Summer Farms

Seasonal exploitation of the uplands from prehistory to the present

Edited by

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Sheffield Archaeological Monographs 16

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J.R. Collis Publications

Published by J.R. Collis Publications and distributed by Equinox Publishing Ltd

Editors: J. Collis, M. Pearce and F. Nicolis

UK: Office 415, The Workstation, 15 Paternoster Row, Sheffield, South Yorkshire S1 2BX
USA: ISD, 70 Enterprise Drive, Bristol, CT 06010

www.equinoxpub.com

First published 2016

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British Library Cataloguing-in-Publication Data

A catalogue record of this book is available from the British Library.

ISBN 978-0-906090-55-8 (hardback)

Library of Congress Cataloging-in-Publication Data

Names: Collis, John, 1944 May 19- editor. | Pearce, Mark (Mark J.), editor. | Nicolis, Franco, editor.
Title: Summer farms : seasonal exploitation of the uplands from prehistory to the present / edited by John Collis, Mark Pearce, and Franco Nicolis.
Description: Sheffield, UK ; Bristol, CT : J.R. Collis Publications and Equinox Publishing, Ltd., 2016.
Series: Sheffield archaeological monographs; 16 | Includes bibliographical references and index.
Identifiers: LCCN 2015031542 | ISBN 9780906090558 (hb)
Subjects: LCSH: Agriculture–History. | Hill farming–History. | Agriculture, Prehistoric. | Bronze age.
Classification: LCC S421 .S86 2016 | DDC 630.9–dc23
LC record available at http://lccn.loc.gov/2015031542

Typeset by J.R.Collis with the assistance of Queenston Publishing

Cover design: Mark Lee
Photograph: Brigitte Andres

Printed and bound in Great Britain by Lightning Source Inc. (La Vergne, TN), Lightning Source UK Ltd. (Milton Keynes), Lightning Source AU Pty. (Scoresby, Victoria).

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Mark Pearce

By moving livestock to summer farms, fodder at the home base is saved but the milk and other animal products produced during the animals' absence are no longer immediately available to those left at the home base. In this paper I shall explore the economic implications of the use of summer farms, in particular the effect on carrying capacity, on the number of livestock which can be over-wintered, and on the use of the milk produced while the animals are at the summer grazing lands. I then explore archaeological evidence from the Bronze and Iron Ages of the Italian uplands (Apennines and Alps). I argue that the production of hard cheese, which converts milk into an easily conservable and transportable commodity, is key to the expansion of summer farms in the Bronze Age of Italy. Cheese production is an essential part of models for the pastoral use of Mediterranean uplands in prehistory but it is commonly held that in the Alps the production of hard cheese only begins in the Middle Ages. I examine the literary and archaeological evidence for the prehistoric production of hard cheese and argue that its production in prehistory is the most parsimonious explanation for the summer use of high mountain pastures and thus for the origins of the Alpwirtschaft *economy in the southern Alps.*

"I'm going a milking, kind sir", she answered me,
"For roving in the dew makes the milk maids fair".

Traditional Sussex Folk Song

Why do people move to summer farms?

It may be useful to begin this discussion by reflecting on the purpose of seasonal movements of stock in the Alps and other high mountain environments. The first point to make is that grass does not grow in the winter months. This is well known, but often forgotten. Furthermore, any available vegetation may be covered by deep snow during the winter (particularly at higher altitudes) and so livestock, whether sheep, goats or cattle, will have to be stabled indoors and fed on fodder collected during the growing season. Indeed, we know that this was precisely the practice at the Bronze Age lake village of Fiavé (TN), which is situated at 648m above sea level (Karg 1998).

If livestock are moved away from the home farm, then available fodder is spared and may be harvested and stored for the winter – thus, if livestock are away for one third of the year, then one third of the available fodder is saved. Because animals have legs and can walk to grazing, while hay must be cut and then transported to be stored, it is clearly more efficient to grow fodder as close as possible to the farm or outlying barn, moving the animals away to graze elsewhere.

