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Michael Kunst | Daniel Steiniger (eds.)

SETTLEMENT STRUCTURES AND METALLURGY

The Relations between Italy and the Iberian Peninsula in the Early Chalcolithic

Papers of an International Conference Held in Rome, Museo Nazionale Romano – Palazzo Massimo, 6–7 October 2011

For some considerable time right up to the present, almost all specialists have been dealing at various different regional levels with the topics of the conference published here. The expansion of the source material in the last decades has led to a comprehensive understanding of early metallurgy and its role in social, economic and settlement-structure terms. Despite this far-reaching progress, concrete questions are emerging more and more clearly that can only be answered at international and interdisciplinary levels. It is precisely this international communication that the conference on which the present volume is based has attempted to set in motion so as to address these complex questions. This publication pulls together and sets out the state of research on the topic at the beginning of the 21st century for the entire Central and Western Mediterranean regions.

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AND METALLURGY

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Ortwin Dally und Norbert Zimmermann

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Vorwort

von *Henner von Hesberg* und *Dirce Marzoli*

Ein offener Dialog, eine einsichtige Darstellung der jeweiligen Arbeitsweisen und die Bereitschaft, den anderen Forschern in die Archive Zugang und in die Ergebnisse eigener Arbeiten Einblick zu gewähren, sind Voraussetzungen eines fruchtbaren Austauschs. Sie führen zu einer vertieften Kenntnis der jeweiligen Erforschung einer archäologischen Epoche, ihrer lokalen Besonderheiten und überregionalen Verbindungen. Ausdruck einer solchen Art von Austausch, der selbst in Zeiten problemloser Kommunikation nicht immer selbstverständlich ist, bilden diese Tagung sowie deren jetzt vorliegende Publikation. Sie erfolgt bedauerlicherweise mit großer Verspätung, aber ihre grundlegende Botschaft ist nicht überholt: nur gemeinsam und länderübergreifend lässt sich das Thema angehen.

Der hier behandelten Kupferzeit Südwesteuropas widmen sich methodisch innovative und interdisziplinär angelegte Projekte, zu denen Ausgrabungen von Siedlungen, Nekropolen, Bergbauarealen ebenso zählen wie Material- und Umweltstudien. Immer komplexer werden dabei auch Einblicke in Gesellschaftsstrukturen, Wirtschaftsweisen, Handelswege und Technologien, zunehmend deutlicher lassen sich zudem die Wege der Übertragung von Fertigkeiten und Produktionsformen nachzeichnen. Einige Ergebnisse liegen schon in internationalen Referenzwerken vor, gleichwohl werden sie im Kontext der Tagung ergänzt und vertieft und um die Forschungsergebnisse aus nicht immer leicht zugänglichen lokalen Publikationen erweitert, welche zudem häufiger lediglich Vorberichte darstellen. Abgesehen davon aber bieten die Beiträge neue Resultate und Interpretationsansätze.

Gerade auf den Gebieten der Siedlungsarchäologie und ihrer Verbindung mit der Montanarchäologie und der Archäometallurgie sind nämlich sowohl auf der Pyrenäen- wie auch auf der Apenninhalbinsel in den letzten Jahrzehnten bahnbrechende Ergebnisse erzielt worden, die nach weiterem Austausch über die Beziehungen zwischen Italien und Südwesteuropa im Chalkolithikum verlangen. Für diese Thematik haben die beiden Abteilungen des Deutschen Archäologischen Instituts – Rom und Madrid –, deren Aktivitäten diesem geographischen Raum vorwiegend gelten, als Veranstalter der Tagung und als Herausgeber der Publikation ein Forum geboten. Mit der Veröffentlichung der Tagung suchen sie der Diskussion im Bereich der Kupferzeitforschung weitere Impulse zu geben.

Die Tagung wurde zwar von den beiden Abteilungen organisiert, aber sie versteht sich als Projekt von Prähistorikerinnen und Prähistorikern aus vielen europäischen Ländern mit dem gemeinsamen Ziel, einen Beitrag zur Kenntnis der westlichen Hemisphäre der europäischen Kupferzeit zu leisten und Anstöße zu weiteren Zusammenarbeiten zu geben. Dabei ging es darum, die sehr unterschiedliche Situation der iberischen mit jener der Apenninhalbinsel zu vergleichen und zu prüfen, ob hier nur der Erkenntnisstand voneinander abweicht oder wir grundsätzlich zwei unterschiedliche Ausprägungen in einem historischen Horizont vor uns haben.

Die Veranstaltung dieser Tagung gewinnt über die fachwissenschaftliche Bedeutung auch eine forschungspolitische. Die Prähistorische Archäologie, die in den Abteilungen des Deutschen Archäologischen Instituts anfangs nur sporadisch und seit den sechziger Jahren in zunehmendem Maße an Bedeutung erlangte, präsentiert sich hier mit einem eigenen Projekt, dessen Anfänge bis in die Zeit der 1954 gegründeten Madrider Abteilung zurückreichen. Zu den Mitarbeitern der ersten Stunde zählte ein Prähistoriker, zu dessen Schwerpunkten die Kupferzeit gehörte: Edward Sangmeister. Ab 1959 war Hermanfrid Schubart als Prähistoriker an der Madrider Abteilung tätig, die er von 1980 bis 1994 leitete. Ihre Forschungen auf diesem Gebiet, vor allem die von ihnen gemeinsam geleitete Ausgrabung in Zambujal bei Torres Vedras in Portugal sind bis heute wichtige Referenzen für die Kupferzeitforschung geblieben. Ihre Namen und der mit ihnen verbundene Grabungsplatz wurden zum Synonym für den Erfolg internationaler Zusammenarbeit, aus der immer weitere Netzwerke hervorgingen. 1994 übernahm Michael Kunst als Referent die prähistorische Forschung der Madrider Abteilung und führte vor allem auch die Grabungen in Zambujal fort.

Das seit 1829 aktive Instituto di Corrispondenza Archeologica war am Anfang ganz den wissenschaftlichen Zielen Johann Joachim Winckelmanns verpflichtet, die in vieler Hinsicht aus einer philologischen Tradition hervorgegangen waren. Deswegen blieben die Zeiträume ohne Schriftzeugnisse zunächst außerhalb der Überlegungen. Erst später, unter dem Einfluss der Entwicklungen in den skandinavischen und angelsächsischen Ländern, kamen einzelne Aspekte der Prähistorie hinzu, konnten aber nie größere Bedeutung erlangen. Immerhin hat Wolfgang Helbig mit seiner 1879 erschienenen

Schrift über „Die Italiker in der Poebene“ sich in diese Bereiche der archäologischen Wissenschaft vorgewagt und damit auch Luigi Pigorini beeinflusst, der seinerseits oft in den Adunanzen des Instituts in jenen Jahren vortrug. Ein gegenseitiger Austausch war vorhanden, aber die Prähistorie in Italien ging bald eigene Wege und das Germanico blieb in der Folgezeit auf die klassische Antike konzentriert, wenn man einmal von der Zeit des Nationalsozialismus absieht, in der aber stärker die Zeit der Völkerwanderung und damit als Wissenschaft die Frühgeschichte an Bedeutung gewann. Spätere Studien von Seiten der Prähistorie, die innerhalb der Abteilung Rom des DAI entstanden, widmeten sich meist der Eisenzeit und ergänzten somit methodisch die Versuche der Klassischen Archäologie, die Frühphasen der späteren Kulturen Italiens zu erschließen. Zu nennen sind hier etwa die 1959 und 1962 erschienenen Werke Hermann Müller-Karpes zu den Anfängen Roms. Später hat Kerstin Hoffmann als Forschungsstipendiatin der Abteilung im Rahmen des von der Gerda-Henkel-Stiftung geförderten Projekts zu den einheimischen Kulturen in Italien sehr intensiv den internen Dialog gefördert. Aber erst mit Daniel Steininger 2006 startete dann ein eigenständiges Projekt, das mit den traditionellen Forschungsfeldern der Abteilung Rom nichts mehr zu tun hatte und ganz im Chalkolithikum angesiedelt war.

Darin kommt ein umfassender Wandel in den Methoden und der Organisation von Forschung innerhalb des Deutschen Archäologischen Instituts zum Ausdruck, der jüngst zu vielen Veränderungen geführt hat, etwa in der sogenannten Bildung von Clustern, also die Abteilungen übergreifenden Forschungsverbünden. Damit die unterschiedlichen Abteilungen des Instituts in den verschiedenen Kulturregionen Europas und der ganzen Welt untereinander weiterhin einen fruchtbaren Austausch pflegen können, zugleich aber auch für ihre Partner an den diversen Universitäten und übrigen Forschungsstätten anschlussfähig bleiben, muss die Konzentration auf einzelne archäologische Disziplinen zugunsten einer breiteren Fächerung erweitert werden. Dadurch ist es möglich, verschiedene historische Horizonte und Epochen etwa im Bereich des Mittelmeeres, aber auch darüber hinaus, in ihren Gemeinsamkeiten und Unterschieden in den Blick zu bekommen. Zugleich profitieren die Disziplinen voneinander durch ihre methodische Vielfalt.

