Using the Technological Feature of Tranchet Blow on *Keilmesser* as a Connecting Element Between Similar Middle Paleolithic Assemblages from the Côte Chalonnaise (Saône-et-Loire, France)

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ABSTRACT

This article examines lithic artifacts which, because of a particular modification, may be considered a shared feature of late Middle Paleolithic assemblages from the Saône-et-Loire Department in eastern France. There, the modification of the cutting edges referred to as tranchet blow was first described in detail in the 1970s using the lithic material from Grotte de la Verpillière I, which was excavated in 1868. However, research carried out in recent years has shown that this tranchet blow modification on *Keilmesser* is not confined to this site; in fact, it also occurs at several surrounding sites. Thus, the tranchet blow modification can be seen as a specific regional phenomenon. Research on *Keilmesser* and the tranchet blow modification brings us face to face with the problem of terminology. It is not the linguistic barrier that is important here, but rather the use of different terms and very different spellings in the literature. This makes the search for further assemblages featuring this phenomenon considerably more difficult. In this context, a technological and terminological rethink is called for.

In previous studies, the similarity between burin blow and tranchet blow modification was highlighted. It has recently been more often assumed that the technological prerequisites of these two reduction variants can be regarded as similar but nevertheless different. This article addresses these technological concerns in a general overview and proposes a coherent standardized terminology using the more neutral term "*Keilmesser*" with the addition of the qualifier "with tranchet blow." Furthermore, regional research on *Keilmesser*, and related tranchet blow modification, is described and the initial results of recent studies on the suggested technological clustering of Middle Paleolithic behavior in Saône-et-Loire are presented.

RÉSUMÉ

Cet article examine des artefacts lithiques qui, en raison d'une modification particulière, peuvent être considérés comme une caractéristique commune aux industries du Paléolithique moyen tardif du département de Saône-et-Loire, dans

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l'est de la France. Cette modification d'un bord tranchant, appelée coup de tranchet, a été décrite en détail pour la première fois dans les années 1970 à partir du matériel lithique de la grotte de la Verpillière I, fouillée en 1868. Les recherches menées ces dernières années montrent toutefois que la modification du coup de tranchet sur les Keilmesser ne se limite pas à ce seul site, mais qu'elle est également présente sur plusieurs sites environnants. C'est pourquoi la modification du coup de tranchet peut être considérée comme un phénomène régional spécifique. Les recherches sur les Keilmesser et la modification du coup de tranchet posent un problème terminologique. Ce n'est pas la barrière linguistique qui est importante ici, mais l'utilisation de termes très différents et d'orthographes très variées dans la littérature, ce qui complique considérablement la recherche d'autres sites présentant ce phénomène.

Dans ce contexte, il est nécessaire de repenser la technologie et la terminologie. Des études antérieures ont souligné la similitude entre le coup de burin et la modification du coup de tranchet. Ces derniers temps, on part plus souvent du principe que les conditions technologiques de ces deux variantes de réduction, bien qu'elles offrent des similitudes. Le présent article aborde ces préoccupations technologiques dans un aperçu général et propose une terminologie uniforme utilisant le terme plus neutre de "Keilmesser" avec l'ajout de "avec coup de tranchet". En outre, les recherches régionales sur les Keilmesser et les modifications connexes du coup de tranchet sont décrites et les premiers résultats d'études récentes sur le regroupement technologique supposé du comportement du Paléolithique moyen en Saône-et-Loire sont présentés.

ZUSAMMENFASSUNG

In diesem Artikel werden lithische Artefakte untersucht, die aufgrund einer spezifischen Modifikation als gemeinsames Merkmal spätmittelpaläolithischer Inventare aus dem Departement Saône-et-Loire in Ostfrankreich betrachtet werden können. Diese als Schneidenschlag bezeichnete Modifikation der Schneidekanten wurde erstmals in den 1970er Jahren anhand des lithischen Materials aus der Grotte de la Verpillière I, die 1868 ausgegraben wurde, ausführlich beschrieben. Die in den letzten Jahren durchgeführten Forschungen zeigen jedoch, dass die Schneidenschlagmodifikation an Keilmessern nicht auf diesen Fundort allein beschränkt ist, sondern auch an mehreren umliegenden Fundorten vorkommt. Aus diesem Grund kann die Schneidenschlagmodifikation als ein spezifisches regionales Phänomen angesehen werden.Die Forschungen zu Keilmessern und deren Modifikation mittels Schneidenschlag stellen uns vor ein terminologisches Problem. Nicht die sprachliche Barriere ist hier von Bedeutung, sondern die Verwendung sehr unterschiedlicher Begriffe und sehr unterschiedlicher Schreibweisen in der Literatur, was die Suche nach weiteren Fundstellen mit diesem Charakteristikum erheblich erschwert.

In diesem Zusammenhang ist ein technologisches und terminologisches Umdenken erforderlich. In früheren Studien wurde die Ähnlichkeit zwischen Stichelschlag und Schneidenschlagmodifikation hervorgehoben. In letzter Zeit wird häufiger davon ausgegangen, dass die technologischen Voraussetzungen dieser beiden Reduktionsvarianten zwar ähnlich, aber dennoch unterschiedlich sind. Der vorliegende Beitrag greift diese technologischen Bedenken in einem allgemeinen Überblick auf und schlägt eine einheitliche Terminologie vor, die den neutraleren Begriff "Keilmesser" mit dem Zusatz "mit Schneidenschlag" verwendet. Darüber hinaus werden regionale Forschungen zu Keilmessern und verwandten Schneidenschlagmodifikationen beschrieben und die ersten Ergebnisse neuerer Studien zur angenommenen technologischen Clusterung mittelpaläolithischen Verhaltens in Saône-et-Loire vorgestellt.

INTRODUCTION

Ongoing research on the Middle Paleolithic, conducted within the framework of Paleolithic projects in southern Burgundy, offers new evidence to help build hypotheses regarding Middle Paleolithic settlement patterns and assemblage characteristics.

This paper focuses on enigmatic tools from Middle Paleolithic assemblages from the northern part of the Saône-et-Loire Department in eastern France (see Fig. 1), in the area known as the Côte Chalonnaise.

Deriving from old surface collections housed in museums and institutions, and from recent fieldwork, the lithic assemblages studied were selected because they contain *Keilmesser* with specific cutting-edge modifications. Known as tranchet blow, this modification is used to lower the edge angle and to produce a straight cutting edge that requires only minimal edge regularization. This contribution aims to describe the technical and technological characteristics of these tools, which we refer to as *Keilmesser* with tranchet blow, from the Côte Chalonnaise.

We examine the confusing diversity of terms used in European lithic studies to refer to *Keilmesser* with tranchet blow and the tranchet blow modification itself, and we follow this with a systematic distinction to other modification systems.

Since little is known about these highly characteristic tools and their modification, which date to the Middle Paleolithic in this region, we have carried out related historical research on important previous regional studies of these tools. The preliminary results of technological studies, which examine the production process with regard to equifinality and permutation of working stages, are presented, demonstrating the high variability of *Keilmesser* featuring the tranchet blow concept.

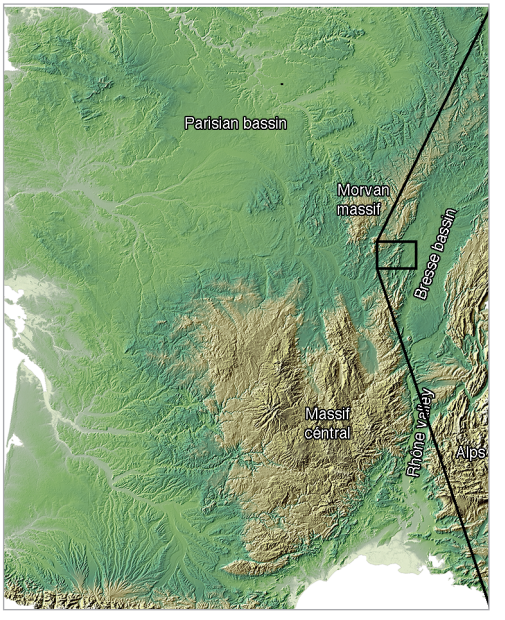
In 2017, we identified n=54 such lithic tools and successively analyzed them with regard to the succession of working stages, their equifinality (What kind of matrix was used? How was the desired tranchet blow stage reached?), the flexibility and exchangeability of working stages and maintenance processes. In this regard, the material from Grotte de la Verpillière I provides the bulk of the data with n=44 *Keilmesser* with tranchet blow and n=55 tranchet blow blanks. As refitting was not possible, the data derive from single piece analyses.