In simple terms, the more land that can be exploited as pasture for grazing or as meadows for hay production, the more animals that can be kept during the summer months. But the more animals that are kept, the more critical the availability of winter fodder becomes (at Early / Middle Bronze Age Fiavé herb and grass fodder was supplemented in early spring with leafless and foliating twigs of hazel, birch, alder, beech and other trees – Karg 1998). The use of upland summer pasture away from the farm is an efficient way of raising carrying capacity, as well as exploiting the excellent grazing of high Alpine pastures, because it spares fodder growing round the farm for use in the winter months.

Another issue that needs to be considered is that sheep, goats and cattle all produce milk in the conventional Alpine economy; as we shall see, Alpine dairy production is documented from at least the Bronze Age. However, this secondary product, unlike wool, *cannot* be stored for long periods, and in the absence of refrigeration, milk deteriorates rapidly. There are two answers to this problem: either the milk may be used to feed young animals, kids, lambs and calves, rather than humans, or alternatively the milk may be transformed into a product than can be stored and transported more easily, such as cheese. Writing in the 1st century AD, Columella (*De Re Rustica* 7, 8, 1) advises precisely this solution: "Casei quoque faciendi non erit omittenda cura, utique longinquis regionibus, ubi mulctram devehere non expedit" ("It will be necessary too not to forget the task of cheese-making, especially in distant parts of the country, where it is not convenient to take milk to the market in pails"; translation: Forster and Heffner 1954:285). It is perhaps superfluous to note that hard cheese is much easier to store and to transport than soft cheese. However, the conventional view, typified by Margarita Primas (1999:3), is that in the Alps the production of hard cheese only begins in the

Keywords: *Alpwirtschaft*, pastoralism, milk, cheese, Bronze Age

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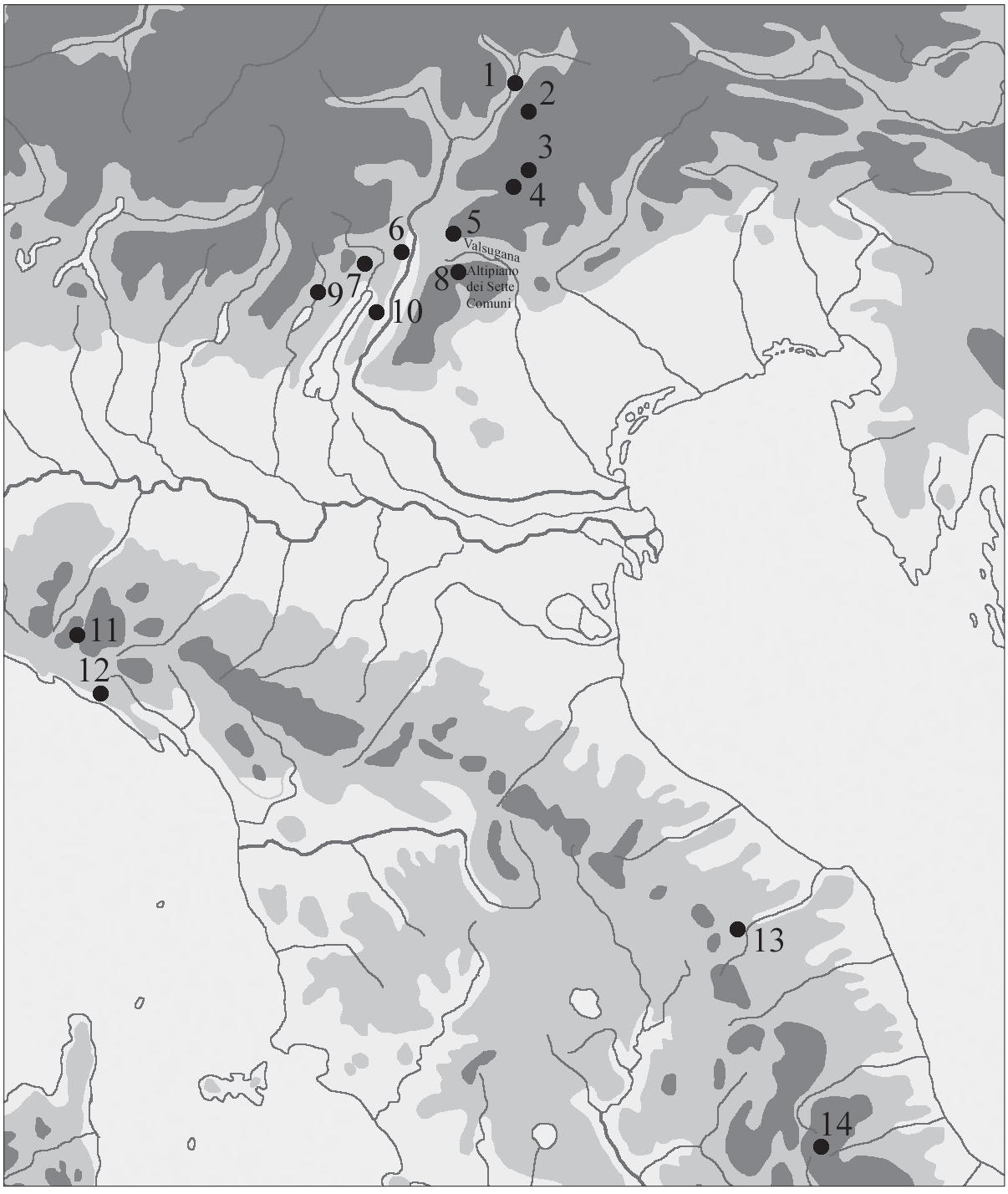