In einer solchen engen Verschränkung kann die Arbeit des Instituts eine wirkungsvolle Ergänzung zu dem Studien- und Forschungsbetrieb der Universitäten bilden, in denen bei aller Interdisziplinarität durch die Studienerfordernisse und Fächerdefinitionen die Grenzen stärker bewahrt werden müssen.

Die Tagung mit ihrer Thematik stellt einen weiteren Schritt in diese Richtung dar und bezeugt zugleich Öffnung und neue Verbindungen, die dadurch möglich sind. Ihr Konzept haben Daniel Steiniger und Michael Kunst gemeinsam entworfen. Beide beschäftigen sich vorrangig mit der Kupferzeit und beide stammen von der Universität Freiburg, wo der eine 2007 und der andere 1982 promoviert hat, womit sie wiederum in der mittelbaren Tradition Sangmeisters stehen.

Ihnen gilt unser besonderer Dank. Danken möchten wir auch Patrizia Petitti und Christian Strahm für die Mitarbeit zur Vorbereitung der Tagung im wissenschaftlichen Komitee sowie allen jenen Kolleginnen und Kollegen, die durch Vortrag, Diskussion und schriftlichen Bericht zum Erfolg des Unternehmens beigetragen haben. Auch an alle anderen, die sich an der Betreuung der Tagung und an der Redaktion beteiligt haben, richtet sich unser Dank. Für die finanzielle Förderung gilt der Fritz Thyssen Stiftung unser besonderer Dank. Hervorheben möchten wir schließlich die Gastfreundschaft von Rita Paris und Anna Maria Moretti, die für die Tagung am 6. und 7. Oktober 2011 ihren schönen Vortragssaal im Palazzo Massimo in Rom zur Verfügung stellten.

Henner von Hesberg, Rom, und Dirce Marzoli, Madrid, Januar 2013

The West Mediterranean Metallurgical Drift (WMD)[1]

by *Christian Strahm*

The originality of cultural development is usually specified by geographical region, so that during this process, a region seems to be unified and is then perceived as a cultural entity. The description of regional cultural patterns is a primary research objective for every historical analysis, and the definition of the geographical region is a prerequisite for this approach. Italy is an interesting case study for such an approach. Because of its geographical location and structure, the Apennine Peninsula seems to be a closed cultural entity. It is defined by a dominating mountain chain, the Apennines, and is almost completely surrounded by water; to the north, the Alps create a barrier to Central Europe. The prerequisites for a uniform original development are thus fulfilled, but the cultural evolution on the Apennine Peninsula is everything but uniform – it is very disparate throughout all periods and epochs. Even the Roman Empire was rather a superordinate political binder than an original cultural entity, and even in modern times, the country is not only culturally fragmented, but is also politically subjected to constantly changing alliances of different influences. For example, after the fall of the Renaissance city states, Italy was basically a pawn in European history. The social demands of the Risorgimento, which fought for a completely free Italy and sense of unity, laid the foundations for Italy as a cultural entity[2]. Today, however, this unity has again been put into question, especially when regarding the centrifugal strength of the Liga Nord[3]!

Regionalism and Heteronomy

In prehistory, the entire Apennine Peninsula was also affected by outside influences, which led to a very disparate development in the different regions. Thus, culturally, Apulia, as well as Sicilia, is more akin to Greece; Sardinia had – like all islands – its own life, while Northern Italy is only to be understood in the context of the North Alpine cultures[4]. The Northern Adriatic, in turn, is a completely different world[5], and Liguria is more affiliated with Southern France. Only Central Italy sets itself apart, at least during the Pre-Christian era, as having what can be seen as an original evolution.

An example for this alleged impression of unity and the (pre)historical disparate reality is the situation during the Chalcolithic, and a preliminary overview of the material and monuments may provide an impression of a cultural entity. Even one of the first researchers of this epoch, G. A. Colini, spoke of a "Civiltà eneolitica" covering all of Italy, which was, however, divided into three sub-groups[6]. This supposed uniformity at this time is displayed by material, technology and the need for specific ceramic grave goods and status objects, for example copper daggers and axes. In this sense, the entire Chalcolithic in Central and Southern Europe must be considered as a single unit, since most of the archaeological cultures show a similar basic inventory. However, these characteristics denote rather a developmental step than a cultural entity[7]. This supposed uniformity is contrasted by the typological diversity in the form inventory of the Chalcolithic cultures in Italy, above all represented by the pottery, the bulk of which are heavily affected by external influences. This underlines the disparate picture: for example, it is possible to recognize a cultural entity in

1 Translation Erica Hanning.
2 Reinhardt 1999, 98–106.
3 This prevailing sentiment was also probably current at the turn of the last century and could have strengthened G. A. Colini's rather progressive theory about the regional development of the Chalcolithic, summarized as a "Civilità eneolitica" (Colini 1901, 124; cited in Steiniger 2007, 15).
4 Rageth 1974, 230.
5 Valmin 1939, 12.
6 Colini 1898–1902; Steiniger 2005, 291.
7 Strahm 2001, 179–184.

the Po Valley and in northeastern Italy, which is strongly affected by eastern or Southern French influences. So, the *Stile metopale* is closely related to the Fontbouisse style[8] and the complementary ceramic of the Bell Beakers in Northern Italy is part of the widespread accessory ceramic in eastern Central Europe[9]. Other regional styles exhibit influences from the Balkan Peninsula, such as the *Ceramica a squame*, *Ceramica a striature* and fingernail impressions, which were integrated in very different ways into the indigenous culture.

This disparity on the Italian peninsula can also be seen in the metallurgy, whose formation can be traced back to external impulses, but its evolution during the Chalcolithic also contains original traits. It also takes part in the forces that formed the traditions of an archaeological entity: Northern Italy and Northern Tuscany are typified by the Remedello dagger, which is primarily made out of arsenical copper with traces of nickel and bismuth. They are also depicted in the rock art along the southern borders of the Alps. Central Italy is dominated by daggers of the type Rinaldone, which were mainly produced from fahlore copper. Southern Italy shows a completely different picture altogether: The typical dagger there is long, narrow and thin, and is not suitable for actual use (fig. 2.2). On the basis of the few imprecise and preliminary analyses that are currently available, they seem to be made of an arsenical copper with traces of silver. In light of the scanty amount of pertinent finds and incomplete analyses, these statements can only be seen as preliminary hypotheses. Even so, there seems to be a clear tendency that the three main regions (the Po Valley and Northern Tuscany, Central Italy, and the Campagna) began to form in the Italian Chalcolithic and are distinguished by independent dagger types, as well as regionally specific copper metal types. All three entities were almost exclusively represented through grave finds and are defined by their specific dagger type (fig. 1). Additionally, the grave inventory also includes a flat axe, as well as an independent form spectrum of grave ceramic.

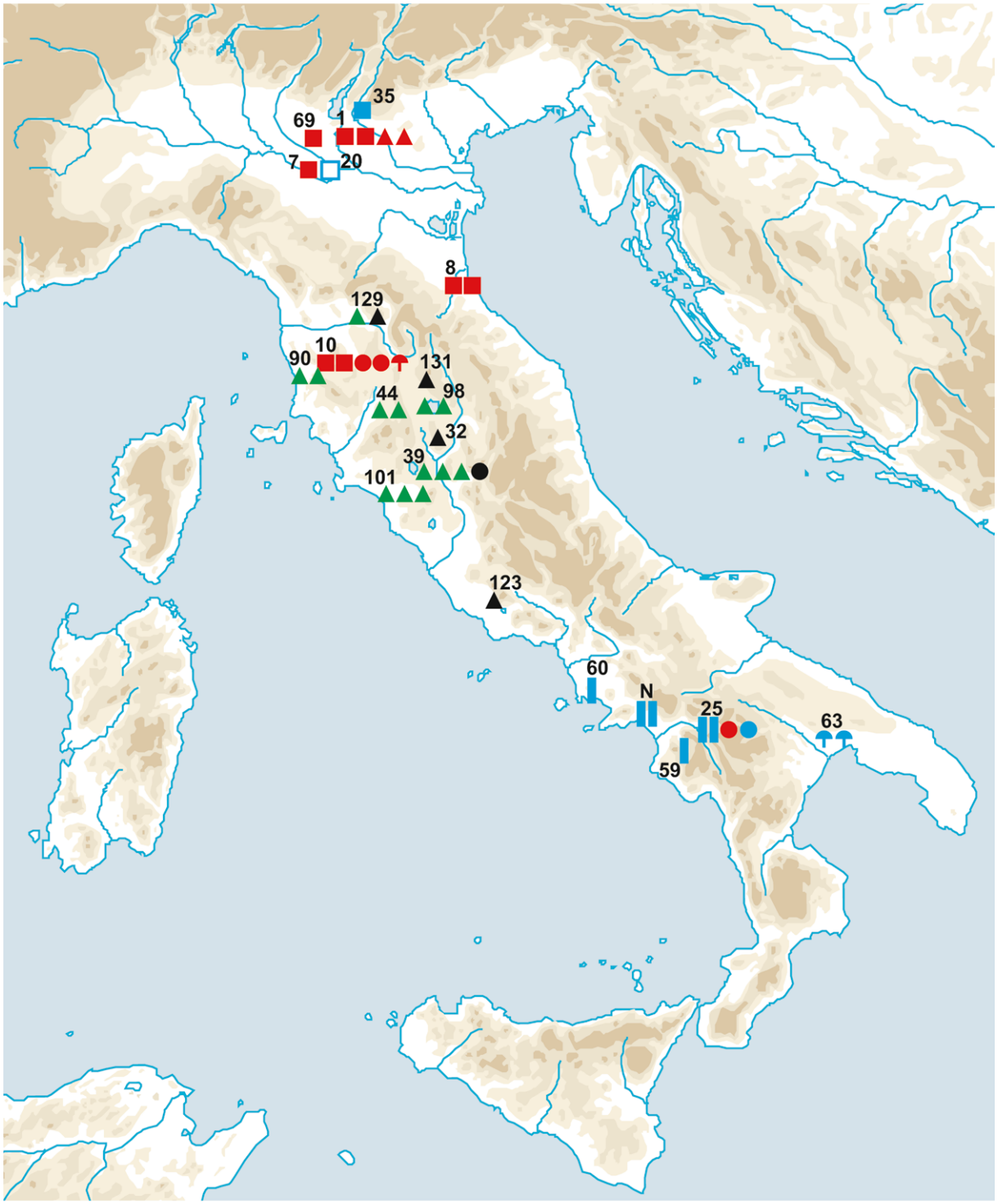
Past studies have assumed that the rest of the undocumented cultural expressions were regionally influenced and were defined by the dagger types and/or graves as part of the Remedello, Rinaldone or Gaudo cultures. It is methodically questionable if such a limited find spectrum can be used to pose the question whether these were conventional "archaeological cultures" (and whether such a term should even be used). However, the methodical consequence is that the individual types can be seen as single elements in a regionally and temporally changing continuum during the Italian Chalcolithic according to the polythetic model (see below). Thereby, it is possible to demonstrate the relationships as well as the originality of the three regions, which have also been graphically portrayed (fig. 1)[10]. Some of the finds also show signs of interdependence, for example a dagger from Grave 1–2 in Buccino has the typical form and material of Remedello (fig. 2.3), or the long-hilted dagger-like object from Montebradoni in Tuscany (which is otherwise only found in Southern Italy) is made of Remedello copper.