KEILMESSER (NOMENCLATURE AND MORPHOLOGICAL DEFINITION)

Diversity in *Keilmesser* nomenclature

The great diversity of names assigned to asymmetrically (mostly bifacially) backed knives or *Keilmesser* (KM in singular and KMs in plural form) makes it difficult to identify these pieces from published sources. A recent survey identified over 20 terms used to refer to them, and if we include

names assigned to objects possessing a tranchet blow negative, then nearly 40 names occur in the reviewed literature (Frick et al. 2017b). The following list, arranged chronologically, provides an overview of this diversity, but is by no means exhaustive:



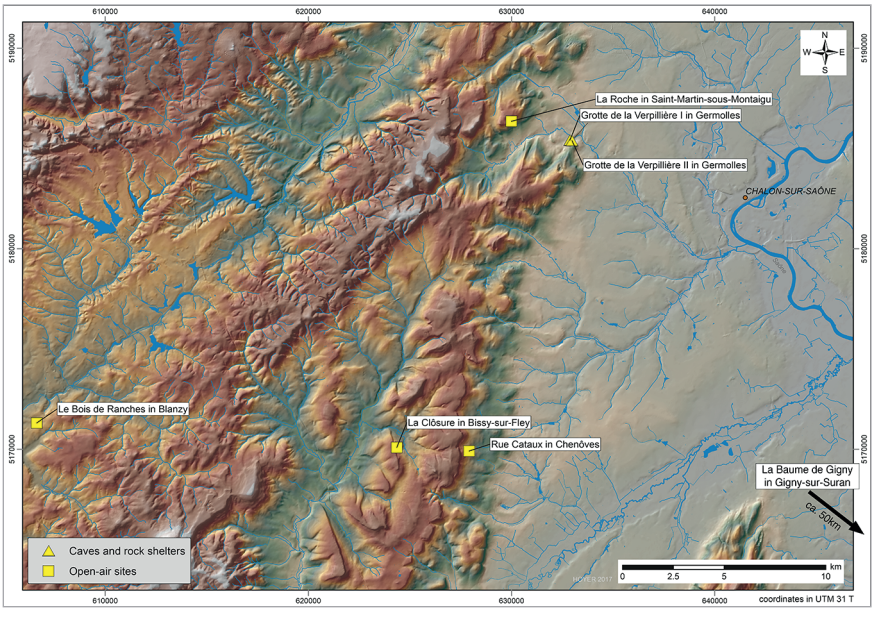


Fig. 1.
Relief maps of southern France showing the locations of sites that have yielded *Keilmesser* in the Côte Chalonnaise. **Right:** Relief map of southern France showing the position of the Côte Chalonnaise between the Massif Central and the Morvan Massif on the western margin of the Bresse Basin (base map: NASA, SRTM 2000, www.pacha-cartographie.com). **Below:** Relief map of the Côte chalonnaise in the North of the Saône-et-Loire department showing the position of the sites that have yielded *Keilmesser* with tranchet blow (map: IGN France 2016; mapping: C. T. Hoyer).

- *Prądnik* (Krukowski 1939-1948);
- *Faustkeilschaber* (Bohmers 1944);
- *Keilmesser* (Jacob-Friesen 1949);
- *Biface-racloir* (Bordes 1961);
- *Prodnik* (Bordes 1968; Brézillon 1971; Chmielewski 1969);
- *Proudnik* (Chmielewski 1970);
- *Faustkeilmesser* (Geer 1967);
- *Prondnik* (Desbrosse et al. 1976);
- *Prondtnick* (Campy et al. 1989);
- *Prondnickmesser* (Boëda 1995; Boëda et al. 2002; Boëda et al. 1990);
- *Couteau micoquien* (Koulakovskaya et al. 1993);
- Bifacial knife-side-scraper (Kozłowski 2001);
- *Racloir-couteau asymétrique bifacial* (Kozłowski 2002);
- Bifacially backed knife (Jöris 2006);
- Asymmetrical backed knife (Migal and Urbanowski 2006);
- *Couteau bifacial* (Van Assche 2012);
- Bifacial scraper-knife, Bifacial backed scraper-knife (*Keilmesser*), Backed bifacial scraper or knife with asymmetric back and outline (*Keilmesser*), Asymmetric backed scraper or knife (Golovanova et al. 2017)
- or Asymmetrically bifacially backed knife (Frick and Floss 2017).

It should be noted that this list only includes terms that are used synonymously for the term *Keilmesser*.

Techno-morphology of *Keilmesser*

A *Keilmesser* is an artificially shaped lithic object which possesses distinctive technical elements. The circumferential edge of a *Keilmesser* can be divided into four sections (Jöris 1993: 81, Fig. 14; see also Kozłowski 1972: 466, Fig. 1; Krukowski 1939-1948: 55–56; Schild and Wendorf 1977: 36, Fig. 3): one (at least) cutting edge (*Schneidekante*, *bord coupant*), a back (*Rücken*, *dos*), a bow (*Bogen*, *arc*) and a base (*Basis*, *base*). The terms are summarized in Figure 2.

The primary active edge (straight cutting edge) is assumed to have been used for various cutting tasks (Jöris 2006; Urbanowski 2003): On the one hand, for longitudinal slicing (cutting-in) and, on the other hand, for transversal whittling (cutting-off) and scraping. Therefore, it can be assumed that these tools were multifunctional (e.g., cutting meat and sinews, whittling wood or scraping wood and bones). Analyses carried out by Rots (2009) provides evidence that *Keilmesser* from Sesselfelsgrotte G were used as knives, projectile tips and scrapers (some of them were hafted and others were hand-held).

The back and base can be naturally (cortical, former surfaces or negatives) or artificially (retouch) formed. Both parts are necessary for hand-held purposes, as was first illustrated by Wetzel (1954: 124, Fig. 13c).

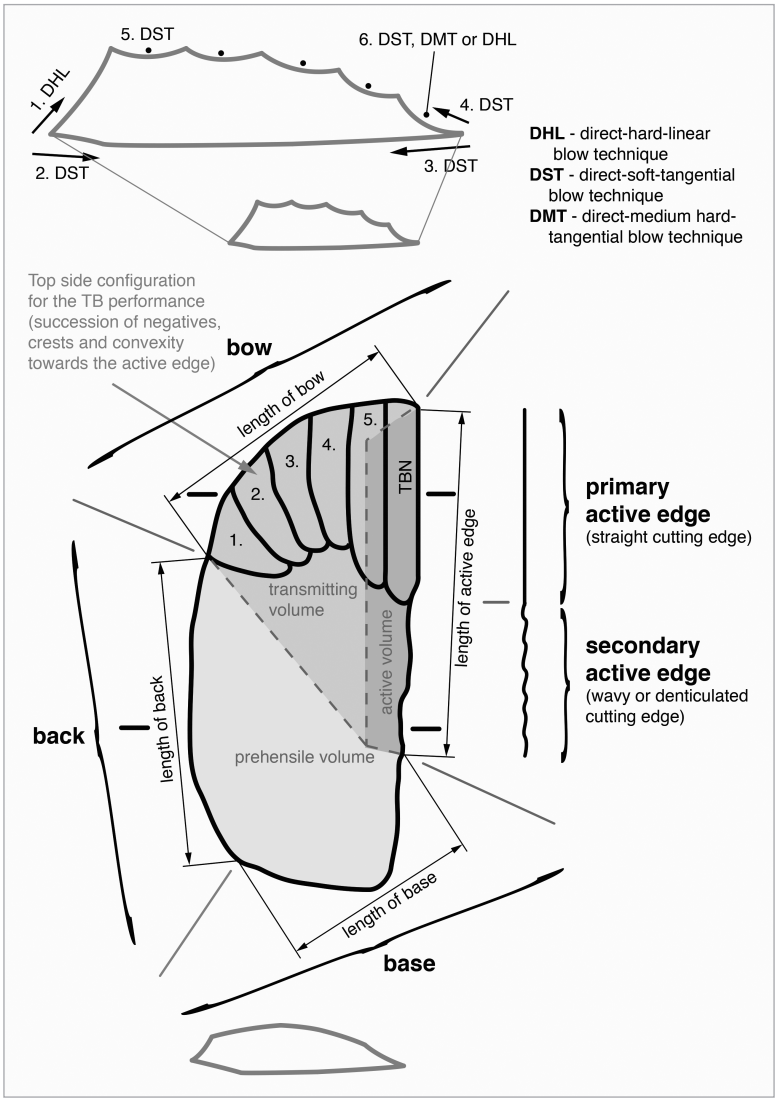


Fig. 2.
Techno-morphology of a *Keilmesser* with tranchet blow.

The bow is important for the formation of the active edge. It consists of a truncation, which serves as a platform for negatives on the top side (more convex surface) that forms the convexity necessary for performing the tranchet blow and also serves as a platform for the tranchet blow.

As is evident from many *Keilmesser* featuring a tranchet blow (KMTBs), the matrix is of great importance because its specific shape immediately determines the succession of the necessary working stages. Despite the necessity for a specific shape, *Keilmesser* can be made on different types of matrices (raw pieces, blanks, frost shards or cores). If a specific part is present (because of the shape of the matrix) then there is no need for the corresponding working stage to be performed.

The following two examples should illustrate the shape specifics listed above. For instance, if a blank selected as a matrix features a natural (cortical) back and a wedge-shaped cross section, then there is no need to produce a back and the shape of the cross section is close to that which is desired. Thus, certain working stages can be skipped (backing and surface shaping). The production now begins with subsequent stages (truncation, cutting-edge formation, blunting of the cutting-edge for guiding purposes, production of the convexity for the execution of the tranchet blow, etc.). However, if a raw piece is selected (completely covered with cortex), then all surfaces (back, top side and bottom side) need to be shaped first, before other working stages can follow.

