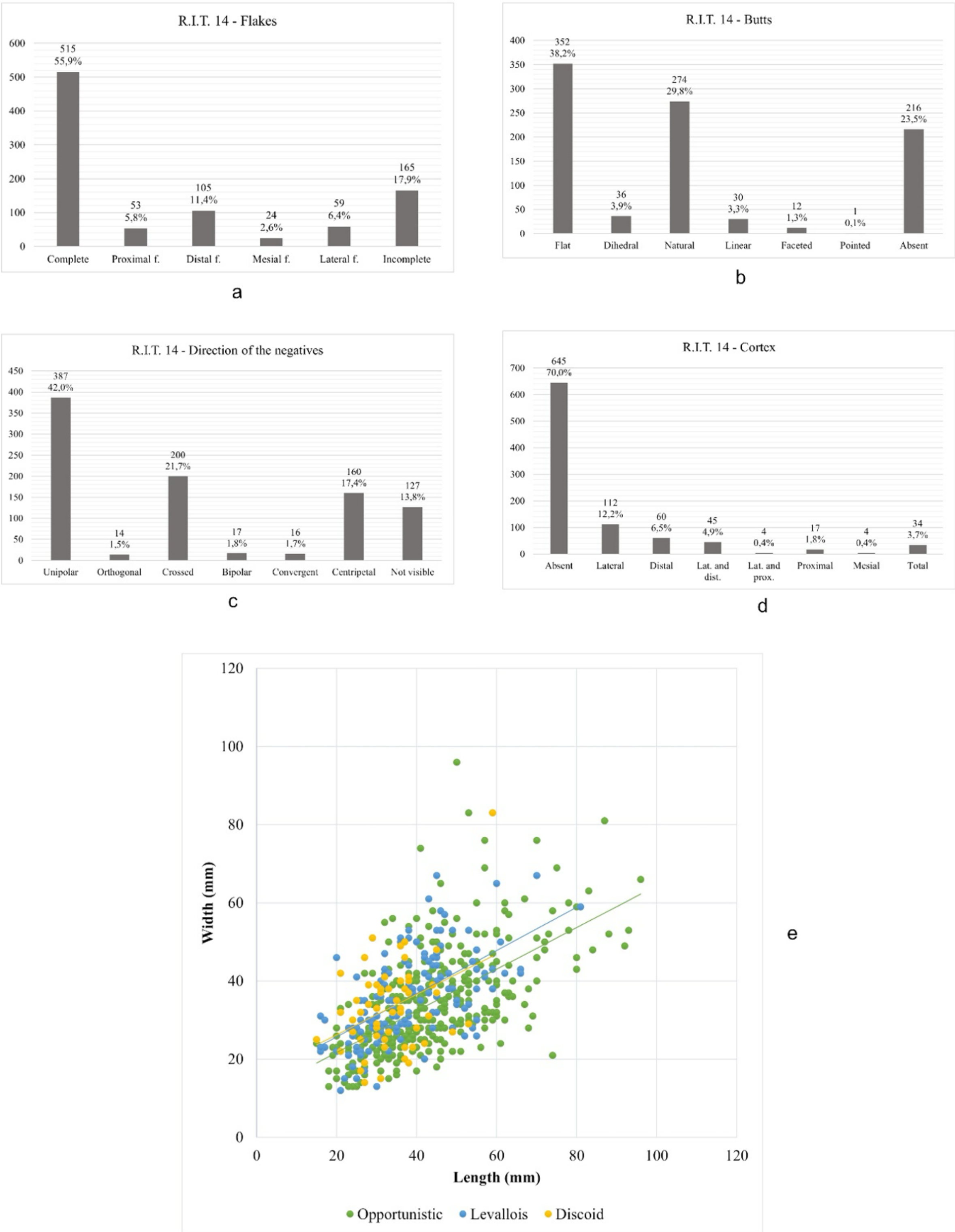


Figure 20 - Charts showing the main technological characteristics of the RIT 14 Middle Palaeolithic lithic assemblage. Flakes (a); butts typology (b); direction of the negatives on the dorsal faces (c); presence and position of cortical and neocortical surfaces on the dorsal faces (d); dimensional analysis of complete and incomplete flakes grouped by knapping method (e)