This heterogeneous cultural background was explicitly and comprehensively documented in Steiniger's dissertation[11], and the different roots of the indigenous ceramic in reference to the Bell Beaker complex were outlined by the author of this contribution[12]. Many characteristics can be traced back to external influences, which are then reflected in the indigenous inventory. Other regional styles exhibit influences from the Balkan Peninsula, such as the *Ceramica a squame*, *Ceramica a striature* and fingernail-impressions, and were integrated in very different ways into the indigenous culture.

Archaeological Entities and Metallurgical Assemblages

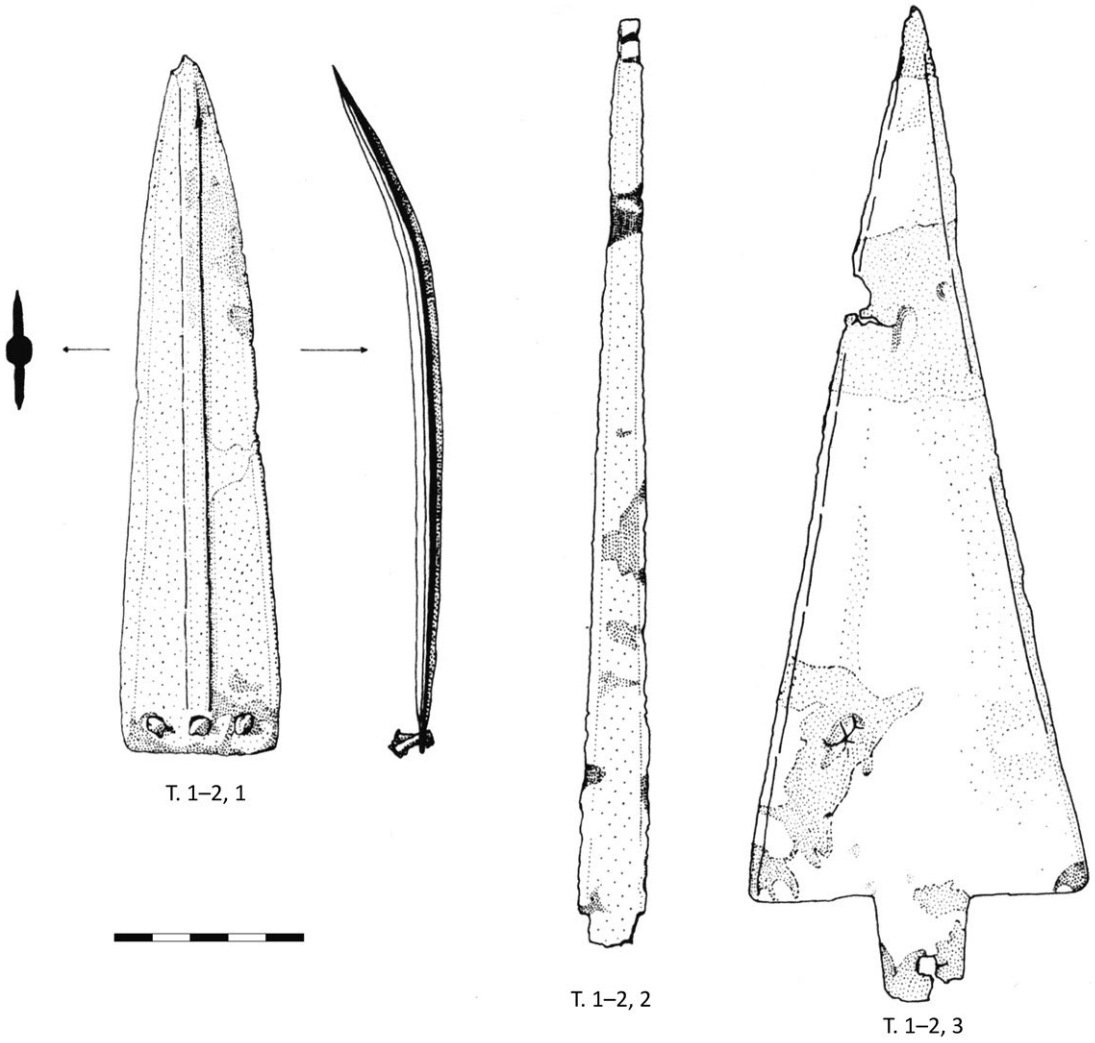
In prehistory, however, these entities can rarely be generally or conclusively interpreted and only represent theoretical constructs of contemporary investigations. Nevertheless, we describe cultural evolution as a succession and interplay of such entities, i. e. archaeological cultures are mainly defined by ceramic styles. This is justified by applying a holistic approach, with the assumption that style represents a particular entity, an archaeological culture and creates the basis for the well-known definition from G. Childe[13] and describes an impressionistic approach to an archaeological entity that is, however, established by us (i. e. the modern researchers). D. Clarke compared this problematic approach with a characteristic analysis that eventually led him to his

8 Bagolini – Fasani 1982, 352; Fasani – Visentini 2002, 234.
9 Strahm 2008, 214.
10 Examples in Steiniger 2000/2001, 82–95.
11 Steiniger 2007, especially fig. 20.
12 Strahm 2008, fig. 6.
13 Childe 1929, 5; Childe 1935, 2.



Types		Material analyses	
□	Remedello type	red:	SAM C 3
Δ	Guardistallo type	green:	SAM FG, G
†	Montebradoni type	blue:	SAM E 01, E 01A
o	Buccino type	black:	different SAM groups: A, B2, FC, FB2
▯	Gaudo type		

1 The extension of the different analyzed chalcolithic dagger types in Italy. As not all daggers are analyzed, the illustration is not complete, but demonstrates clearly the cultural entities in Italy in the 3rd mill. BC. Typology after V. Bianco Peroni; copper groups after Junghans et al. SAM 2,2, 1968. (See also fig. 3 and 4 in contribution D. Steiniger in this volume)



2 Copper artifacts from Buccino, Tombs 1–2

polythetic model. It is a half-statistical approach that can also lead to a graphic delimitation of an entity. There are good descriptions of what would be called an archaeological culture, but they also clearly show the problems that come with using this term (see fig. 3)[14].

This methodically complex situation is especially apparent for three reasons: firstly, the source material for chalcolithic finds is very unequal, so it cannot be assumed that this epoch is sufficiently documented and consistently investigated; secondly, the state of research varies greatly, many of the old excavations in some regions are not published and there are not any new large-scale excavations[15], and theoretical discussions are only making headway at a few but notable university fields of study; the third point deals with the terminology – the connotation of the term "archaeological culture" is rarely breached in almost the entire Romance-speaking world[16]. The issue that there are unsatisfactory and unequal prerequisites for an archaeological culture as defined by Childe is known – and so some try to use more neutral terms, such as *facies* (Cocchi-Genick). However, this does not really solve the problem. From the author's point of view there are only two options for writing history without giving "archaeological culture" a specific connotation: either one describes the entire cultural and natural evolution in a specific region on the basis of ab-

14 Steiniger 2000/2001, 69–90 and table on page 90.

15 One of the notable exceptions are the long-term research projects in the region of Sesto Fiorentino conducted by the Univerità degli Studi di Siena and the Soprintendenza Archeologica della Toscana (Lucia Sarti and Fabio Martini). For an overview of this interdisciplinary project, see Baioni et al. 2008, 19–149.