The entire production is focused on one goal, the execution of a tranchet blow. Even if a piece is maintained at a later date using a tranchet blow, the morphology of the piece must be, or will be, designed in such a way that the execution of a tranchet blow is technically possible from the outset. The morphology, technology, functionality and handling of a Keilmesser with tranchet blows was described in more detail in Frick and Herkert (2020).

TRANCHET BLOW (NOMENCLATURE AND MORPHOLOGICAL DEFINITION)

Diversity in tranchet blow nomenclature

Just as for the tool itself, there are a plethora of terms in use for this highly specific cutting-edge modification, as well as for the resulting blanks and negatives. The following list of terms is in chronological order but again is by no means exhaustive:

- *Coup du tranchet* (Octobon 1922);
- Tranchet blow (Moir 1925);
- *Pararylcowa* (Kowalski 1967);
- *Burin plat* (Chmielewski 1969);
- *Micoque-Technik* (Bosinski 1969);
- *Schneidenschlag* (Bosinski 1969);
- Para-burin (Kozłowski 1972);
- *Coup de tranchet*, *Schneidenschlag*, tranchet blow (Inizan et al. 1995; 1999; Inizan et al. 1993; Tixier et al. 1980);
- Long sharpening flakes (Cornford 1986);
- *Pradniktechnik* (Jöris 1992; 1993);
- Para-burin blow (Conard and Fischer 2000);
- Sharpening blow (Urbanowski 2003);
- *Pradnik-Schneidenschlag* (Floss and Poenicke 2006);
- *Prądnik* technique, sharpening spall, sharpening flakes (Jöris 2006);
- Tranchet blow and tranchet blow spall (Douze 2014);
- Tranchet blow, tranchet blow blank and tranchet blow negative (Frick 2016).

From this short review it is clear that two major lines of description exist for this modification. On the one hand, the modification is—even from its name—directly linked to cutting-edge modification, e.g., coup de tranchet, Schneidenschlag or tranchet blow. Furthermore, tranchet blow is the literal translation of coup de tranchet or Schneidenschlag, and the translation used by Inizan et al. (1995, 1999, 1993). On the other hand, the supposed technical similarities between these modifications and burins are reflected in the terms para-burin (Conard and Fischer 2000; Kozłowski 1972) or burin plat (Chmielewski 1969).

Diversification of tranchet blow modifications

The tranchet blow modification is known from the Acheulian (Bordes 1971; Chevrier 2006, 2012; Jagher 2016; Jagher et al. 1997; Tuffreau and Zuate y Zuber 1975; Wenban-Smith 1989; Zuate y Zuber 1972), the early and late Middle Paleolithic and Middle Stone Age (Cornford 1986; Douze

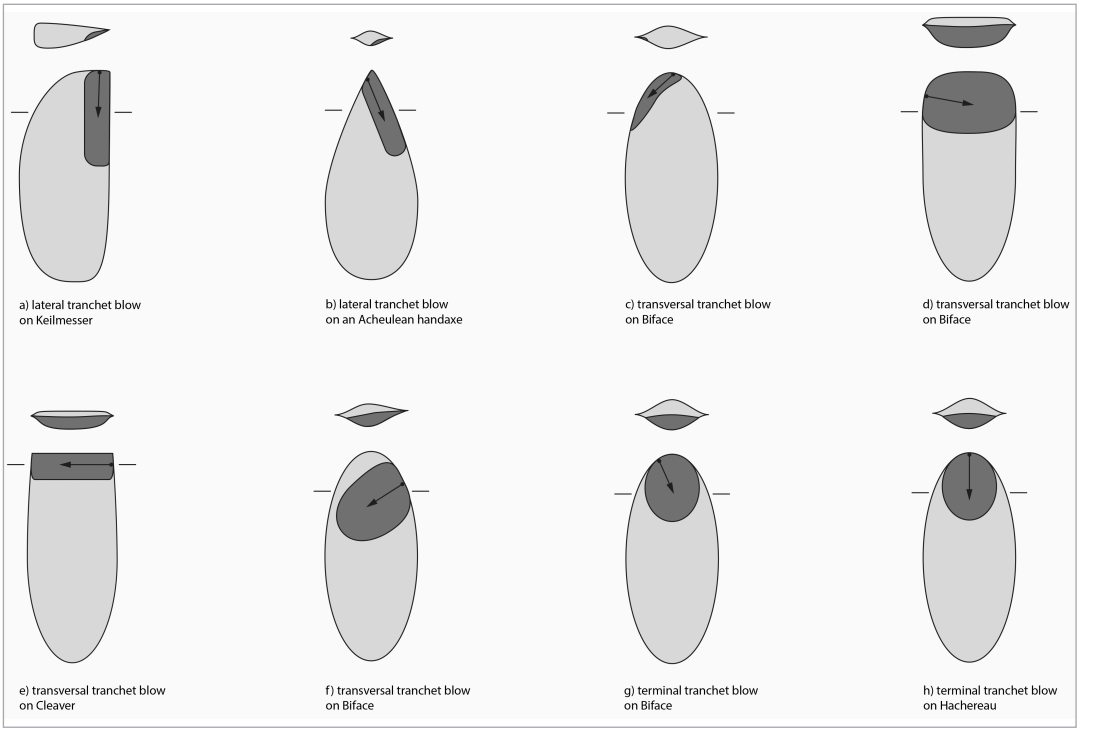


Fig. 3.
Positions of tranchet blows as described in various publications. A) Lateral tranchet blow on a *Keilmesser* (Bourguignon 1992; Jöris 2001); B) Lateral tranchet blow on an Acheulian handaxe (Bordes 1979: plate 86.1; Inizan et al. 1999: 86, fig. 34.2); C) Transversal tranchet blow on biface (Bordes 1979: planche 64.3); D) Transversal tranchet blow on biface (Baldé 2008: 14, fig. 2.9a); E) Transversal tranchet blow on cleaver or hachereau (Bordes 1979: plate 71.2); F) Transversal (invasive) tranchet blow on biface (Blaser et al. 2012: 14, fig. 6.1); G) Terminal (oblique) tranchet blow on biface (Roberts and Parfitt 1999: 361, fig. 263) and H) Terminal tranchet blow on hachereau (Guichard and Guichard 1966: 7, fig. 2).

	Illustration in Fig. 3	
Differences	**Fig. 3a - e**	**Fig. 3f - h**
Shape of the resulting cutting edge when viewed from the side	Straight	Wavy (bulb negative)
Shape of the resulting cutting edge when viewed from above	Straight	Concave (bulb negative)
Nature of the resulting cutting edge	Straight, low angled and sharp	Wavy, mid-angled, splintered
Position	Along an edge	Orthogonal to an edge
Shape of the surface of the removed volume (dorsal face of the removed blank)	Long and convex	Short and convex
Part of the resulting negative that functions as cutting edge	Lateral	Basal

Table 1.
Differences in modifications referred to as tranchet blow.

2014; Schild and Wendorf 1977; Soriano 2001), the Gravettian (Le Mené 1999; Otte 1976; Pesesse and Flas 2012), the Late Paleolithic, Mesolithic and Neolithic (Moore 1982) on different tool shapes, but it seems that the aim of all variants was to sharpen an edge in a low angled and straight manner (in top and lateral view).

Desbrosse and colleagues preferred the term coup de tranchet (latéral) instead of the term pseudoburin used in Polish literature (e.g., Chmielewski 1969). In general, they differentiate between a transversal (on biface-hacheraux and biface à biseau terminal) and a lateral variant (on backed bifaces, namely prondniks). However, other publications describing the tranchet blow modification on bifacial objects offer additional possibilities, as illustrated in Figure 3.

Two main variants can be distinguished (as listed in Table 1). On the one hand, the tranchet blow results in a low angled, straight cutting edge. On the other hand, what is also called a tranchet blow results in a wavy cutting edge that can feature some splintering on the edge.

Technical differences between tranchet blow and burin blow

As described above, the cutting-edge modification on *Keilmesser* is sometimes, in terms of its nomenclature, related to the burin blow. It is true that both the tranchet blow and the burin blow affect the edge of a lithic object. However, the main difference between them lies in the fact that a burin blow blunts the edge while a tranchet blow sharpens it, as depicted in Figure 4. In the light of these major technical differences, we prefer to use the term tranchet blow for this cutting-edge modification.

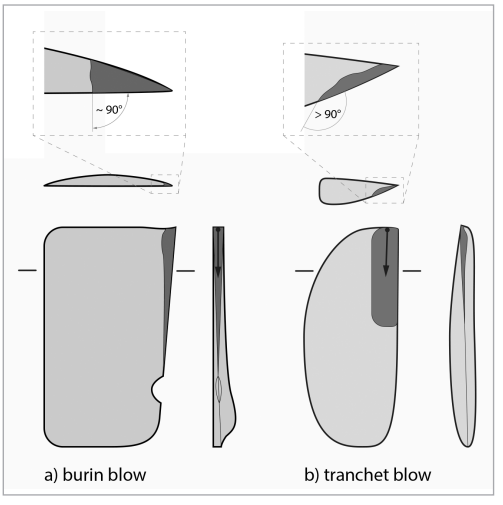


Fig. 4.
Technical differences between burin blow and tranchet blow modification. A) Execution of a burin blow and B) Execution of a tranchet blow.