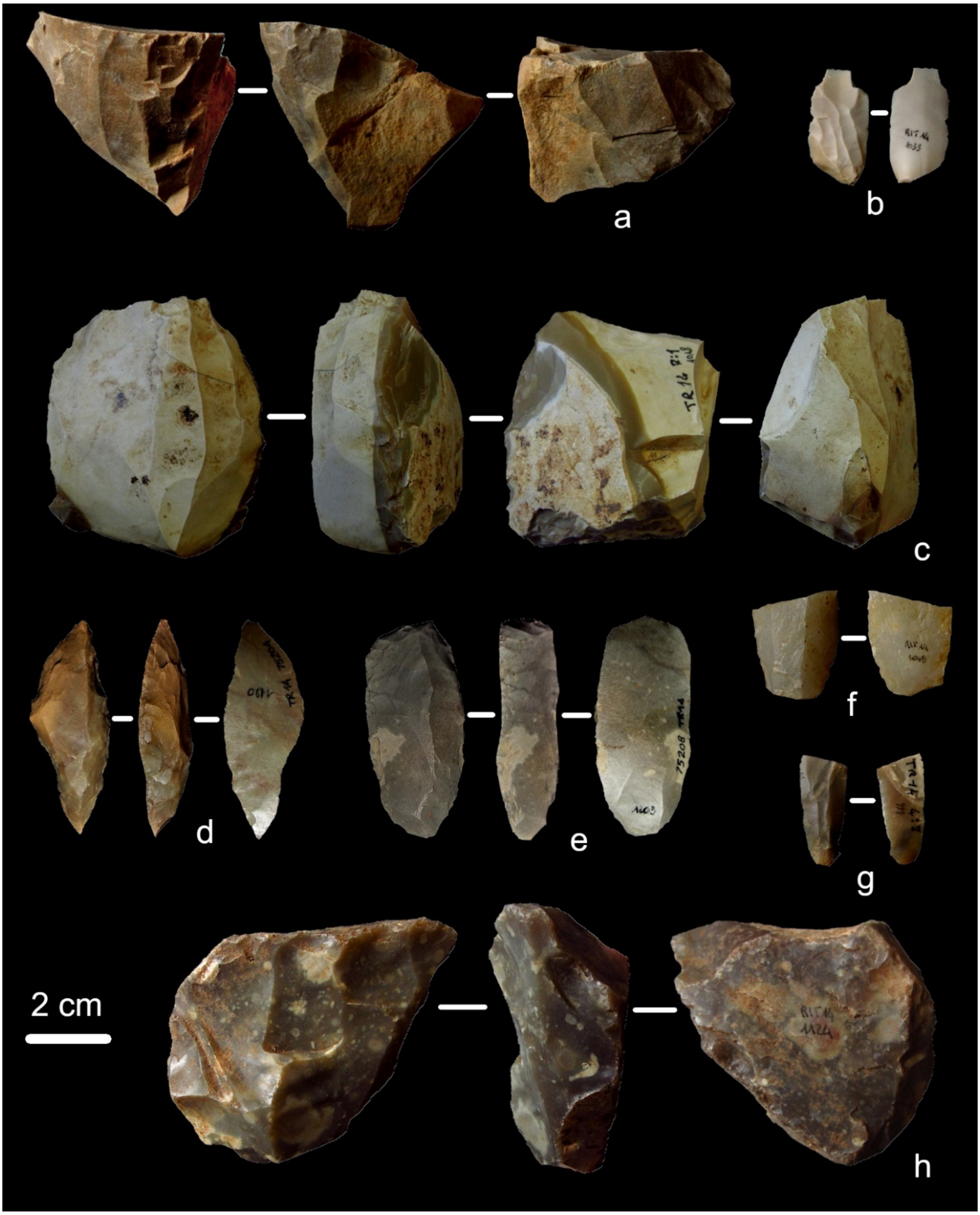


Figure 21 - Laminar debitage from RIT 14. Laminar cores on chert (a, c, h); core maintenancet flake manufactured by direct soft hammer percussion (b); point on chert laminar blank (d); end scraper (e); vein quartz blade manufactured by pressure technique (f); chert bladelet manufactured by indirect percussion (g)

Opportunistic reduction sequences are represented by 16 cores and 507 flakes. Cores are all made from vein quartz pebbles or polygonal blocks. The exploitation often consists in the knapping of one surface in following a suitable convexity and in a unipolar direction. One core shows bipolar exploitation (Figure 19 c) while 6 are exploited by S.S.D.A. scheme. As well as for Levallois and discoid knapping sequences, S.S.D.A. cores are discarded after short production sequences. The flakes produced have mainly unipolar negatives on the dorsal face and their dimensions are determined by the morphology and dimensions of the cores (Figure 20). Two flakes indicate the opening of a striking platform by removing a spherical cap from vein quartz pebbles. They present a neocortical dorsal face and are probably linked to the beginning of an opportunistic exploitation.

Regardless of the knapping method, flakes are mostly complete (55.9%), while a significative proportion (17.9%) is incomplete (Figure 20). Lateral fragments are often linked to siret fractures that occurred during knapping activities. Cortical or neocortical surfaces are present on about one third of flakes, and mostly on the lateral parts (Figure 20). The predominance of unipolar negatives on the dorsal faces of the flakes (exclusively associated to opportunistic flakes) and of flat and natural butts confirms what has been observed on the cores: regardless the knapping method, the exploitation starts from surfaces already present on the cores; opportunistic reduction strategies are aimed to a unipolar exploitation of one of the core convexities.

Neolithic laminar cores are manufactured on chert and radiolarite slabs (Figure 21 c): they are exploited through pressure to produce bladelets. Four cores have one striking platform exploited for different phases of bladelets production. Laminar cores are exploited through direct percussion by hard and soft hammer are manufactured on the same raw materials, but their chronology remains indeterminate. They usually have one striking platform, but in four cases a second and opposite striking platform is opened, probably to control the core convexity. The products obtained are blade and bladelets and the blanks chosen as cores are small pebbles or slabs (Figure 21).

In the Middle Palaeolithic assemblage, the reduction sequences are complete, with all the phases of lithic production represented in the archaeological record. The laminar method, cores and core-shaping/maintenance flakes are well represented in the assemblage, while blades and retouched tools are scarce. This data suggests that the knapping activities took place in the area for all the phases of human occupation, but during Middle Palaeolithic the lithic artefacts were produced, used and discarded at the site, while during the following periods part of the lithic products were probably transported out of the Trino hill.