16 Van Willigen 2006, 16–18; Strahm – Van Willigen 2014.

Time Scale	Period	Archaeological Entities	Objects and types	Metal	Metall-urgical phases	Interpreted impulses
1600	MBA	Polada	EBA Types	In Tin -Bronze	Industrial phase	North alpine expansion
	Developed phase of EBA					
2000	Early phase of EBA	Proto-Polada Sobara			Phase of Consoli-dation	New impulses
2500	Late Chalcolithic	Bell Beaker; Fazies Remedello, Fazies Rinaldone, Fazies Gaudo	D: RemedelloType, Guradistallo T.; FA: Cumarolo T., Similaun Type	In Fahlore		
3000	Middle Chalcolithic					
3500	Early Chalcolithic			Fornace SHA ⬅ Peripheral Influences		
	Final Neolithic	Late VBQ, Rivoli-Castelnovo Style	Imported obj. or imp.Technology i.e. Kollmann	Mondsee copper	Innova-tion-phase	Second drift
4000	Late Neolithic		Imported objects: Lana, Sgurgola, Bocca Lorenza	Pure copper	Initial Phase	First drift
4500	Middle Neolithic	Middle VBQ, Rivoli-Chiozza Style				
5000						

3 The metallurgical evolution in Italy based on typological classification

solute dates, such as L. Sarti and F. Martini have done in their exemplary work for Sesto Fiorentino, or one limits oneself to individual studies of cultural movements, tracing the influences or networks of different aspects, as other authors have done[17]. In this way, traditional cultural tags are consciously used, knowing that they were defined using insufficient sources and without methodical refection. It is known, for example, that the Remedello "culture" is almost exclusively represented by its name-giving cemetery; the Rinaldone "culture" is only composed of graves and even the Gaudo "culture" has very lopsided source material. With that being said, it is also known that there is an archaeological entity that used specific dagger types.

17 In this way, L. Barfield has often indicated the long-lived, intercultural burial traditions that separate Northern Italy into western and eastern areas. This separation has been in place since the Neolithic and became especially apparent during the Chalcolithic. Likewise, E. Mottes notes "there are no logical reasons why typological significance and that other factors such as size of raw material, the skill of the craftsman, the functional or ritual purpose, state of reworking, etc. all played a part in the ultimate typology of an individual dagger. Also currently, there is no evidence that a specific form is related either to a specific period of time or a specific cultural group"; Mottes 2001, 532.

Theses about the History of Metallurgy

In order to illustrate the abovementioned influential disparities and to understand the heteronomy of the *differentiation* of the regions' cultural evolution, it is imperative to briefly illustrate some of the main features of the history of metallurgy and the prerequisites needed for its diffusion in the Old World. These have been justified many times elsewhere and so are only outlined here in the form of theses[18]:

The first thesis concerns the source of metallurgy inside the Old World. Today it is commonly accepted that these origins are to be found in the Near East and that it is the diffusion of a new technology, since the oldest evidence can be found there, in the area of the Pre-Pottery-Neolithic-B culture during the 8th millennium BC. This was discovered as part of pyrotechnical experimentation with new material, also including the creation of usable artefacts from native or pure copper. The knowledge of how a new resource could be controlled that then spread over Asia Minor and further abroad, but remained for millennia by this simple manufacture. There was no further development, because there was little need for metal tools whose efficiency was not equal with the perfected stone implements; the first metallurgy was an additional technology without cultural consequences. Curiosity was obviously the driving force for the introduction of the first metallurgy, which has been designated as Initial Phase.

The second thesis, which is defined as a constant in the development of metallurgy, is also included in the illustrated sequence: the development happens in specific, well-defined phases.

Metallurgy unfolded in different regions in the Old World in the same way as in the Near East: it happened in steps, not continually, but accelerating and also stagnating. The phases are admittedly shifted in time; they appear in a chronological gradient from southeast to northwest – a gradient that, in the beginning, was very steep and became less and less so in later times. The time-delayed diffusion also had the consequence that not all of the steps are present in every region. It is also not expected that there was a technologically obligatory succession. While the entire development can be traced step-by-step in the early developmental centres, some of the phases are absent in the expansion zones and especially in the peripheral zones[19].

The third thesis is concerned with the respective impulses for the evolution of metallurgy. The formation of each step has a different reason or motivation; within a region they are coherent and their progress is uniform. While in the beginning, it was curiosity that drove people to try new raw materials, in later times the high valuation, i. e. the prestige factor, gave the material its significance. Thus, the first extensive production of copper tools occurred in regions with consolidated agricultural cultures that had a need for prestige goods. Metal objects are well suited to cover the need for prestige goods, since they not only embody prestige, but also their manufacture entails work potential and the owner of this potential would be held in high esteem and have power. Thus, for the first time, there was an increased need for representative – but not necessarily efficient – metal tools that led to an early metallurgy (Innovation Phase). The technical knowledge was seldom developed by itself; instead, a new step was first made when the society was ready for it. There is an interaction of different factors that first create this new path. Therefore, it is also understandable that these developmental phases are not a gradual linear process, but consists of staggered steps, instead.

18 Recently, Strahm – Hauptmann 2009.

19 For example, the metallurgy in Southern France and in certain regions in Italy begins with the Innovation Phase, i. e. with the use of fahlore (see below). This incomplete succession is depicted in the chronological tables that have been published in several different articles; recently in Strahm 2010, 181. The table can also be found in this volume, in the article in Dolfini 2013, fig. 9. In an earlier study "The Emergence of Metallurgy in the Central Mediterranean Region. A New Model", A. Dolfini inserted the table published by the author and mentioned above; Dolfini 2013, figs. 9 and 10. He wanted to illustrate that metallurgy in Italy was introduced by the Carpathian Metallurgical Drift according to the new Rinaldone dates, which suggest an earlier beginning of Rinaldone metallurgy. By doing so, he has unfortunately ignored the historical statement of the table by placing the arsenic-copper technology of the Mondsee-Pfyn culture on the same level as the fahlore technology of the Rinaldone *facies*, and has therewith postulated a genetic correlation of this metallurgical evolution.

Expansion into Italy

The abovementioned theses were developed using finds and features from Southeast and Central Europe. However, they also build the basis for the expansion and description of the introduction of metallurgy on the Apennine Peninsula during the 5th and 4th millennium BC. Expansion mainly occurred in several waves that are difficult to separate from each other in terms of chronology and have different developmental histories (figs. 5 and 6).

The first wave comprised only imports, i. e. single objects that were traded. These were heavy, massive axes – impressive not only due to their uncommon material but also because of their size. It is readily apparent that these were prestige objects, symbols or signs of power. This horizon is typified by axe-adzes, type Jászladány and thick flat axes, which are found in the regions north of the Alps, as far as North Germany[20]. Such prestige objects are also found in Northern Italy; especially poignant examples are three axes, type Szakálhát (or a variant thereof), from Bocca Lorenza (fig. 4)[21]. All three axes were analyzed by L. Matteoli and C. Storti in Varese and are composed of pure copper[22] that falls into the Stuttgart metal analyses (SAM) group E 00. These are supplemented by additional objects like a broad-butted flat axe from Marendole (OW 759) and San Briccio (OW 114), as well as an old find from Sgurgola in Latium (Anal. Kat. SAM), which is also a broad-butted flat axe; all of these are composed of pure copper (E 00). There are more massive flat axes from Kanzianiberg, as well as from the Tominzhöhle[23] and Lana[24], which have not been analyzed, but are comparable to the Szakhálhát type (or a variant thereof) that is commonly found in the Carpathian region and Slovakia[25]. Although the axes were not from well-stratified contexts and the find from Bocca Lorenza has been interpreted differently[26] (even when it belongs typologically to the second half of the 5th millennium BC) there are some small finds like awls from Botteghino, Alba or Arene Candide that can be attributed to the VBQ-complex and are thus chronologically concurrent[27]. Since they have not been analyzed, they cannot be assigned to a certain copper type. Only in the case of the awl from Bannia (Friuli-Venezia Giulia), which was found in layers dating to the VBQ-culture (Square-Mouthed-Vases culture), it is possible to say that it was made from pure copper (E 00)[28].