Technical differences between tranchet blow and orthogonal retouch

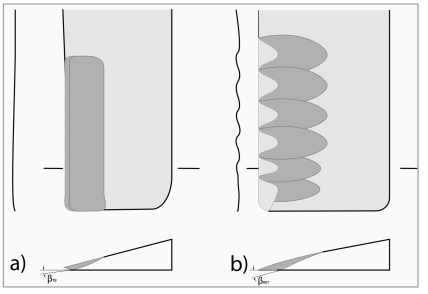


Fig. 5.
Illustration of angle lowering using the tranchet blow modification as opposed to modification by orthogonal retouch.

We must ask ourselves why such specific edge modification was employed? Compared to a regularization of the orthogonal edge, the tranchet blow has several advantages. The most important of these is that it is possible to create a cutting angle that is much more acute (often < 30°) than that achieved using orthogonal retouch (see also Bourguignon 1992). Another advantage is that the orthogonal retouch retains the remnants of the bulb negatives, which means that a completely straight edge cannot be produced. However, both advantages are not completely convincing, since the execution of a tranchet blow is very complicated and requires specifically shaped surfaces and edges. The main shape difference (straight versus wavy edge) between tranchet blow modification and orthogonal retouch is illustrated in Figure 5.

Sometimes the active edge can be divided in two. The first (terminal) part possesses the tranchet blow. The second (basal) part has been modified by orthogonal retouching (uni- or bifacial), which is wavy, toothed or straight. This part can be used for rough working action such as scraping.

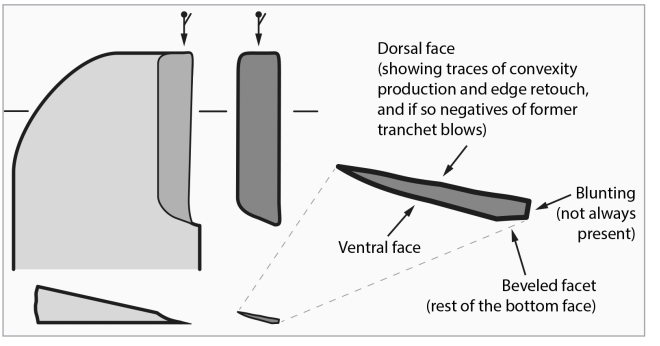


Fig. 6.
Schematic illustration of a tranchet blow negative (left) and its corresponding tranchet blow blank (right).

Techno-morphology of tranchet blow

The tranchet blow blank, which can be seen as a waste product (Migal and Urbanowski 2006), is a very distinctive lithic object (Fig. 6). The lower face is bipartite, consisting of the actual ventral face and a beveled facet (representing a removed part of the bottom side of the modified object using tranchet blow). Therefore, it is mandatory in terms of metrical observations that the blank is wider than the resulting negative. The upper face (dorsal face) shows traces of the convexity production and also sometimes edge retouch. In the case of previous tranchet blow detachment, the dorsal face possesses the corresponding negative. In many cases, the edge of the lithic object where the tranchet blow will be detached, shows blunting. This blunting is seen as a guiding ridge that supports the convexity of the top side. Together, both morphological features (convexity and

blunting) help to detach the tranchet blow blank in the correct and desired position.

To conclude, our approach (Frick 2016; Frick and Floss 2017; Frick et al. 2017a, 2017b, 2018) is to use the term *Keilmesser*; it stresses the wedge-shape (German *Keil*) and the presumed (main) function of the object as a knife (German *Messer*). In cases where a tranchet blow is evident, we employ the longer term: "*Keilmesser* with tranchet blow." To distinguish between the singular and plural form of the term, an "s" is added to the abbreviation, since both are spelled the same in German.

Other advantages in using the term include its neutrality, in the sense that it does not refer to an archaeological site but to the form of an object. Also, there is only one spelling for the term *Keilmesser*. This stands in stark contrast to the term Prądnik, with its countless spellings appearing in the literature. If the technical and technological criteria for the presence of a tranchet blow modification are available and conclusive, "with tranchet blow" is added to the term *Keilmesser*.

Therefore, we now suggest the following terms and abbreviations: *Keilmesser*, *Keilmesser* with tranchet blow, KM, KMTB, KMs and KMTBs.

HISTORICAL OVERVIEW OF REGIONAL RESEARCH INTO *KEILMESSER*

Méray and the beginnings of regional research into *Keilmesser*

After reviewing the techno-morphological features and the associated difficulties with nomenclature, we will now switch our attention to a brief historical overview of regional research into *Keilmesser*. The first mention of pieces we would now call *Keilmesser* with tranchet blow occurs in the work carried out by Charles Méray in the 19th century at the site of Grotte de la Verpillière I (VP I) at Germolles. The site was first excavated in 1868, the same year that the site was discovered during road construction (Méray 1869). The report of this excavation (Méray 1876) depicts three *Keilmesser* with tranchet blow modification from the site (Fig. 7); one of the objects is described as follows: "Ils devaient servir à découper les peaux ; l'un d'entre eux , privé de son manche , à la forme d'une véritable serpe coupant dessus et dessous […]"(Méray 1876: 262–263). Méray did not explain the production of these tools and did not mention the cutting-edge formation. For him, the shape of the tool alone was of importance, coupled with the intended task.

One hundred years later, Desbrosse and colleagues

A century later, Desbrosse and his colleagues reviewed a number of collections (Jeannin collection, Méray collection and Lènez collection) of material from VP I; they illustrated n=9 KMTBs (see Fig. 8) from VP I in two publications (Desbrosse et al. 1976; Desbrosse and Texier 1973) and compared the *Keilmesser* with similar pieces from Buhlen, Ciemna, Kůlna, Okiennik and Wylotne (Desbrosse et al. 1976).