RIT 15

The lithic assemblage from RIT 15 consists of thirteen vein quartz artefacts (Tables 1 and 3). The scars on flakes and cores indicates that the only technique employed is freehand hard hammer percussion. Recurrent centripetal Levallois is documented by one core and one flake. The core does not show sequences of core maintenance and it is exhausted (Fig 22 a). The desired products are oval, medium-sized flakes. The presence of preferential Levallois knapping strategies is confirmed by one flake. Seven flakes belong to opportunistic reduction sequences: butts are flat or natural while the knapping scars on the dorsal faces are always unipolar (Figure 22 c). We suggest that the opportunistic exploitation starts directly from the natural surfaces of the core and develops until the exhaustion of the convexity. After a short production sequence cores were probably abandoned. The knapping method of two lithic implements are indetermined. Based on the criteria adopted in this study, from the technological point of view the thirteen artefacts from RIT 15 can be referred to Middle Palaeolithic.

RIT 16

A small lithic assemblage from RIT 16 is composed of seven lithic artefacts (Tables. 1 and 3) manufactured on radiolarite, jasper and chert by opportunistic, Levallois and laminar reduction strategies (Figure 23). One radiolarite flake, affected by thermal alteration, is indetermined concerning the knapping method (Figure 23 b), while one of the artefacts is a debris strongly affected by rounding. The Levallois preferential method is present in the with one chert flake with faceted butt and it is assigned to the Middle Palaeolithic (Figure 23 c). The laminar component of this small assemblage shows characteristics consistent with an exploitation of chert and radiolarite through direct soft hammer percussion. Only one blade fits a production phase, while the other two laminar elements represent phases of core maintenance. In the absence of significative data and of retouched tools, it is difficult to propose a time period for the laminar products, which could belong eitherto an Upper Palaeolithic and to a Neolithic occupation.

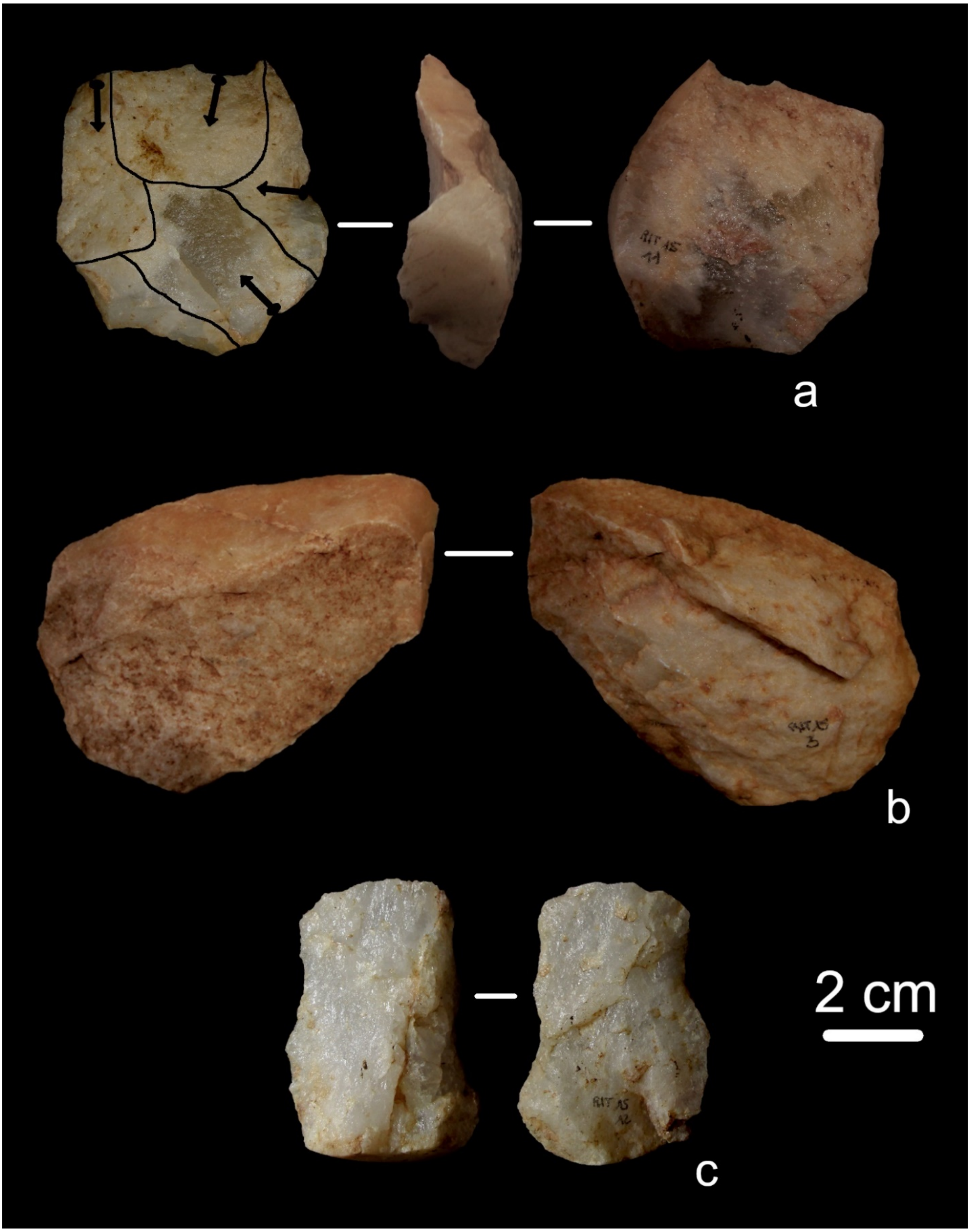


Figure 22 - Vein quartz lithic artefacts from RIT 15. Recurrent centripetal Levallois core (a); Opportunistic flakes (b, c)