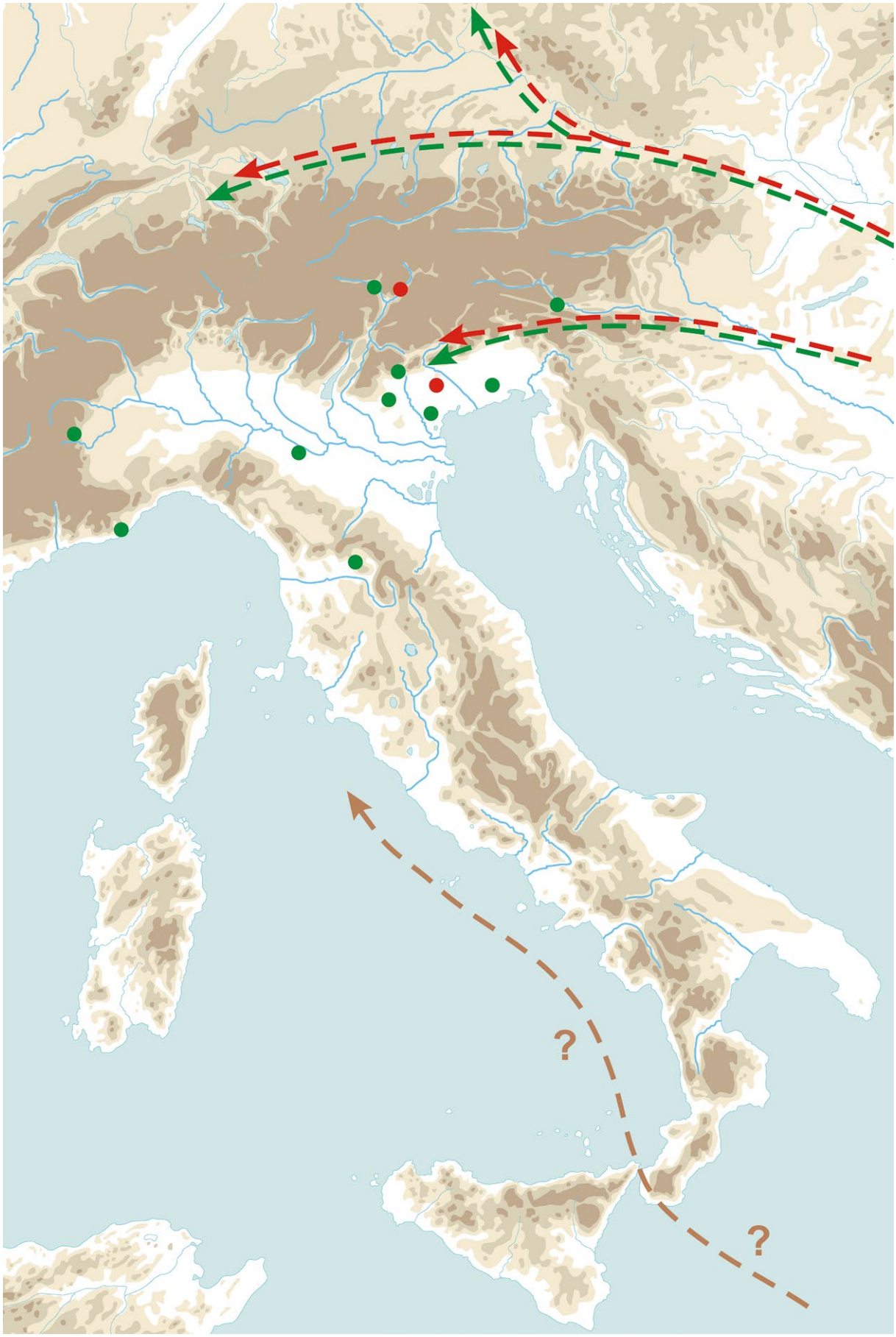
4 Flat axes from Bocca Lorenza

There is very little evidence that hints at a relationship with Hungary and Slovakia, but it does show that the early metallurgy (Initial Phase) found there had radiated outward as far as Northern Italy and that this new technology (innovation) was introduced in conjunction with the VBQ-culture[29].

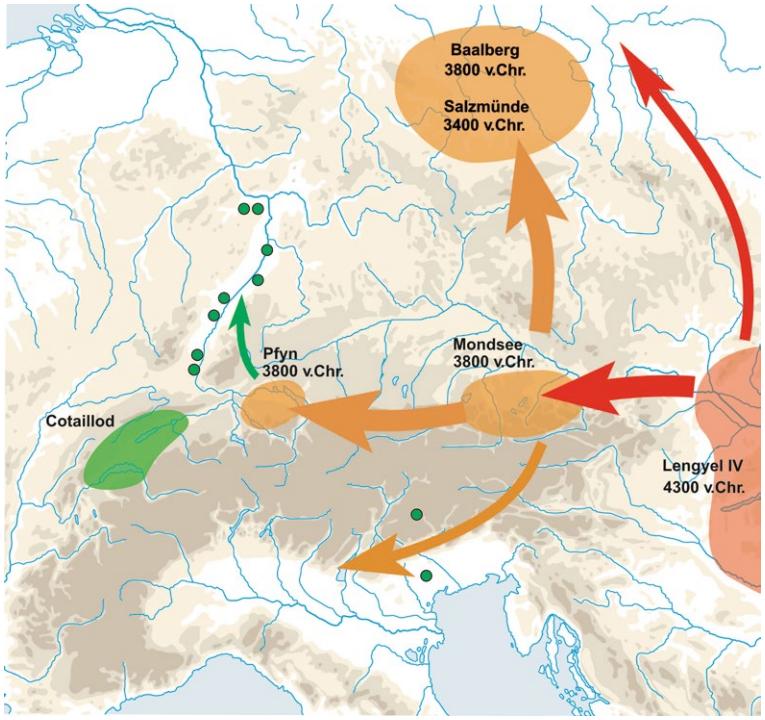
This first wave had not only spread to eastern Central Europe, but also reached south of the Alps into Northern Italy. There are two arms of the stream that had its source in the Carpathian Basin and in the Balkans (fig. 5). A transfer between these two arms over the Alps was not obligatory[30].

The second wave was of a different nature: the expansion of a technological innovation that was integrated into the archaeological culture. This would be akin to the innovation phase of the metallurgical developmental phases referring to the distribution of arsenical copper that again came from the Carpathian Basin, but emanated from Transdanubia and mainly extended into the North Alpine region[31]. This metallurgy is an aspect of a larger cultural complex that has its roots in the Balaton-Lasinija culture, which was transformed via the Retz-Gajary culture into the Mondsee culture and then contributed to the formation of the Altheimer and Pfyner cultures, and whose influence continued into the

20 Schubert 1965, 281; Klassen 2000, 117; Strahm 2010, 185.
21 Citton 1988, 618; Barfield 1996, 67.
22 Matteoli – Storti 1982, 66.
23 Many thanks to Manuela Montagnari and Annaluisa Pedrotti for pointing out this find.
24 Lunz 1973.
25 Patay 1984, 24–27.
26 Last by Dolfini 2013.
27 Summarized in Mazzieri – Dal Santo 2007, 130.
28 Giumlia-Mair 2005, 120.
29 This eastern correlation was newly proposed by L. Klassen and A. Dolfini, and was already pointed out by E. Sangmeister (Junghans et al. 1968, 82 f.), but has been ignored by research.
30 Differently minded: Klassen 2010, 29–33.
31 Strahm 1994; Klassen – Stürup 2001, fig 8.



5 The introduction of metallurgy in Italy in the first half of the 5th mill. This first metallurgical drift is documented by massive long flat axes and some awls, both in pure copper. A similar diffusion from the Carpathian region introduced metallurgy in the North Alpine and Central European region. Red: first drift 5thmill. – green: second drift, first half 4thmill. – brown: Chalcolithic, sec. half 4thmill and 3thirdmill



6 The diffusion of the so-called Mondsee-copper (ca. 3800–3400 BC). This arsenical copper probably produced in Slovakia or the Eastern Alps is well represented in the North Alpine region, but only little evidence is documented in Northern Italy (for complete map, see Dolfini 2014 fig. 8)

Funnelbeaker culture. The copper objects are a characteristic component of the find inventory and are an integral part of the respective archaeological culture. They are present in copious amounts in the abovementioned cultures and periphery evidence can also be found in the neighbouring cultures, for example, the unique find from Colmar-Aerodrome[32].

This second wave is the crucial phase in Central Europe for the introduction of this new technology. The flow of metallurgy from the Carpathians has already been mentioned above. During the first half of the fourth millennium BC, metallurgy covers a widespread area north of the Alps, up to Central and Northern Germany (fig. 6), and is mainly designated by the term "Mondsee copper"[33]. South of the Alps, in Northern Italy, there are only singular finds that are typologically similar and of the same type of copper as the North Alpine objects. These are the smaller, rather unshaped flat axes from Val Fontega and an axe from Kollmann near Brixen. Both have been analyzed[34] and are composed of arsenical copper E 01, which characterizes the aforementioned expansion south of the Alps. In the face of the small number of finds from this time, as well as the limited availability of comparable analyses, it is to be expected that more objects would turn up in small regional museums and collections.

An example of the rather peripheral influences is one of the few known shaft-hole axes (*Schafthalsaxt*) from the Museum in Udine[35]. It was found in the northernmost tip of Italy, in San Daniele del Friuli, Fornace, and belongs to the larger group of shaft-hole axes, type Fajsz or Kozarac, found in depots dating to the Řivnáč-Jevišovice-B culture horizon. Their main distribution area is in the central Danube region in Slovakia, but can also be found in Western Romania, Moravia and Central Germany[36]. The find from Fornace is thus on the outer-

32 Lefranc et al. 2012, 718–724.
33 The research tradition and history of the definition of Mondsee copper was recently described by the author; Ch. Strahm in: Lefranc 2012, 718–724; see also Matuschik 1985, 241.
34 Matteoli – Storti 1982, 66; OW 279 analytical catalogue SAM 19800.
35 Visentini 2019.
36 Mayer 1977, 28.

most periphery of the Danube type and is of only minor importance for the development in Italy.