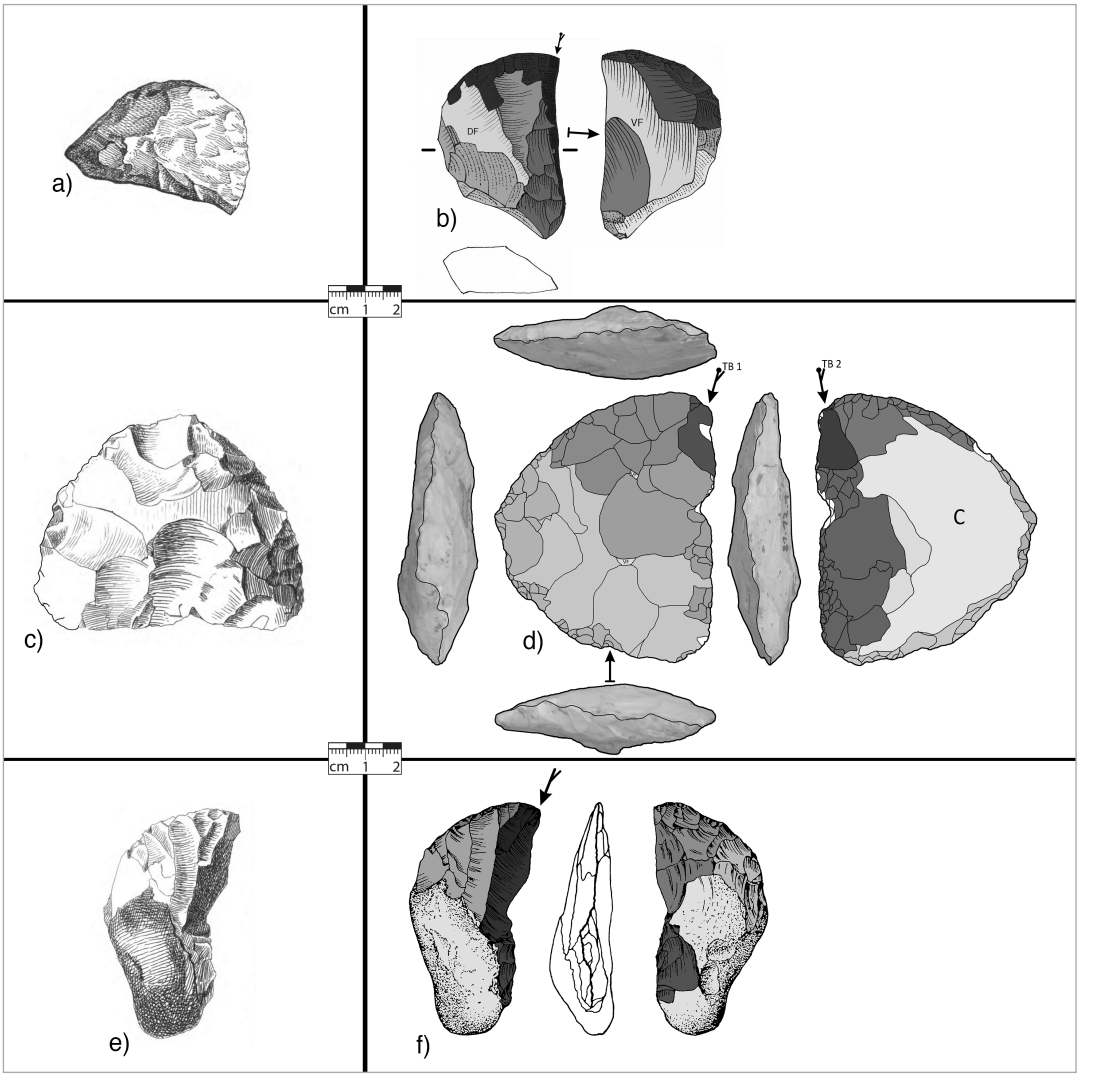


Fig. 7.
Depiction of three *Keilmesser* with tranchet blow from the report of Méray's excavation at Grotte de la Verpillière I (Méray 1876). A) Original illustration from Méray (1876: 263, fig. 17); B) Modern illustration (Inv.-No. 81.12.1.107; C) Original illustration from Méray (1876: 267, fig. 22.6); D) Modern illustration (Inv.-No. 81.12.1.137; E) Original illustration from Méray (1876: 267, fig. 23) and F) Modern illustration (Inv.-No. Jeannin.74). For a better understanding, the two modern illustrations (b and d) are rotated to the original illustrations.

Desbrosse and his colleagues used the term *Prondnik* to refer to asymmetrically bifacially-backed knives with a bow on the terminal end, in a similar manner to Bosinski (1969) who used the term *Pradnikmesser*. However, none of them used the tranchet blow modification to qualify the term *Prondnik/ Pradnik*, although they clearly recognized and mentioned the modification.

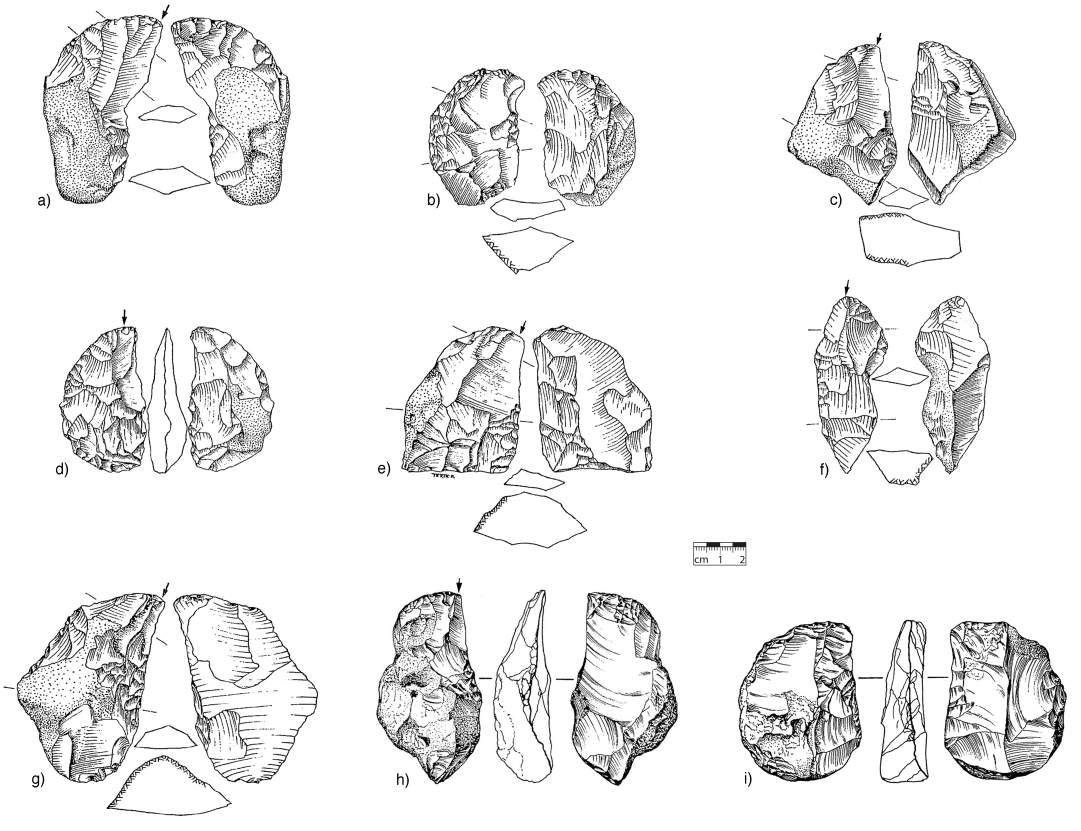


Fig. 8.
Drawings of *Keilmesser* with tranchet blow as depicted in two publications by Desbrosse and colleagues (Desbrosse et al. 1976; Desbrosse and Texier 1973).
A) Desbrosse and Texier (1973: 65, fig. 1) (Inv.-No. Jeannin.74); B) Desbrosse and Texier (1973: 65, fig. 2) (Inv.-No. Jeannin.77); C) Desbrosse and Texier (1973: 65, fig. 3) (Inv.-No. Jeannin.76); D) Desbrosse and Texier (1973: 65, fig. 4) (Inv.-No. Jeannin.73); E) Desbrosse and Texier (1973: 65, fig. 5) (Inv.-No. Jeannin.75); F) Desbrosse and Texier (1973: 65, fig. 6) (Inv.-No. Jeannin.72); G) Desbrosse and Texier (1973: 65, fig. 7) (Inv.-No. Jeannin.71); H) Desbrosse et al. (1976: 435, fig. 1.2) (Inv.-No. CA27.126)and I) Desbrosse et al. (1976: 439, fig. 4.2) (Inv.-No. CA27.171).

Research and attribution at the turn of the millennium

In the course of the 1990s, Farizy studied Middle Paleolithic assemblages from Saône-et-Loire (Farizy 1995) and excavated test pits at La Clôsure in Bissy-sur-Fley (Farizy 1994). Due to the significant quantities of scrapers uncovered there, Farizy (1995) assigned the site of Champlost, Yonne (which she excavated in the 1980s) to the *Moustérien de tradition Charentienne d'Europe occidental*. Because of the high percentage of Levallois production, the site was attributed to the *faciès Ferrassie*, although transversal sidescrapers and Quina-like retouch are also present. In addition, the assemblage shows similarities with the central European Micoquian as de-

fined by Bosinski (1967). From the description given by Bosinski (1967), she saw the Micoquian as being characterized by the absence of *débitage* and the presence of numerous bifacial objects of a particular shape. She goes on to state that several sites in Saône-et-Loire also exhibit such a Micoquian character (Bissy-sur-Fley, Blanzy and Germolles). She characterized the industry of Bissy-sur-Fley as Levallois, featuring numerous sidescrapers with thinned backs (*racloirs à dos amincis*), inverse sidescrapers (*racloirs sur face plane*), sidescrapers with flat and invasive retouch (*racloirs à retouches plates et envahissantes*), foliated tools and points with bifacial foliation (*outils foliacés et de pointes foliacées bifaces*). For her, the industry contains many sidescrapers and backed bifacial objects. In Germolles (VP I) *prondniks* are present as well. These listed elements are, in her opinion, a clear signal that the Micoquian people from central Europe were present in eastern France.

In the course of the 1990s, Jöris (1992) and Richter (1997) used the information provided in Desbrosse et al. (1976) to associate VP I with assemblages from central Europe. On the one hand, Jöris (1992: 9, Fig. 7) added the site to the distribution of the *Pradnik-Horizont* (n=16 sites with *Pradnik* knives and an additional n=4 sites with blanks of tranchet blow) and, on the other hand, Richter (1997: 235) found n=10 sites yielding Ciemna knives with lateral tranchet blow. Richter (1997: 243) thus defined Germolles as part of the older M.M.O. (Mousterian with Micoquian-Option A) and described this M.M.O.-A as a non-Levallois industry (using Quina or Discoidal reduction) belonging to the early MIS 3.

Taking up the ideas of Farizy (1995), Gouédo (1999) studied the lithic material from Farizy's excavation at Champlost (Yonne), as well as Vinneuf (Yonne) and Vérrière-le-Buisson (Essonne), and identified Micoquian industries in all three assemblages. He discussed an evolutionary model of the Micoquian technocomplex, which is separate from the Mousterian technocomplex.

For him, the Micoquian developed from the Acheulian at around 450 to 400 ka. He saw an evolutionary line from the classic Acheulian (Cagny-Garenne, Cagny-Cimetière) in the MIS 12 and 11, to the ancient Micoquian of MIS 10 to 8, to the Micoquian rich in pointed bifaces in MIS 7 to 6 and the Micoquian rich in non-pointed bifaces in MIS 5 to 3. He also separated the Micoquian rich in non-pointed bifaces into two branches. The first he called the *Keilmessergruppen*, *Pradnik-Horizont* and the second he termed *Absence de Keilmesser* (*"bifaces" MTA puis pièces bifaciales*). He developed three Micoquian groups (A, B and C), which run parallel but differ in character.