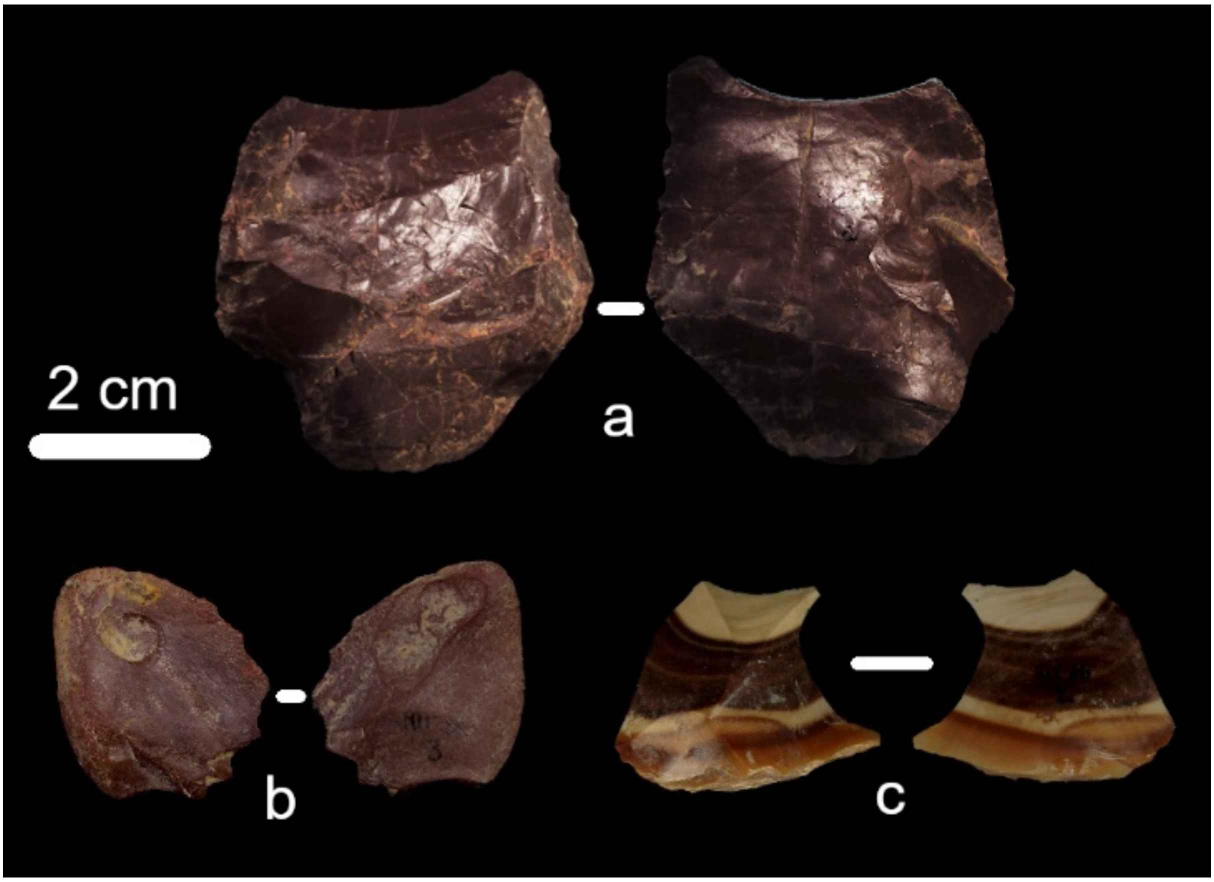


Figure 23 - Lithics from RIT 16. Opportunistic flake made of jasper (a); indeterminate radiolarite flake affected by thermal alterations (b); chert Levallois preferential flake (c)

RIT X

This group includes all the lithic artefacts collected at Trino hill without any indication of the collection area. Thirty-eight lithic artefacts mainly manufactured from vein quartz, chert and radiolarite, are in this collection (Tables 1 and 3). From a technological perspective, 27 artefacts could be assigned to Middle Palaeolithic. Of these, 23 are vein quartz flakes, 2 are vein quartz cores (1 discoid and 1 preferential Levallois) and 2 are chert retouched tools. Debitage products exhibit recurrent centripetal Levallois (n=5), preferential Levallois (n=4), discoid (n=4) and opportunistic (n=10) knapping methods (Figure 24). Four flakes are indeterminate concerning the knapping method. The only technique employed is direct hard hammer percussion. The two cores show the raw material choice of vein quartz pebbles with suitable convexities for the development of discoid and Levallois reduction sequences (Figure 23 a, b). In both cases the production of the desired products starts after a short sequence of core shaping. Retouched tools are represented by two convergent scrapers and a denticulate (Figure 24 c, f, h). The scrapers are manufactured on Levallois products, while the denticulate is manufactured on an opportunistic flake.