Although the evidence for the influence of arsenical copper technology in Italy is scanty, it is important with respect to the origin of Italy's surprisingly rich Chalcolithic metallurgy. Its emergence is unclear and has repeatedly been the subject of discussion. One interesting contribution to this discussion has been put forward in 1969 by L. Barfield[37] and more recently by A. Dolfini[38], which the current author principally agrees with, but would like to add on to with the following comments. At the beginning of this article, the variability of the regions of the Apennine Peninsula has been described, which is also a typical characteristic during the Chalcolithic. Even though it is not possible to ignore common, uniting elements, the three major regions have been influenced in very different manners. Thus the roots of the Chalcolithic metallurgy in Italy cannot be analyzed in bulk, but must be observed by region. Over the years there has been much speculation, but the arguments are usually based on dagger typologies. There is a hypothesis that the Remedello-type daggers can be traced back to influences[39] coming from the Aegean due to the fact that there are similar dagger types in Crete. Barfield returned to this issue later[40]; the thesis was, however, never investigated nor tried with new data. According to A. Dolfini, it is questionable on chronological and chorological grounds[41] and its hypothetical character is evident[42]. Admittedly, it is supported by the metal analyses: C6 copper is very typical for the Aegean and almost exclusively found in this region, with an additional 7 examples occurring in Italy[43].

In any case, the metallurgical analyses of the Remedello finds point to another aspect of the evolution of metallurgy in Northern Italy. The majority of objects are made of the very characteristic copper type C3, which is also an arsenical copper[44]. This type is differentiated from the abovementioned arsenical copper E 01/ E 01 A only by the elevated levels of silver and bismuth. The oxide ores that are used to produce arsenical copper are much easier to process. This is the main type in the North Alpine Recent Neolithic (Jungneolithikum), i. e. in the first half of the fourth millennium B.C., and is chiefly known by the Mondsee copper. Fahlore is somewhat more difficult to smelt, but because of the varying amount of antimony, silver, nickel and arsenic, it also delivers better results – i. e. harder but more stabile daggers. In general, this was the dominant copper type during the third millennium B.C., but in isolated cases, fahlore also appeared earlier. This is understandable since ore extraction was not carried out "mono-fractionally", which would have been the case for Central Italy, where most of the Copper Age objects are composed of an antimony-dominated fahlore and were recently dated to as far back as 3600 B.C.[45].

The inclusion of the copper types into the discussion of the origin of metallurgy in Italy makes one wonder if the rather scantily documented horizon pertaining to early arsenical copper (E 01 and E 01 A) was the first impulse for the development of metallurgy of the Remedello group, which was also based on arsenical copper (C 3). However, it cannot be overlooked that this hypothesis is contradicted by both typological and chronological arguments: Firstly, there are barely any comparable types in the place of origin, and secondly, the Remedello group is not datable to such an early period, in spite of several new attempts[46].

In this context, the new early dating of some of the finds from Ponte San Pietro, Garavicchio, Fontenoce di Recanti connected to the Rinaldone *facies* (Rinaldone culture) should also be included[47]. This leads to two interpretations:

Firstly, since the metallurgy of the Chalcolithic objects from Central and Northern Italy (*facies* Rinaldone and Remedello) are closely intertwined, it could be postulated that in spite of the abovementioned concerns about the dating of the Remedello, this entity (culture), as well as the Rinaldone culture, could have emerged in the middle of the fourth millennium BC. The Northern Italian arsenical copper brought the first impulses for the development of the fahlore technology in Central Italy, which was decisive for the following periods.

A second hypothesis can also be put forward: The fahlore technology of the Rinaldone culture was the result of impulses from the Aegean, in which the dominating copper type C 6 from this region (which was also produced from fahlore) was the archetype. Thus, metallurgy in Central Italy had a different point of origin, which would also explain its originality. Although the typological differences cannot be overlooked, the Chalcolithic cultures in Southern Italy might have acted as a type of bridge or interim location.

37 Barfield 1969, 68.
38 Dolfini 2013.
39 Branigan 1966; Barfield 1969; Eaton 1973; Renfrew 1974.
40 Barfield 1996, 71.
41 Dolfini 2013.
42 See Steiniger 2000/2001.
43 Junghans et al. 1968, 86.
44 Junghans et al. 1968, 86; De Marinis 2006.
45 Dolfini 2010.
46 Mottes 2001, 532; Steiniger 2007, 64–68 esp. fig. 5; De Marinis 1997, 33–51.
47 Dolfini 2013.

The Western Mediterranean Metallurgical Drift

The clarification of the origin of metallurgy in Italy is problematical, but the expansion on the Apennine Peninsula is well outlined. It took place in the common well-known steps that were explained above: first came the imports; then an independent manufacture; lastly local ore extraction and a specific form inventory[48]. This originality can especially be witnessed during the Chalcolithic periods; it is well documented and extensively known, but cannot be discussed here in detail. The focus of this paper is on the further development of metallurgy on the peninsula and its expansion outside Italy, and can be subsumed under the term Western Mediterranean Metallurgical Drift (WMD): The sustainable development of metallurgy on the Apennine Peninsula also had an impact on the neighbouring regions. For example the expansion into Southern France, which was of particular importance and – thanks to the pioneering work of Paul Ambert and colleagues – it is also well documented[49]. The abovementioned second wave can be found in Eastern France as the outermost periphery of the North Alpine Mondsee copper that was discontinued there afterwards[50]. More important, however, is the metallurgy during the Chalcolithic in Southern France, which was quite well developed. Its development can be easily traced: Early metallurgical steps, i. e. the use of oxide ore, are not known from there; metallurgy starts with the use of fahlore, instead, beginning around 3100 B.C. This late start, as well as beginning in a more developed phase, points to the new technology being brought in from elsewhere. There is also no evidence for an independent emergence in Southern France. There are many more isolated finds that point towards their origin and path, which document intensive contact between Italy and Southern France: the grave goods and construction of a grave in a 1000-meter-high necropolis in Fontaine-le-Puits (on an important route to the small St Bernhard Pass and near copper ore deposits) clearly show similarities to the Rinaldone *facies*[51]. On the basis of new ^{14}C-dates, this Grave A is dated into the second half of the fourth millennium B.C.[52]. Depictions of Remedello-type daggers were carved into the walls of a rock shelter that lies on the route between Cuneo and the Durance[53]; and lastly, there is the well-known dolmen from Orgon, les Gavots, located at the mouth of the Durance River, that contained a Remedello dagger and two awls. The material of the objects was identical to the copper type that dominated the cemetery in Remedello[54]. The theory of a spread of metallurgy from Italy to Southern France also pertains to Western Switzerland, where Remedello daggers are portrayed on the steles in Sion. Other objects, not only in Southern France but also in Switzerland, are also primarily composed of copper commonly distributed in Northern and Central Italy[55].

In Southern France, an independent production that used fahlore grew out of the above-described expansion. A particularly well-investigated example is the antimony-silver-arsenic copper that is found in the ore deposits in Cabrières and was distributed in Languedoc[56]. On the basis of find complexes it is possible to reconstruct the entire metallurgical chain[57], giving this site a distinguished role in the literature. Ore extraction, smelting and production of the objects are all documented at the site, and because of the specific copper type it is possible to track the distribution area, i. e. the trade area, which is limited to Languedoc with isolated instances to the Northwest, to Aquitania, and was even sometimes traded as far as Western Switzerland.

Other finds and copper types in Southern France are reminiscent of Rinaldone objects and support the assumption that both the artefacts and the technology were transferred. There is also evidence of a reverse flow in Italy, as can be observed in the typical dagger forms, the copper types from Southern France, as well as in the well-known Late Neolithic Western Swiss FC-copper that is found sporadically in Italy. This West Mediterranean Metallurgical Drift had also certainly touched other areas in Western Europe, but an overall analysis of this cultural movement would exceed the scope of this article.

The hypothesis of the derivation of the first copper metallurgy in Italy from the Carpathian region and the two scenarios about its further development are at the moment hypotheses that need to be verified or refuted. They still include rather large gaps in the current state of research, but the few clues are significant enough to at least recognize the beginnings of a metallurgical development. These are the first attempts of an interpretation that also contain new demands for future research. It is hardly possible to tie the few metal finds – each coming from singular contexts and mostly only from graves – to larger outspread entities (archaeological cultures), and

48 Strahm 1994, 35.
49 Ambert et al. in this volume.
50 Lefranc 2012, 718–724.
51 Müller 1909, 836; Strahm 2005, 28.
52 Rey et al. 2010.
53 Müller et al. 1991, 159.
54 Courtin 1974.
55 Sangmeister 2005, 22 f.
56 Laroche et al. 2019; Sangmeister 2005, 23 Group 24.
57 Strahm 2005, 14 pl. VI B.

all the aspects of the cultural intertwining cannot be traced. On the one hand, the entire spectrum of the cultural expression connected with metallurgy should be depicted; on the other hand, another goal is to be aware of the regional entities, to learn from them, and to understand their changes through space and time as a fluid continuum. In this way, a holistic term of an archaeological culture will either become obsolete or be clarified, or merely used as a working term. Only by taking these new approaches into account will it be possible to live up to the distinguished position Italy had in the history of metallurgy.