Jöris (2003), in adding Germolles to the west European part of the *Pradnik-Horizont* (KMG-B2), described the associated industry as follows (Jöris 2003: 107): Levallois-Reduction as insignificantly present; almost no systematic blank production; other bifaces as rare and only present as single pieces; *Keilmesser* with an arc-shaped bow and a straight cutting edge as dominant; nearly all *Keilmesser* and also other bifacial tools as modified with a tranchet blow; other bifacial objects such as

Faustkeilblätter as rare. For the interpretation and research-historical use of the term Micoquian (Micoquien), the reader is referred to Frick 2020.

REASSESSMENT OF OLD COLLECTIONS AND RECENTLY CONDUCTED EXCAVATIONS

Studies related to VP I

It was not until 2005 that these enigmatic objects from VP I were once again illustrated and described. Floss (2005) identified n=6 *Keilmesser* (n=4 of them possessing tranchet blow negatives) from the old collections (see Fig. 9), and assigned them to the Micoquian; he also proposed new excavations of the site.

New studies conducted on the material from old collections and from the recently conducted excavations at VP I (2006-2016) would alter earlier existing assessments (Jöris 2003; Richter 1997) of the assemblages from the site VP I (Frick 2010; Frick and Floss 2017; Frick et al. 2017a, 2018). Levallois is the main reduction concept and is also used for providing matrices for bifacial objects. In addition to *Keilmesser* with tranchet blow, there are simple *Keilmesser*, asymmetrical bifaces with small backs, symmetrical bifaces with plano-convex cross sections and bifaces with double reflection symmetry.

Study of other collections

When we look at the numerous older collections from the region around Chalon-sur-Saône, it is clear that several other sites, besides VP I, have yielded *Keilmesser* (Herkert 2016, 2020; Herkert et al. 2015).

In addition to the presence of *Keilmesser* at Grotte de la Verpillière I, we know of such pieces from the open-air sites of La Roche in Saint-Martin-sous-Montaigu, Le Bois des Ranches in Blanzy, La Clôsure in Bissy-sur-Fley, Rue Cataux in Chenôves, as well as from caves and rockshelters, such as Grotte de la Verpillière II and La Baume de Gigny (Jura). Furthermore, the excavations at Grotte de la Verpillière II provided dating evidence and material which allowed detailed technological studies of lithics from intact Middle Paleolithic layers (Frick 2016).

Scope of the assemblages investigated

The tranchet blow modification is evident in all of the assemblages from these sites. According to the current state of the evaluation (as of 2017), a total of n=54 KMTBs have been identified (see Table 2). We have decided to exclude the site of La Baume de Gigny because the tranchet blow modification is only known from the literature (Campy et al. 1989) and was not identified in the course of our own studies.

The vast bulk of the material originates from VP I and has been subjected to previous detailed technological studies (Frick et al. 2017a, 2018).

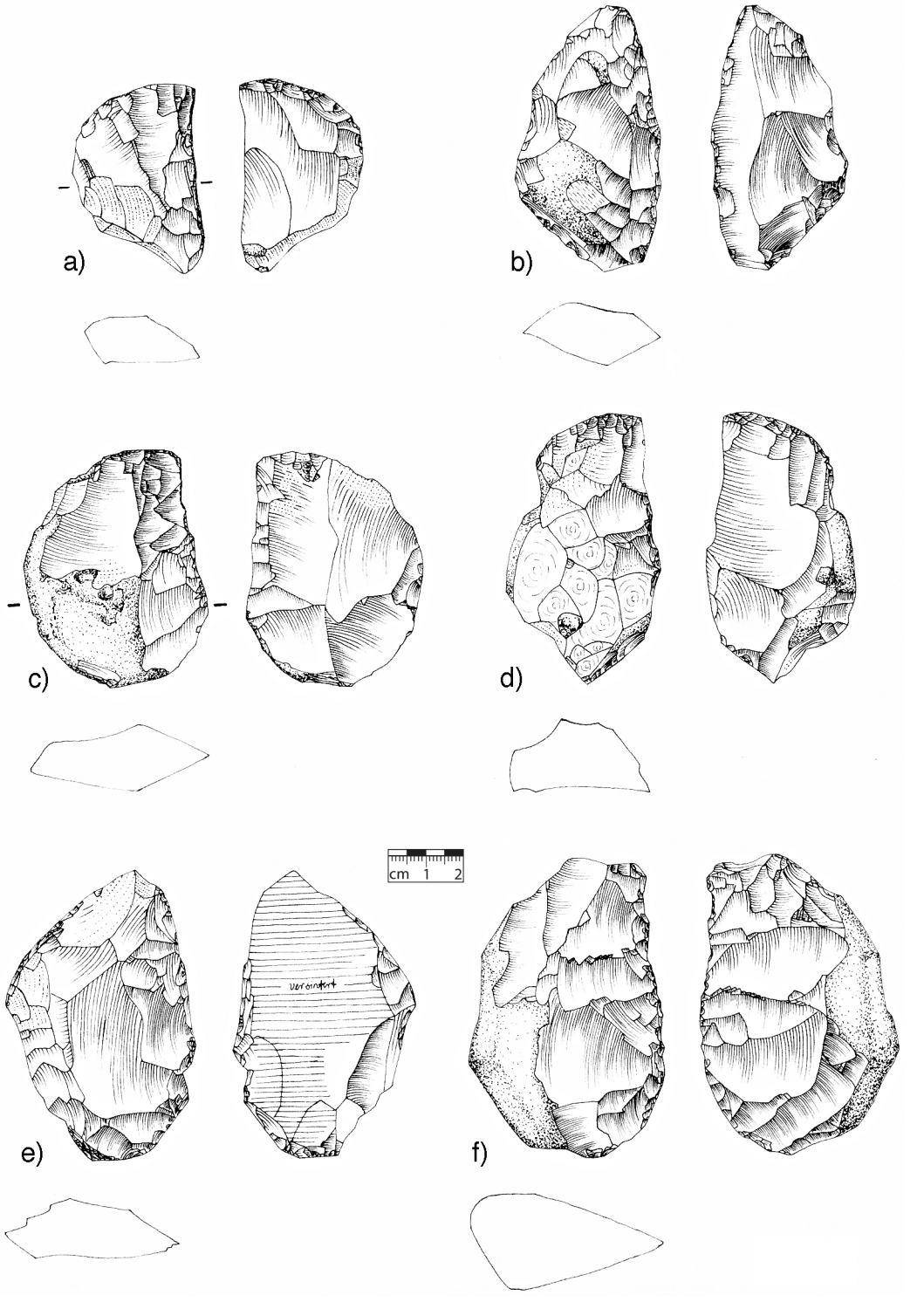

a)
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Fig. 9. left
Grotte de la Verpillière I. *Keilmesser* from old collections as depicted by Floss (2005: 118, fig. 5). A) Inv.-No. 81.12.1.107 (Jeunet Collection); B) Inv.-No. 81.12.1.108 (Jeunet Collection); C) Inv.-No. CA27.171 (Méray Collection); D) Inv.-No. CA27.126 (Méray Collection); E) Inv.-No. 81.12.1.111 (Jeunet Collection) and F) Inv.-No. CA27t.61 (Lénez Collection).

In addition, both pieces from VP II were also technologically studied (Frick 2016; Frick and Floss 2017). Another line of evidence consists of tranchet blow blanks, but so far these pieces are only known from VP I (n=55) and VP II (n=10).

Preliminary technological studies of known KMTBs from the Côte Chalonnaise

Detailed technological studies of KMTBs from the Côte Chalonnaise were conducted on the pieces from VP I and VP II (Frick 2016; Frick and Floss 2017; Frick et al. 2017a, 2018; Herkert and Frick 2020) and provide evidence regarding the equifinality and permutation of these tools. With a total of n=44 KMTBs, the material from VP I offers good insight into tool production. Certain technological aspects of these objects from VP I are thus presented in the following section.

Equifinality and Permutation

As the pieces from VP I demonstrate, they can be made using different matrices. Therefore, the production is based on different initial conditions (different shapes, presence or absence of cortex, etc.) but all result in the execution of a tranchet blow. This circumstance can be described by the term equifinality (for the term see also Bertalanffy 1950). Gummerman (1976: 8) applied this term to lithic studies: "Viewed as a system, the fracture of flint-like materials exhibits the property of equifinality—a charac-

Table 2.
Number of *Keilmesser* with tranchet blow, simple *Keilmesser* and other bifacial objects that could be identified in the studied assemblages from the Côte Chalonnaise (as of 2017). The material is currently housed at in the Musée Denon (Chalon-sur-Saône) and at the University of Tübingen.