Two chert retouched blades and a laminar core are assigned to the Neolithic period (Figure 24 d,e). They are manufactured through the pressure technique and the blades are a sickle element and a point respectively. A fragmented retouched blade, shows an invasive retouch on both edges, is manufactured by direct soft hammer percussion.

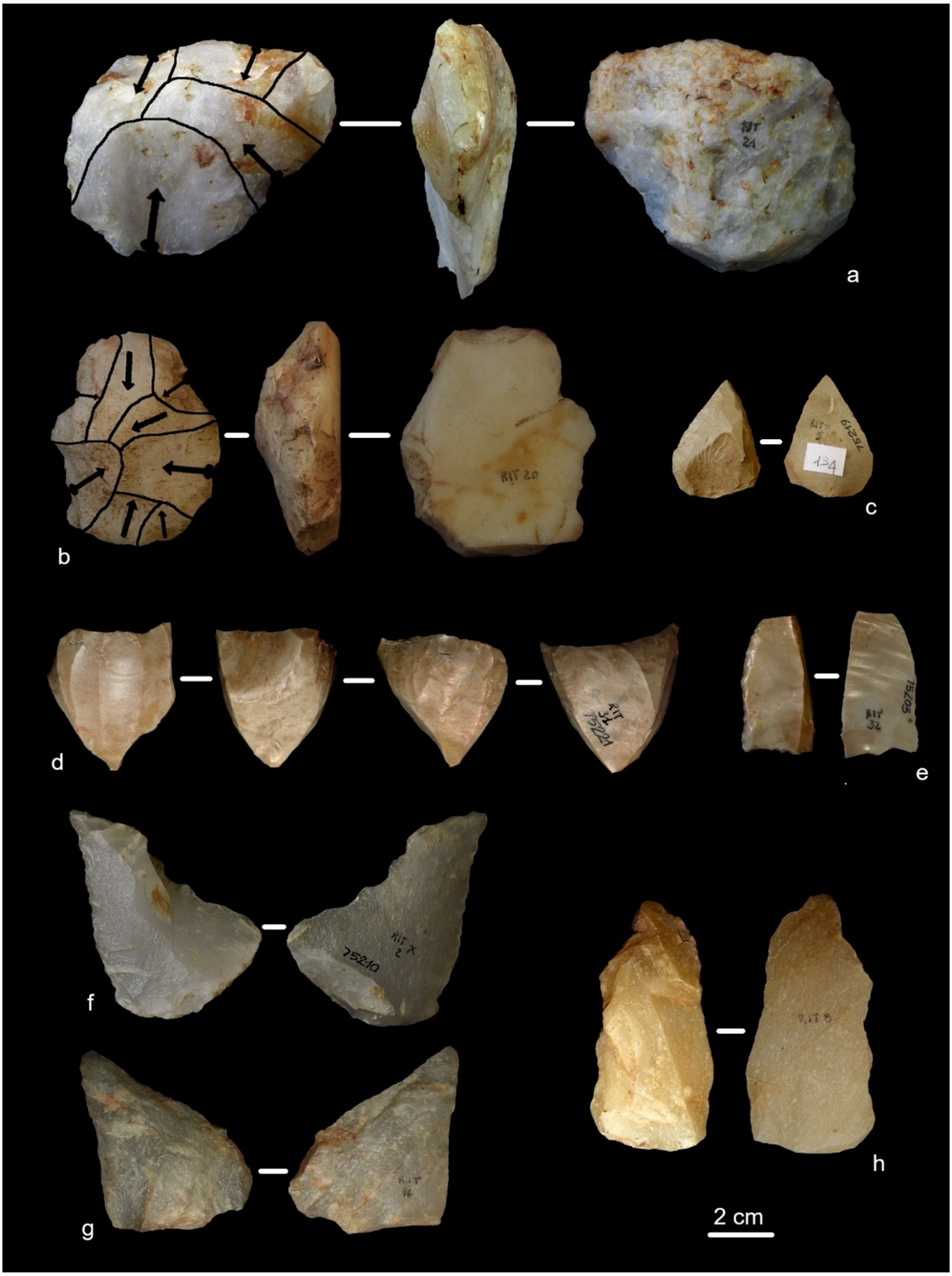


Figure 24 - Vein quartz and chert lithic artefacts from Trino hill. Levallois preferential core (a); unifacial discoid core with neocortical striking platform (b); convergent scraper on a Levallois point (c); laminar core (d); sickle element (e); convergent scraper on a Levallois flake (f); discoid flake (g); opportunistic flake with a denticulate retouch on the left margin (h)

Other surface collections in the Trino area

In addition to the collection areas located on the Trino hill, sporadic findings come from the immediate surroundings. A small vein quartz assemblage is from Casotto Diana, south of the Trino hill (Table 1): 25 flakes and two cores are manufactured by opportunistic, Levallois and discoid reduction strategies, attributes observed in the Middle Palaeolithic assemblages described above. To the east of the Trino hill, beyond the Natural Reserve "*Bosco della Partecipanza di Trino*" (Figure 2), in the surroundings of Cascina Ariosa, 16 vein quartz lithic artefacts were collected: 6 flakes and 1 core can be referred to Middle Palaeolithic; 2 blades belong to most recent occupations of the area, while 7 lithic implements are affected by strong post-depositional alterations that prevent their technological interpretation.