Appendix

This essay is based on the author's presentation at the congress "Strategie insediative e Metallurgia" in Rome in 2011, which is published in this volume. In accordance with the given question, most of the contributions focused on the manifold relations with neighbouring regions[58]. This is because an overall view of this heteronomy has hardly been a topic of research up to now, and the integration of the spectrum of types and material analyses of copper objects from all over Italy into the history of metallurgy has only rarely been addressed; the regional differences and thus the research orientation of the institutions were too great[59]. Thanks to the international participation at the congress, the opportunity arose to exchange with colleagues from different regions and countries. In consideration of these discussions, the present paper was developed, which was presented to the editors in 2014. Since then, however, a number of important studies have appeared which could not be incorporated into the text, but which should at least be pointed out.

The conference had a decisive influence on further research, because the personal exchange of views there also provided the opportunity to get to know the argumentation of a different point of view; in the literature this is usually only cursorily presented. In particular, it was found that there was a greater degree of agreement in the assessment of the development in the Chalcolithic than was reflected in the specialist literature, because up to now it was rather the regional finds and features that were presented and discussed and the impulses from outside were usually only noted in passing.

Due to various imponderables, it has not yet been possible to print the congress lectures. Some have now been published elsewhere in a revised format. However, the new approaches have found their way into the scientific community, because the given objective - namely heteronomy and the integration of the different regional developments into an overall picture – represented a special challenge to the international participants and had an impact in the following discussions. It is therefore still important to present this state of research at that time and the new impulses, because most of the contributions are likely to be valid today. In the meantime, further new discoveries have been made, and there are also exciting individual studies, especially in the field of metal analysis, which confirm the contributions of the congress volume, but the basic outlines of the syntheses presented in Rome have not been decisively further developed. We would like to mention some of the papers published since then only briefly, because they complement or even confirm our contribution.

At the same time as our present contribution, a further study, parts of which were already presented and discussed in Rome, has been produced: It is the knowledge-able, excellent work of A. Dolfini[60]. All aspects of metallurgy are comprehensively treated in it, the decisive importance of the geological conditions and technological processes, which also determine cultural evolution, is rightly emphasized. In general, there is a great deal of agreement with our ideas. For example, Dolfini also assumes that the earliest Late Neolithic (in the terminology of Italian research!) copper finds of the 5th millennium are imports from the Carpathian region, consisting mainly of massive flat axes. This represents the first wave of a strong expansion (the so-called Schwergerätehorizont) from the Carpathian region to the northern pre-alpine region. It is less pronounced in the southern pre-alpine region with finds as far as Central Italy. The second wave, which we have described above as the "Crucial phase for Central Europe", brought arsenic copper from 3800 BC into the Mondsee Culture and the Pfyn Culture (above fig. 6)[61]. However, it is hardly documented in Northern Italy and Dolfini does not distinguish it from the first expansion.

58 Cf. Introduction: Steiniger/Kunst: in this volume.
59 Differently Steiniger 2000/2001 and 2007; Dolfini 2014.
60 Dolfini 2014.
61 Ch. Strahm in: Lefranc et al. 2018, 20–36.

The subsequent "impressive but rather unchanging metal production of the Copper Age"[62] also fully meets our expectations, but we do not see this technology as a continuation and fluent further development of the "Neolithic metallurgy south of the Alps, which looks fairly basic"[63], but as a decisive, revolutionary innovation that introduced a new spectrum of types as well as technological innovations.

This interpretation is also supported by the metal analyses (see above). In general, the disparity lies in the different weighting of the arguments: While we focus on heteronomy, e. g. by referring to the impulses from the Aegean Sea in the 4th and 3rd millennium mentioned above, which Branigan (1966), Barfield (1969) and Eaton (1973) mentioned, may be questionable, but are still not disproved. Dolfini emphasizes the fluent development within Italy. In contrast, the integration of metallurgy into a pan-European framework seems to us to correspond more to historical reality.

This different evaluation may also be a reason why Dolfini misunderstood our description of the Metallurgical Development Phases.[64] "This trajectory, however, should not be understood as a sequence of clear-cut phases (sensu Strahm and Hauptmann 2009), but one that depended on context-specific conditions including, crucially, the nature of the ore and the technological savoir-faire of the smelters. Centuries-long overlaps between stages seem also attested in the record"[65]. This is precisely what we actually meant at the time when we applied the development phases.

Finally, there is the recent synopsis on European paléométallurgie européene in the Actes du Colloque Paul Ambert. In it, S. Rovira gave an excellent presentation of the geological foundations of metallurgy in Western Europe.[66] In particular, he competently and clearly summarised and historically evaluated the important and further-reaching results achieved in recent years by Gilberto Artioli and his team (Dipartimento di Geoscienze, Università Padova) and published in various articles. On the basis of geochemical and lead isotope analyses of ores and a few objects, they have determined the origin and processing of ores in the Italian Eastern Alps and in the Tuscan region. The examination of the slags provided information on the development of the smelting process over time. An important result is the finding that the large mineralisation zones are the material basis for the culture areas described in the introduction. They are therefore with respect to mining and mineral resources (or oxydes) autonomous. The initial mining of primary minerals and sulphide ore deposits and the further processing of the ores in simple smelting furnaces and crucibles document a similar sequence of mining and technology in al the cultures areas. G. Artioli has also studied the rare slags (from Milan, La Vela, San Carlo, etc.) (2007, 2016), distinguishing the coarse, viscous highly heterogenous slags containing abundant vacuoles (slag cakes), which are typical of the Copper Age, and which testify to early metallurgy. They testify to a simple metallurgical process, "a crucible metallurgy", which was "normalised" only in the course of the Bronze Age.

Bibliography

Bagolini – Fasani 1982 B. Bagolini – L. Fasani, Problemi sulla fine del Neolitico ed il passagioall'età de Bronzo nel verdante meridionale dell regione alpina Centrale, in: A. Aspes – L. Fasani (eds.), Il passagio dal Neolitico all'età del Bronzo nell'Europa centrale e nella Regione alpina (Verona 1982) 343–355

Baioni et al. 2008 M. Baioni – V. Leonini – D. Lo Vetro – F. Martini – R. Poggiani Keller – L. Sarti (eds.), Bell Beaker in Everyday Life. Proceedings of the 10th Meeting "Archéologie et Gobelets", Firenze – Siena – Villanuova sul Clisi, 12–15 maggio 2006, Millenni. Studi di archeologia preistoria 6 (Florence 2006)

Barfield 1969 L. H. Barfield, Two Italian Halberds and the Question of the Earliest Halberds, Origini. Preistoria e protostoria delle civiltà antiche 3, 1969, 67–83

Bianco Peroni 1994 V. Bianco Peroni, I pugnali nell'Italia continentale, PBF IV 10 (Stuttgart 1994)

Branigan 1966 K. Branigan, Prehistoric Relations Between Italy and the Aegean. BPI 75, 1966, 97–109

62 Dolfini 2014, 498.
63 Dolfini 2014, 496.
64 Strahm – Hauptmann 2009.
65 Dolfini 2014, 484.
66 Rovira – Strahm 2019, 109–113.

Childe 1929 V. G. Childe, The Most Ancient East. The Oriental Prelude to European Prehistory (London 1929)

Childe 1935 V. G. Childe, New Light On the Most Ancient East. The Oriental Prelude to European Prehistory (London 1935)

Citton 1988 E. Bianchin Citton, Asce in rame dalla caverna di Bocca Lorenza, RassAPiomb 7, 1988, 618–619

Colini 1898–1902 G. A. Colini, Il sepolcreto di Remedello Sotto nel Bresciano e il periodo eneolitico in Italia, BPI 24, 1898, 1-27, 88-110, 206-60, 280-95; BPI 25, 1899, 1-32, 218-95; BPI 26, 1900, 57-101, 202-67; BPI 27, 1901, 73-132; BPI 28, 1902, 5-43, 66-103

Courtin 1974 J. Courtin, Le néolithique de la Provence, Mémoires de la Société Préhistorique Française 11 (Paris 1974)

De Marinis 1997 R. C. De Marinis, The Eneolithic Cemetry of Remedello Sotto (BS) and the Relative and Absolute Chronology of the Copper Age in Northern Italy, NotABerg 5, 1997, 33-51

De Marinis 2006 R. C. De Marinis, Aspetti della metallurgia dell'età del Rame e dell'antica età del Bronzo in Toscana, RScPreist 56, 2006, 211-72

Dolfini 2010 A. Dolfini, The Origins of Metallurgy in Central Italy. New Radiometric Evidence, Antiquity 84, 707-723

Dolfini 2013 A. Dolfini, The Emergence of Metallurgy on the Central Mediterranean Region. A Model, European Journal of Archaeology 16, 1, 2013, 21-62

Dolfini 2014 A. Dolfini, Early Metallurgy in the Central Mediterranean, in: B. W. Roberts – C. P. Thornton (eds.), Archaeometallurgy in Global Perspective (New York 2014) 473–506

Eaton 1973 E. R. Eaton, Eneolithic Blades from Buccino, BCamuno 10, 1973, 89-100

Fasani – Visentini 2002 L. Fasani – P. Visentini, L'insedamento neolitico e dell'età del Rame di Colombare di Negrar sui Monti Lessini (Verona), in: A. Ferrari – P. Visentini (eds.), Il declino del mondo neolitico. Ricerche in Italia centro-settentrionale fra aspetti peninsulari, occidentali e nord-alpini. Atti del Convegno Pordenone 2001, Quaderni del Museo Archeologico del Friuli Occidentale 4, 2002, 229-235