	Bifacial object			
Site	**KMTB**	**Simple *Keilmesser***	**Other bifacial objects**	**Total**
La Roche in Saint-Martin-sous-Montaigu	1	11	117	129
La Clôsure in Bissy-sur-Fley	5	13	33	51
Rue Cataux in Chenôves	2	2	23	27
Grotte de la Verpillière I in Germolles	44	20	50	114
Grotte de la Verpillière II in Germolles	2	5	25	32
Total	**54**	**51**	**248**	**353**

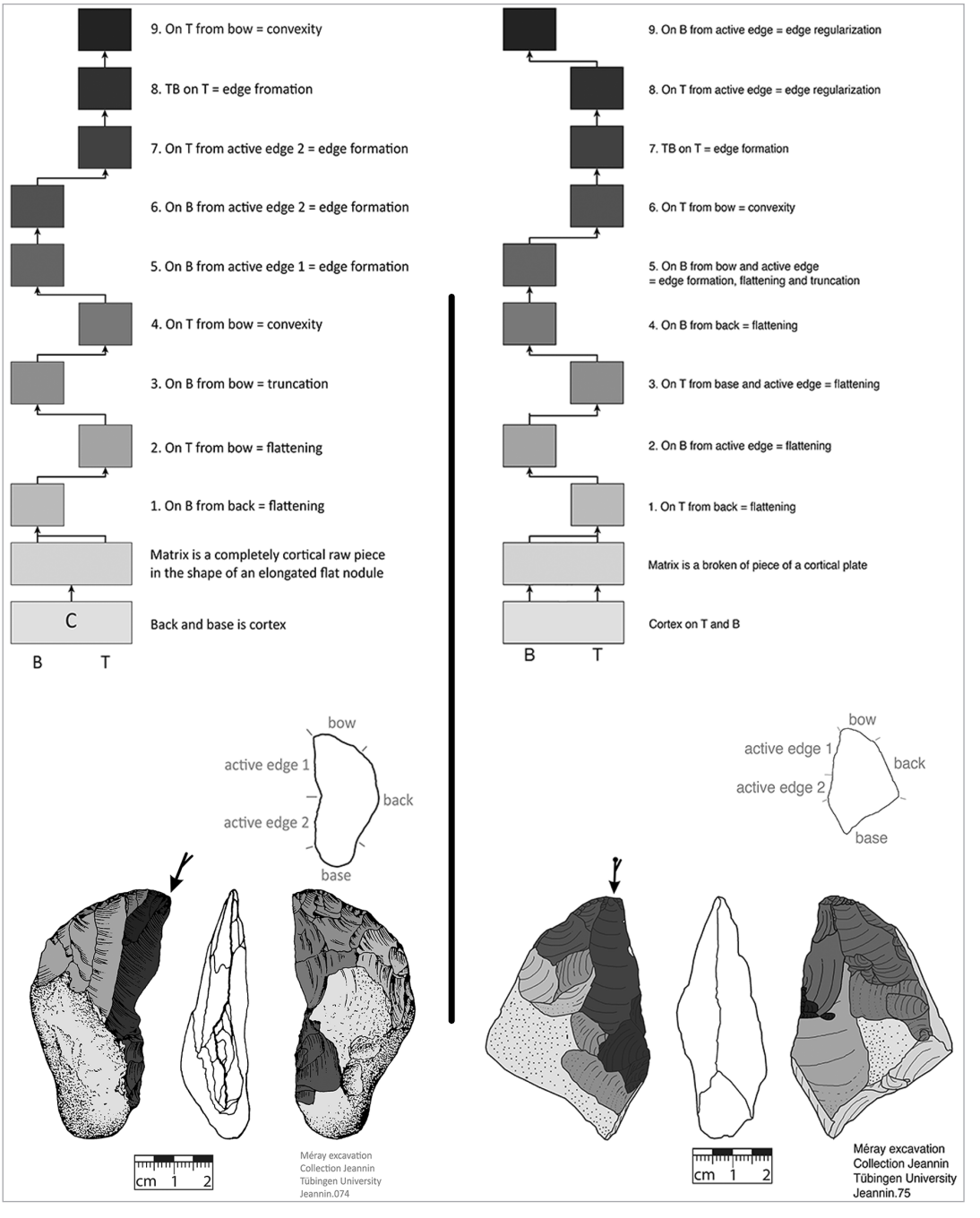


Fig. 10. above and right
Comparison of the Harris-matrix of the n=3 raw pieces modified to form *Keilmesser* with tranchet blow from VP I.

teristic of open systems. In other words, the same final state may be reached from different initial conditions and in different ways […]."

Included in the notion of equifinality is the possibility that working stages can be exchanged with each other; the material from VP I also demonstrates this.

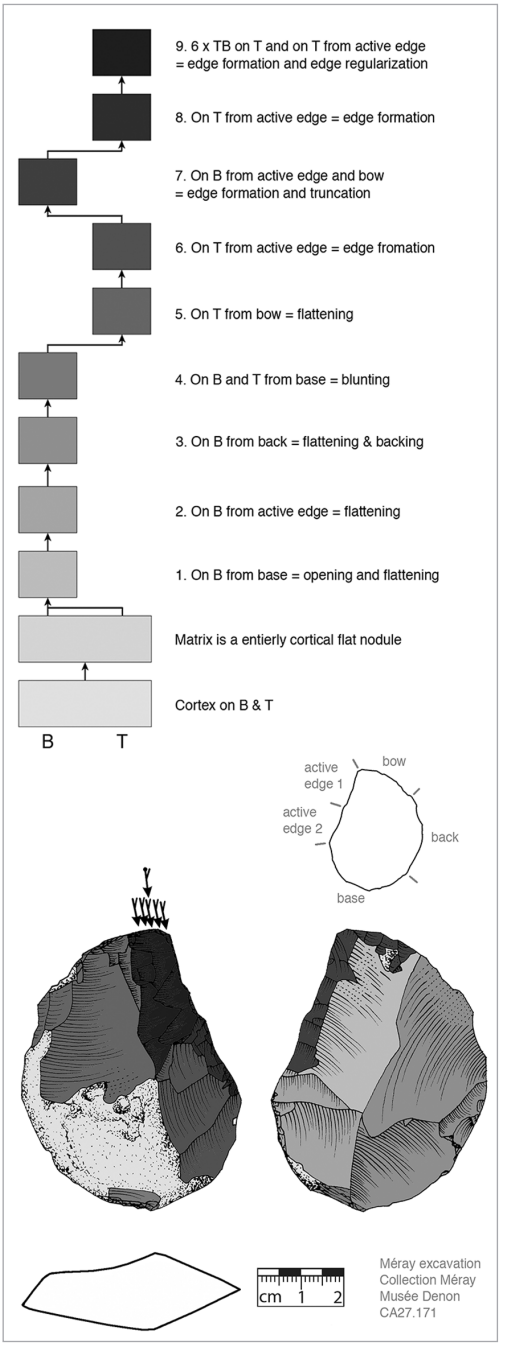
The phenomenon can also be called interchangeability of working stages or permutation (with and without repetition).

Analysis of KMTB assemblages reveals two extremes of matrix selection: on the one hand, at Abri du Musée (Bourguignon 1992; Frick 2020) and only flint blanks (mostly Levallois blanks) are used and, on the other hand, at sites such as Buhlen (Jöris 2001) and Balve (Jöris 1992) plates of flinty slate (Kieselschiefer) are mainly used as matrices.

The VPI material, however, lies between these two extremes: At VP I, nearly all matrix variants are used, but the majority (n=34, 77%) of the KMTBs are made on blanks (n=3 are made from raw pieces and n=6 are made from frost shards). Therefore, the KMTB assemblages from VP I provide a good case study for comparing the similarities and differences of KMTB production with regard to matrix selection.

The example here focuses on n=3 raw pieces used as matrices (see Fig. 10). Flattening is always the first working stage. On n=2 pieces, this is followed by truncation, active edge formation and the execution of a tranchet blow (inventory-No. Jeannin.74 and Jeannin.75) and one-piece succession switches to active edge formation, truncation and tranchet blow (inventory-No. CA27.171). Despite the fact that all three artifacts are made from raw pieces, the working stage succession is equivalent to the main succession variants seen on blanks. Because of the shape and the presence of cortex on the back, no backing is necessary (only CA27.171 shows some minor blows from corrections on the back).

If all KMTBs from VP I are taken into account, three branches of working-stage succession are present: flattening first (n=32), backing first (n=10), edge formation first (n=1).



If the side (top side or bottom side) of the first working stage is not considered, there are n=9 succession strategies for working stages after flattening first and n=7 for backing first.

Edge formation and truncation are the working stages with the highest frequency of interchangeability. Good examples here are the two major variants of working-stage succession: 1. Flattening, truncation and edge formation (n=11) and 2. Flattening, edge formation and truncation (n=9). On all of these pieces, backing was not necessary because a back was present on the change succession.

If we also take into account the side where the first working stage was performed, over all there are n=24 working-stage succession variants visible on all n= 44 KMTBs from the site of VP I. This demonstrates the high variability of the KMTB concept and shows that there were many ways of producing such objects.