The lithic artefacts from "*Bosco della Partecipanza*" and from the adjacent localities of Ronsecco, Tricerro and Cantone (Table 1) are almost exclusively chert blades and bladelets of undetermined time period. On the other hand, the three polished axes from Cantone, *Bosco della Partecipanza* and Ronsecco certainly date to the Neolithic period but in the absence of additional information, the laminar assemblages from these localities cannot be clearly associated to this chronology.

Discussion

Summary of the results

The study of the lithic assemblages from Trino represent a further step in the understanding of the peopling of north-western Italy, as evidence about population and technological characteristics of Palaeolithic in this area and in particular in Piedmont are scarce and mostly represented by sporadic findings and non-systematic investigations (Guerreschi & Giacobini, 1998). The lithic artefacts from the Trino hill are the only significant evidence of a Palaeolithic occupation of the Po plain. Even based only on non-systematic surface collections, the data allow us to gain some understanding about the different phases of human occupation and the technological behaviour of the groups that occupied the region.

On technological basis, the lithic assemblages of the Trino hill, can be divided in five groups: a large assemblage of lithic artefacts from the Middle Palaeolithic (1440 artefacts – 73,3%); fewer Neolithic cores, blades and retouched tools (42 artefacts – 2,1%); a few retouched tools that can be considered Upper Palaeolithic (22 artefacts – 1,1%); a set of laminar cores and products that could be either of Upper Palaeolithic or Neolithic age (151 artefacts – 7,7%); a Lower Paleolithic bifacial tool. The remaining part of Trino's lithic industries (309 artefacts – 15,7%) corresponds to debris, retouch flakes, and fragments for which attribution remains undetermined.

The shaped tool (Figure 3), according to its stratigraphic position, can be attributed to Lower Palaeolithic and it represents the only Lower Palaeolithic artefact known in the region. The hypothesis of a Lower Palaeolithic human presence at the Trino hill was already proposed by Fedele, based on the characteristics of the lithic artefacts from RIT 1, 2, 3 and 4 (Fedele, 1974; GSQP, 1976), however, the revision of the lithic assemblages completed here, makes more likely to place those lithics in the Middle Palaeolithic assemblage, given the well attested Levallois technology.

The most important set of lithic artefacts analysed show characteristics of a Middle Palaeolithic technology. Levallois reduction sequences are well attested by cores and flakes, obtained through both the preferential and recurrent centripetal methods. Similarly, discoid, opportunistic and S.S.D.A. reduction sequences have been recognized, although their attribution to the Middle Palaeolithic is difficult and a margin of uncertainty remains. Most of the artefacts were found without a clear stratigraphic position but the general technological features and the consistency with the lithics found in the intermediate loess during the 1970s, makes realistic to suppose that they could belong to the same stratigraphic horizon. The chronology of the Middle Palaeolithic frequentation of the Trino hill could then belong to a time span between MIS 6 and MIS 4.

The Middle Paleolithic in Trino

The technological characteristics observed on the Middle Palaeolithic assemblages and, in particular, on those from RIT 14 (962 artefacts) allow us to make several suggestions about the general technological behaviour. The collection of the raw material mainly took place at the Trino hill and in the immediate surroundings. Vein quartz is the most exploited rock (Table 3) and can be easily found on the Trino hill in secondary deposits in the form of rounded pebbles or small polygonal blocks. The same must be said for limestone, porphyry, and quartzite, sporadically observed in the lithic assemblages. Other rocks like radiolarite and chert are allochthonous, and the ongoing identification of their supply areas will clarify the mobility of these human groups. The radiolarites exploited at the Trino hill are consistent with those identified at Ciota Ciara cave (Borgosesia, VC) (Daffara et al., 2019b) that come from the nearby Lombardy. Even though, precise data on the sources of the rocks exploited at the Trino hill will come from the ongoing analysis. It is not even possible to propose sources for the different kinds of chert exploited, since studies aimed to the identification of possible lithic raw materials supply areas have not yet been completed in the region.

Reduction sequences are complete for vein quartz and radiolarite that were introduced in the area as natural blanks and then exploited through opportunistic, discoid and Levallois reduction strategies. In the Middle Palaeolithic assemblage, chert is a secondary raw material, mainly represented by retouched tools and flakes. This observation suggests a sub-local source for the radiolarite and an allochthonous provenience for chert (Geneste, 1988; Kuhn, 1992; Féblot-Augustins, 1999; Bourguignon et al., 2004; Jaubert & Delagnes, 2007; Meignen et al., 2009; Turq et al., 2013; Wilson et al., 2018), that was probably collected in a range of some kilometres from the Trino hill. According to available gological data and preliminary results of the ongoing study of supply areas, we can assume distances between 30 and 60 km. In the probable Middle Palaeolithic assemblages, opportunistic reduction strategies are very well documented from vein quartz cores and flakes. Pebbles and polygonal blocks of various sizes and morphologies are knapped opportunistically and often discarded before exhaustion. The cores show a preferential unipolar exploitation that starts from a natural surface: a limited number of products is produced, and the core is abandoned. Sometimes, multidirectional reduction strategies are applied but the knapping sequences are short as well: each of the surfaces is usually exploited to produce one or two flakes. These data are reflected in the characteristics observed on the flakes issued from opportunistic debitage like the preponderance of unipolar negatives and of natural or flat butts (Figs. 10, 16, 18 and 20)