Giumlia-Mair 2005 A. Giumlia-Mair, Analisi metallurgiche di una punta metallica, in: P. Visentini (ed.), Bannia-Palazzine di Sopra. Una comunità preistorica del V millennio a.C., Quaderni del Museo Archeologico del Friuli Occidentale 5, 2005, 119-20

Junghans et al. 1968 S. Junghans – E. Sangmeister – M. Schröder, Kupfer und Bronze in der frühen Metallzeit Europas, Studien zu den Anfängen der Metallurgie 2 (Berlin 1968)

Klassen 2000 L. Klassen, Frühes Kupfer im Norden, Jutland Archaeological Society Publications 36 (Aarhus 2000)

Klassen 2010 L. Klassen, Karpaten oder Alpen? Zur Herkunft der Kupferscheibe aus Hornstaad (Lkr. Konstanz), AKorrBl 40, 2010, 29-48

Klassen – Stürup 2001 L. Klassen - S. Stürup, Decoding the Riesebusch-Copper. Lead Isotope Analysis Applied to Early Neolithic Copper Finds from South Scandinavia, PZ 76, 2001, 55-73

Laroche 2019 M. Laroche, Dimension historique et archéologique du district minier de Cabrières-Péret (Hérault), in : M. Laroche - L. Bruxelles - Ph. Galant - M. Ambert (eds.), Paysages pour l'homme. Actes du colloque international en Hommage à Paul Ambert. Cabrières (Hérault), du 15 au 19 octobre 2019 (Cabrières 2019) 97-107

Laroche et al. 2019 M. Laroche - L. Bruxelles - Ph. Galant - M. Ambert, Paysages pour l'homme. Actes du colloque international en Hommage à Paul Ambert. Cabrières (Hérault), du 15 au 19 octobre 2019 (Cabrières 2019)

Lefranc et al. 2012 P. Lefranc – R. Arbogast – F. Chenal, Inhumations, dépôts d'animaux at perles en cuivre du IVe millénaire sur le site Néolithique récent de Colmar "Aérodrome" (Haut-Rhin), Bulletin de la Société Préhistorique Française 109, 2012, 689–730

Lunz 1973 R. Lunz, Ur- und Frühgeschichte Südtirols. Rätsel und Deutung (Bolzano 1973)

Matteoli – Storti 1982 L. Matteoli – C. Storti, Metallographic Research on Four Pure Copper Flat Axes and one Related Metallic Block from an Eneolithic Italian Cave, Historical Metallurgy 16, 2, 1982, 65-69

Matuschik 1985 I. Matuschik, Zur Chronologie des Spätneolithikums des bayerischen Donautals. Die Stratigrafie und Radiocarbondaten aus Oberschneiding, Lkr. Straubing-Bogen, Archäologische Denkmalpflege in Niederbayern. 10 Jahre Außenstelle des Bayerischen Landesamtes für Denkmalpflege in Landshut (1973–1983). Arbeitshefte des Bayerischen Landesamtes für Denkmalpflege 26 (München 1985) 46–65

Mayer 1977 E. F. Mayer, Die Äxte und Beile in Österreich, PBF IX, 9 (München 1977)

Mazzieri – Dal Santo 2007 P. Mazzieri – N. Dal Santo, Il sito del Neolitico Recente di Botteghino (Parma), RScPrehist 57, 2007, 113-38

Mottes 2001 E. Mottes, Bell Beakers and Beyond. Flint Daggers of Northern Italy Between Technology and Typology, in: F. Nicolis (ed.), Bell Beakers Today. Pottery, People, Culture, Symbols in Prehistoric Europe. Proceedings of the International Colloquium Riva del Garda (Trento 2001) 519-545

Müller 1909 H. Müller. L'Age du cuiver dans les Alpes française. Sépultures énéolithiques de Fontaine-le-Puits (Savoie), Association française pour l'avancement des sciences. Compte-rendu de la 38e session Lille 1909, Notes et mémoires (Paris 1909) 836–845

Patay 1984 P. Patay, Kupferzeitliche Meißel, Beile und Äxte in Ungarn, PBF IX 15 (München 1984)

Rageth 1974 J. Rageth, Der Lago di Ledro im Trentino und seine Beziehungen zu den alpinen und mitteleuropäischen Kulturen, BerRGK 55, 1974, 73–259

Reinhardt 1999 V. Reinhardt, Geschichte Italiens (Munich 1999)

Renfrew 1974 C. Renfrew, Beyond a Subsistence Economy. The Evolution of Social Organization in Prehistoric Europe, in: Ch. B. Moore (eds.), Reconstructing Complex Societies. An Archaeological Colloquium, BASOR Suppl. St. 20 (Cambridge 1974) 69–94

Rovira – Strahm 2019 S. Rovira – Ch. Strahm, Paléométallurgie européenne. Approche transversale et regards croisés, in : M. Laroche - L. Bruxelles - Ph. Galant - M. Ambert (eds.), Paysages pour l'homme. Actes du colloque international en Hommage à Paul Ambert. Cabrières (Hérault), du 15 au 19 octobre 2019 (Cabrières 2019) 109-124

Sangmeister 2005 E. Sangmeister, Les débuts de la métallurgie dans le sud-ouest de l'Europe. L'apport de l'étude des analyses métallographiques, in: P. Ambert - J. Vaquer (eds.), La première métallurgie en France et dans les pays limitrophes (Paris 2005) 21-25

Schubert 1965 F. Schubert, Zu den südosteuropäischen Kupferäxten, Germania 43, 1965, 273-286

Steiniger 2000/2001 D. Steiniger, Die chalkolithischen Kulturen Italiens (Master's Thesis, Freiburg 2000/2001)

Steiniger 2005 D. Steiniger, L'Énéolithique en Italie, in: P. Ambert - J. Vaquer (eds.), La première métallurgie en France et dans les pays limitrophes (Paris 2005) 287-301

Steiniger 2007 D. Steiniger, Untersuchungen zum Chalkolithikum der Apenninhalbinsel (Dissertation, Albert-Ludwigs-Universität Freiburg 2007); <URN:urn:nbn:de:bsz:25-opus-98520> (access date: 2007)

Strahm 1994 Ch. Strahm, Die Anfänge der Metallurgie in Mitteleuropa, HelvA 25, 1994, 2–39

Strahm 2001 Ch. Strahm, Das Kulturenkonzept und das Periodisierungskonzept, in: B. Eberschweiler - J. Köninger - H. Schlichtherle - Ch. Strahm (eds.), Aktuelles zur Frühbronzezeit und frühen Mittelbronzezeit, Hemmenhofener Skripte 2, 2001,177-184

Strahm 2005 C. Strahm, L'introduction et la diffusion de la métallurgie en France, in: P. Ambert – J. Vaquer (eds.), La première métallurgie en France et dans les pays limitrophes (Tolosa 2005) 27–36

Strahm 2008 Ch. Strahm, The Complementary Ware in Bell Beaker Everyday Life. The Italian Model – A Theory, Millenni. Studi di Archeologia Preistorica 6, 2008, 209-219

Strahm 2010 Ch. Strahm, Kupfer. Prestige, Netzwerke - Ein neuer Werkstoff, der Geschichte schreibt, in: Badisches Landesmuseum Karlsruhe (ed.), Jungsteinzeit im Umbruch. Die „Michelsberger Kultur" und Mitteleuropa vor 6000 Jahren. Ausstellungskatalog Karlsruhe (Karlsruhe 2010) 179–190

Strahm – Hauptmann 2009 Ch. Strahm - A. Hauptmann, The Metallurgical Developmental Phases in the Old World, in: T. L. Kienlin - B. W. Roberts (eds.), Metals and Societies. Studies in Honour of Barbara S. Ottaway (Bonn 2009) 116-28

Strahm – Van Willigen 2014 Ch. Strahm – S. Van Willigen. Le concept de culture dans la recherche sur le Néolithique. Un regard transfrontarlier, in : R.-M. Arbogast – A. Richard (eds.), Entre archéologie et écologie, une préhistoire de tous les milieux. Mélanges offerts a Pierre Pétrequin (Besançon 2014) 467-480

Valmin 1939 N. Valmin, Das adriatische Gebiet in Vor- und Frühbronzezeit, Lunds Universitets Årsskrift (N. F.) 35 (Lund 1939)

Van Willingen 2006 Van Willigen, Die Neolithisierung im westlichen Mittelmeerraum, IA 7 (Mainz 2006)

Visentini 2010 P. Visentini, An Update On The Data About The Late Neolithic And Eneolithic In Friuli, https://www.scilit.net/journal/1800567. Studia universitatis hereditati, znanstvena revija za raziskave in teorijo kulturne dediščine 6, 2010, 9–36

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Fig. 1 Typology after V. Bianco Peroni; copper groups after Junghans et al. 1968 (see also fig. 3 and 4 in contribution D. Steiniger in this volume)
Fig. 2 Table adapted after a draft from D. Steiniger 2001, 90; the features after Steiniger 2001, 82, dagger types after Bianco Peroni 1994
Fig. 3–5 Author
Fig. 6 Photo: M. Civici Vicenza

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