Maintenance processes

In addition to the possibility of interchanging working stages and equifinal use of different matrices for the production of KMTBs, maintenance processes can also greatly change the *gestalt* of the objects. Jöris (2001), in studying the material from Buhlen, was able to demonstrate that on KMTBs made from flinty slate, the terminal end (featuring the truncation and the tranchet blow) was quite often chipped off and a new bow was created for the execution of a new tranchet blow on the active edge. He called this approach "*das dynamische Keilmesser-Konzept*" (the dynamic *Keilmesser* concept). In addition, Migal and Urbanowski (2006) described four other possibilities for KMTB maintenance that result in parallel or inclined size reduction:

a) Parallel size reduction at active edge and bow, the subsequent tranchet blow is performed parallel to the previous (Migal and Urbanowski 2006);
b) Inclined size reduction at active edge and bow resulting in an inclined direction of the subsequent tranchet blow (Migal and Urbanowski 2006);
c) Reduction by repeated and parallel tranchet blow performance without any other reduction (Migal and Urbanowski 2006);
d) Parallel size reduction and rotating for a new tranchet blow performance resulting in an opposing subsequent tranchet blow (Migal and Urbanowski 2006);
e) Removal of the terminal part and parallel size reduction on active edge and bow resulting in parallel subsequent tranchet blow (Jöris 2001).

All five of these maintenance processes were recognized at VP I. As an example, the inclined size reduction is shown in Figure 11.

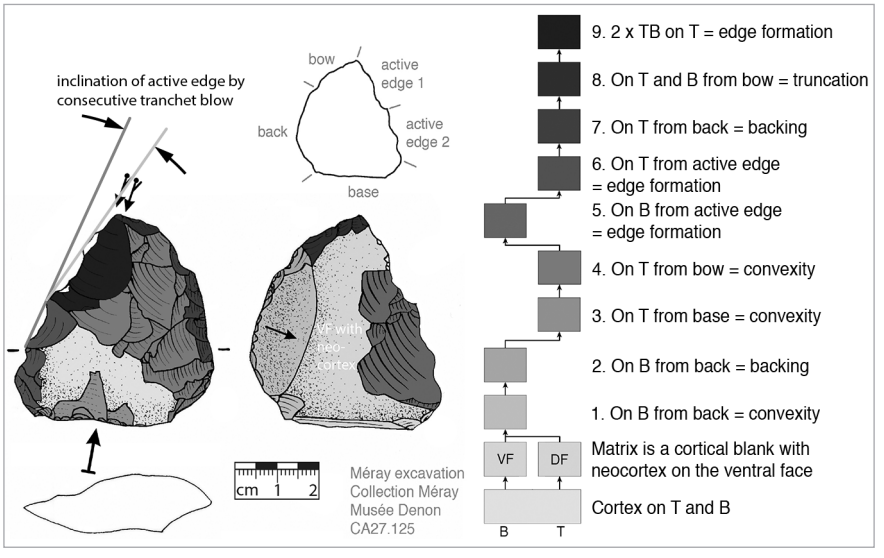


Fig. 11.
Inclined size reduction on a KMTB from the Méray collection (CA27.125).

Overview of KMTBs from other sites in the Côte Chalonnaise

In addition to the n=44 KMTBs from VP I, the studies resulted in the identification of a further n=10 KMTBs from surrounding sites (see list in Table 2). The material from La Roche, La Clôsure and Rue Cataux derives from surface collections carried out during the 20th century. The assemblage from VP I is the result of a combination of surface collections and excavations, while the material from VP II is exclusively material from recent excavations.

GH 3 of VP II yielded n=5 lithic objects modified with a tranchet blow (see Frick 2016: 459, Fig. 266) including two KMTBs. All five are highly distinct from each other, their only common feature being the tranchet blow. An initial review of the assemblages (AG Floss in 2015 and 2016) from the other sites mentioned above revealed additional n=10 KMTBs.

As an example, one of the KMTBs from Rue Cataux in Chenôves is illustrated in Figure 12; this artifact represents an excellent example for establishing the succession of working stages and techno-functional units of a KMTB. On this object, the bottom side was flattened first, followed by edge formation, surface working (convexity production), truncation, edge regularization, execution of the tranchet blow and final edge regularization. The object was made on a blank with a cortical back, therefore no backing was necessary. The tranchet blow was not the last working stage, as the bow and parts of the active edge were regularized afterwards.

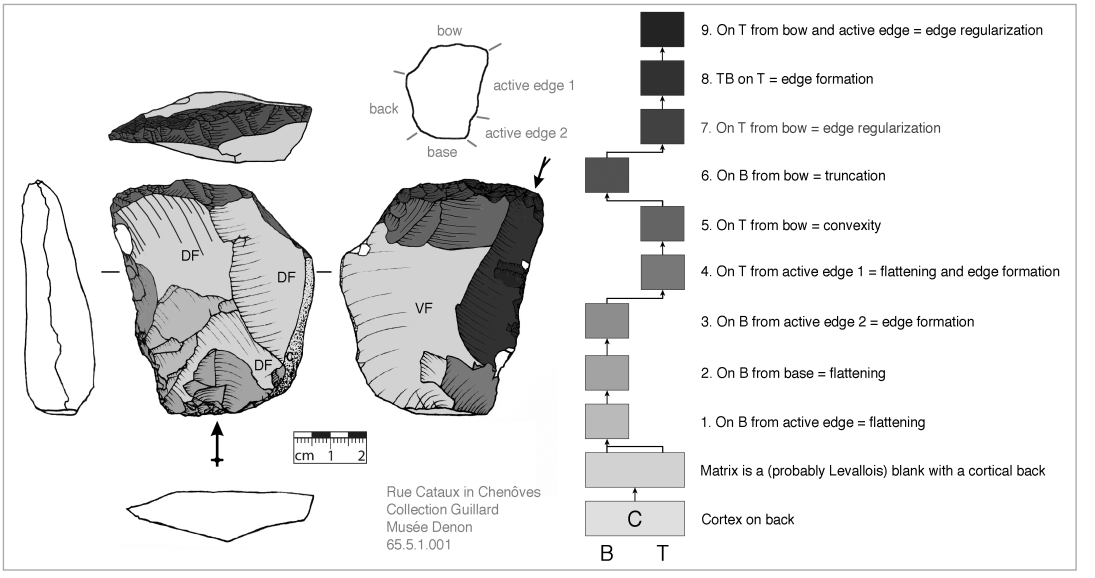


Fig. 12.
Working stage succession and techno-functional units of one of the KMTBs from Rue Cataux in Chenôves from the collection of Guillard, housed in Musée Denon (65.5.1.001).

SUMMARY

As early as the 1970s, Grotte de la Verpillière I was recognized as a unique find spot in eastern France with n=9 *Prondniks* (as they were called by Desbrosse et al. 1976) (see Fig. 8). This picture changed at the end of the 1980s when material from different levels at the site La Baume de Gigny (around 75 km southeast of VP I, in the Jura Department) was published (Campy et al. 1989).

It took until 2012 for another *Keilmesser* with tranchet blow to be revealed in a level at Grotte de la Verpillière II (Frick 2016; Frick and Floss 2015). Over the past few years, other older collections and material from modern excavations have been reviewed and studied (see Fig. 12 and Herkert et al. 2015; Herkert 2021; Herkert and Frick 2020).

As a result, we have been able to identify further *Keilmesser* with tranchet blow from the same region. Limiting our study to accessible collections housed in museums and institutes, and to material from our own archeological excavations at both Grottes de la Verpillière I & II, we now know of n=54 of these objects from the Saône-et-Loire Department (see Table 2); to date, VP I has yielded n=44 of these *Keilmesser* with tranchet blow.

Technological studies on the objects has allowed us to reveal considerable diversity in homogeneity with regard to equifinality (different matrices can be used to create pieces featuring a tranchet blow; see Figs. 10 and 11) and permutation (interchangeability or flexibility of working stage succession for the production), as well as homogeneity in diversity (the same morphological shapes of tool parts are necessary to perform a tranchet blow).

The particularity of these objects is observed in that they possess a negative on a lateral side of one of the surfaces (see Figs. 2 and 6); this significantly lowers the edge angle of the cutting edge in a way that no other edge sharpening method can achieve. In order to perform such a lowering of the edge angle, certain parts of the lithic object need to be shaped to create a specific morphology, making it structurally possible to detach adequately the tranchet blow blank. It is necessary to create a convexity on the top side that provides a volume to be detached, and a truncation on the bow that serves as a striking platform (see Fig. 2). In addition, other morphologies can support a successful tranchet blow detachment, for instance a blunted edge on the prospective active edge (serving as an additional guiding ridge; see Fig. 6) or a faded convexity on the top side were the tranchet blow negative is set to end (similar to a stop notch for burin-blank detachment; see Fig. 4). The tranchet blow is distinguishable from a burin blow (Fig. 4) or orthogonal retouch (Fig. 5). Different edge-formation processes on different lithic objects are called tranchet blow, illustrated here in Figure 3, with their differences listed in Table 1.

Our techno-morphological studies on these *Keilmesser* with tranchet blow clearly demonstrate that the execution of such a blow required a specialized knowledge of knapping technology (Frick et al. 2017a; Frick and Herkert 2020); this observation raises the possibility that close relations, with regard to knowledge transfer and group dynamics, existed between the sites in Côte Chalonnaise (see the contribution of Herkert et al. this volume and Herkert and Frick 2020) that have yielded these enigmatic *Keilmesser* with tranchet blows.

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