Levallois and discoid methods also shows complete reduction sequences. Cores are small and medium-sized rounded pebbles with natural convexities suitable for these kinds of exploitation. For Levallois technology, reduction strategy varies by raw material. Vein quartz cores show just one reduction series, after which the core is discarded. In the recurrent centripetal method, the production of Levallois flakes starts directly from the natural surfaces of the core with a striking platform that is often natural. In the preferential method the striking platform is prepared in correspondence of the impact point with big, centripetal removals. Levallois preferential and recurrent centripetal cores on chert show a more careful preparation of the convexities and, even if sporadically, faceted butts are present. Moreover, the knapping surfaces show different phases of core configuration, thus demonstrating longer Levallois reduction strategies on chert than on vein quartz. As already pointed out by studies on vein quartz (Mourre, 1996; Lombera-Hermida, 2009; Tallavaara et al., 2010), these differences are linked to technological adaptations to the raw materials properties. The more intensively the vain quatz is used, the more unpredictable become the knapping activities, due to the formation of inner fracture planes. Furthermore, the use of neocortical surfaces as striking platforms reduces the occurrence of knapping accidents and fractures.

The same technological adaptations are visible for discoid reduction sequences, mainly developed on vein quartz small pebbles. The unifacial reduction strategy uses a neocortical surface as striking platform and also in the bifacial method natural surfaces are visible. The discoid production follows a centripetal direction, with no regards for the maintenance of the core convexities: the reduction sequences are intentionally short, and cores are discarded before their complete exhaustion.

The Middle Palaeolithic technological behaviour at the Trino hill can be defined as expedient (Binford, 1979; Bamforth, 1986; Kuhn, 1992; Andrefsky, 1994; Vaquero et al., 2015; Vaquero & Romagnoli, 2018), with the predominant exploitation of local lithic resources and the choice of natural blanks with suitable morphologies in order to start the production of the wanted products without long phases of core configuration.

The Upper Palaeolithic and the Neolithic in Trino

Laminar reduction strategies are used on radiolarite, chert and, to a lesser extent, on vein quartz. Neolithic use of vein quartz occurs at the nearby site of Montalto Dora (Padovan et al., 2019), while no evidence is known for the Upper Palaeolithic. Techno-typological criteria allow placement of 18 retouched tools in the Upper Palaeolithic; the same criteria, together with the identification of the pressure technique, allow us to identify 53 lithic implements as Neolithic, even if it is not possible to to specify a particular Neolithic phase.

Cores, blades and flakes without diagnostic characteristics resulting from phases of core maintenance cannot be referred to a specific time period. With the exception of the Epigravettian site of Castelletto Ticino (Berruti et al., 2017), no other Upper Palaeolithic contexts are known in the region, thus making very difficult the identification of this horizon at the Trino hill. The only clear similarity with Castelletto Ticino is the production of laminar implements through direct percussion by organic hammer, documented by an end-scraper, two scrapers, two retouched blades and a notch typologically attributable to Upper Palaeolithic. One hundred forty one blades from Trino are manufactured by the same technique, but in the absence of other diagnostic features they cannot be placed in the Upper Palaeolithic assemblage.

It is interesting to note that of 257 laminar implements, 28 are cores and 110 are flakes and blades belonging to core maintenance. The production phases and the retouched tools seems to be underrepresented in the considered assemblage. It marks a clear difference with respect to what has been observed for Middle Palaeolithic: during the most recent occupations of the Trino hill, chert was introduced in the site as natural blanks or as cores partially configurated, cores were knapped in the site, but the final products were transported outside the area of the Trino hill.

Trino in the Northern Italian context

It is not easy to propose a precise contextualisation of the lithic assemblages of Trino mainly because of the absence of a precise chronological framework. Even thought, on a technological basis we can make some useful propositions, especially about the Middle Palaeolithic assemblage.

At a local scale, the Middle Palaeolithic reduction strategies documented at the Trino hill find a close comparison with those described at the Ciota Ciara cave (Arzarello et al., 2012; Daffara et al., 2014, 2021). As of today, Ciota Ciara is the only Middle Palaeolithic multidisciplinary project with systematic excavations in the southern margin of the central and western Alps. Trino hill shares with Ciota Ciara cave some technological features: 1) the predominant use of vein quartz, radiolarites and chert to produce chipped stone tools using opportunistic, Levallois and discoid strategies.; and 2) use of technological strategies to exploit vein quartz pebbles. The use of vein quartz is broadly documented in Piedmont by lithic assemblages resulting from old excavations and from sporadic findings in different localities (Conti, 1931; Fedele, 1966; Rubat Borel et al., 2013, 2016). Additional regional technological comparison can be found in the Middle Palaeolithic assemblage from Vaude canavesane (Rubat Borel et al., 2013). Resulting from un-authorized excavations and surface collections, this assemblage as well shows the predominant exploitation of vein quartz through opportunistic, Levallois and discoid reduction strategies and its attribution to Middle Palaeolithic is based on technological criteria. Beside the sporadic nature of the data available concerning Piedmont, the ongoing studies suggest quite homogeneous technological behavior during the Middle Palaeolithic occupations of the region. They seem to be based on the exploitation of vein quartz as main lithic resource, from time to time accompanied by other local lithic resources with technological adaptation to the quality and mechanical properties of the raw materials employed.

In the context of the Alpine and sub-Alpine region, Piedmont represents a particular case-study in the field of lithic technology. Along the southern margin of the central and western Alps (i.e., Piedmont and Lombardy), reliable data about Middle Palaeolithic occupations are missing, while in the nearby Liguria and in the eastern side of the Southern Alps archaeological sites are numerous and well documented (Cauche, 2007; Picin et al., 2013; Peresani et al., 2014; Delpiano et al., 2018; Holt et al., 2019) (Figure 1). It is difficult to identify the causes of this absence, but one of them is certainly the lack, in the last decades, of specific studies aimed at identifying and investigating Paleolithic occupations in the area. Another factor is the lithic raw material availability at a regional scale. Chert is very abundant in the eastern part of the Alpine arc and many formations provide excellent quality lithic resources that were systematically exploited by the Middle

Paleolithic human groups. In Piedmont, the most widespread rock is vein quartz, while Monte Fenera (north-eastern Piedmont) is the only area where chert can be easily accessible.

The data available for the western part of the alpine arc are in our opinion still too scarce to propose a detailed contextualization at a large scale but the ongoing research will certainly provide a more precise placement of Piedmont even in the context of the European Palaeolithic.

Conclusion

Based on the available data, we hypothesize that during Middle Palaeolithic the Trino hill was a residential location, probably linked to repeated seasonal occupations, with subsistence activities focused on local resources while during the most recent periods the occupations become more intermittent, likely in the form of hunting camps, and linked to the production of tools. Unfortunately, the lack of information on collection protocols, i.e., by chance and unsystematic, precludes evaluation of factors that effect recovery, such as visibility as well as spatial or temporal survey intensity, limiting interpretations of past behavior. Collections may have been biased by selection on the basis of dimensional and/or aesthetic criteria (fragmented artifacts, debris) and in general the entire minute fraction that usually constitutes a lithic industry is likely underrepresented. Thus, if Trino hill is a residential site we would expect a high proportion of broken or exhausted instruments, but in this case we must develop expectations comensurate with potential collection bias. However, in the Middle Paleolithic assemblage there are cores, flakes and retouched tools and possibly debris for manufacture of retouch flakes, although in the analysis we considered this portion of the assemblage temporally ambiguous.

Thus, the Middle Paleolithic reduction sequences can is considered complete, suggesting that Trino hill represents habitual movements of human groups, where raw mateerial was introduced from Lombardy (i.e., radiolarites) and local lithic resources (i.e., vein quartz) was intensively exploited for production of lithic implements. On the other hand, the scarcity of blades and bladelets is so important that it cannot, in our opinion, be due to collection problems alone. For this reason, changes in the mobility of human groups and/or function of the Trino hill along the usual routes of movement are to be considered realistic, at least from the Upper Paleolithic onward.

Middle Palaeolithic studies completed in the recent past (Ciota Ciara cave, Vaude Canavesane, Baragge Biellesi) (Rubat Borel et al., 2013, 2016) and the data from Trino, give a quite homogeneous picture of the Piedmontese area. We observed the presence of human occupations based on the exploitation of local resources, among which vein quartz is the most present, and with similar technological behaviours. On the other hand, there is still a long way to go to clarify modalities and characteristics of the Upper Palaeolithic in the region. Even in the absence of precise stratigraphic data and therefore of a clear chronological framework, the technological analysis of the lithic assemblages collected at the Trino hill allows to define some technological trends useful to hypothesize the modalities of site occupation, essentially definable as an area object of repeated human occupations linked to the production of lithic tools and to the development of subsistence activities. The study of Trino hill enhances our understanding of the Palaeolithic peopling of the southern margin of the western Alps that has become better known in the last several years.

Acknowledgements

New research about the lithic assemblages from Trino have been possible thanks to *Soprintendenza Archeologia, Belle Arti e Paesaggio per le provincie di Biella, Novara, Verbano-Cusio-Ossola e Vercelli,* to the Trino municipality and to the help and support of the members of *Tridinum. Associazione per l'Archeologia, la Storia e le Belle Arti*. We would like to thank Elena Molzino and Pier Luca Monge, members of TRIDINUM, for their significant help in the development of the present research. The research work here presented is dedicated to the loving memory of Elena Molzino. Preprint version 6 of this article has been peer-reviewed and recommended by Peer Community In archaeology (https://doi.org/10.24072/pci.archaeo.100421; Kornfeld, 2024)

Funding

No funding was received to assist with the preparation of this manuscript

Conflict of interest disclosure

The authors declare that they comply with the PCI rule of having no financial conflicts of interest in relation to the content of the article. The authors declare the following non-financial conflict of interest: Sara Daffara and Gabriele L.F. Berruti are recommenders of PCI Archaeology

Data, script, code, and supplementary information availability

The raw data used for this article are available at: https://doi.org/10.17605/OSF.IO/J6GMV (Daffara, 2024)

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