Figure 4.1 Places mentioned in the text. 1: Albanbühel (Bressanone / Brixen BZ); 2: Castelir di Bellamonte (Predazzo TN); 3: Sotćiastel (Badia / Abtei BZ); 4: Selva di Val Gardena / Wolkenstein in Gröden BZ) and Lech Sant (Santa Cristina Valgardena / Sankt Christina in Gröden BZ); 5: Acqua Fredda (Bedollo TN); 6: Dos Grum di Cadine (Trento TN); 7: Fiavé (TN); 8: Malga Principi (Luserna TN); 9: Dosso Rotondo and Malga Vacil (Storo TN); 10: Mandrom de Camp (Brentonico TN); 11: U Puzzu di Ertola (Rezzoaglio GE); 12: Monte Loreto (Castiglione Chiavarese GE); 13: Sentino Gorge (AN); 14: Campo Pericoli (Pietracamela TE) and Grotta a Male (L'Aquila AQ).

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Middle Ages and that the traditional Alpine economy was not practised in prehistoric times.

Another reason for moving livestock to mountain pastures is the quality of the grazing – indeed some of the most prized matured cheeses made in Italy today are produced in high Alpine pastures, such as Vézzena or Bagós (Viviani 1993). It should also be borne in mind that the lowlands are hot in summer: it is generally considered to be too hot in the Po plain to make good cheese in the summer and so, for example, connoisseurs avoid eating Gorgonzola cheese made in the summer months.

Prehistoric production of hard cheese?

Having established these basic principles, let us now consider whether, despite the conventional view, it may be shown that the Alpine economy and the production of hard cheese can be dated to the Bronze Age in the southern Alps (Fig. 4.1).

I shall start by examining the Italian peninsula. In 1959 Salvatore Puglisi posited a transhumant pastoralist economy for the Apennine Bronze Age. His argument was that the Italian peninsula is ideal for such an economy as the high mountain pastures of the Apennine chain can be reached easily from the coastal lowlands via well-watered river valleys (Puglisi 1959:18). He also noted faunal samples with high percentages of sheep and goats (Puglisi 1959:31–33), and posited an ethnographic analogy between the material culture of the shepherds of the Abruzzo in the 1950s and the so-called milk boilers that characterise the Bronze Age inventory of peninsular Italy (Figs 4.2, 4.3 and 4.4; Puglisi 1959:33–37). Finally, he adduced the presence of other artefacts that could be interpreted by analogy as having been used for cheese-making, such as whisks, skimmers, perforated strainers and pot-stands (Figs. 4.5, 4.6; Puglisi 1959:38–41). Indeed, many Apennine Bronze Age sites seem best adapted to a pastoral-

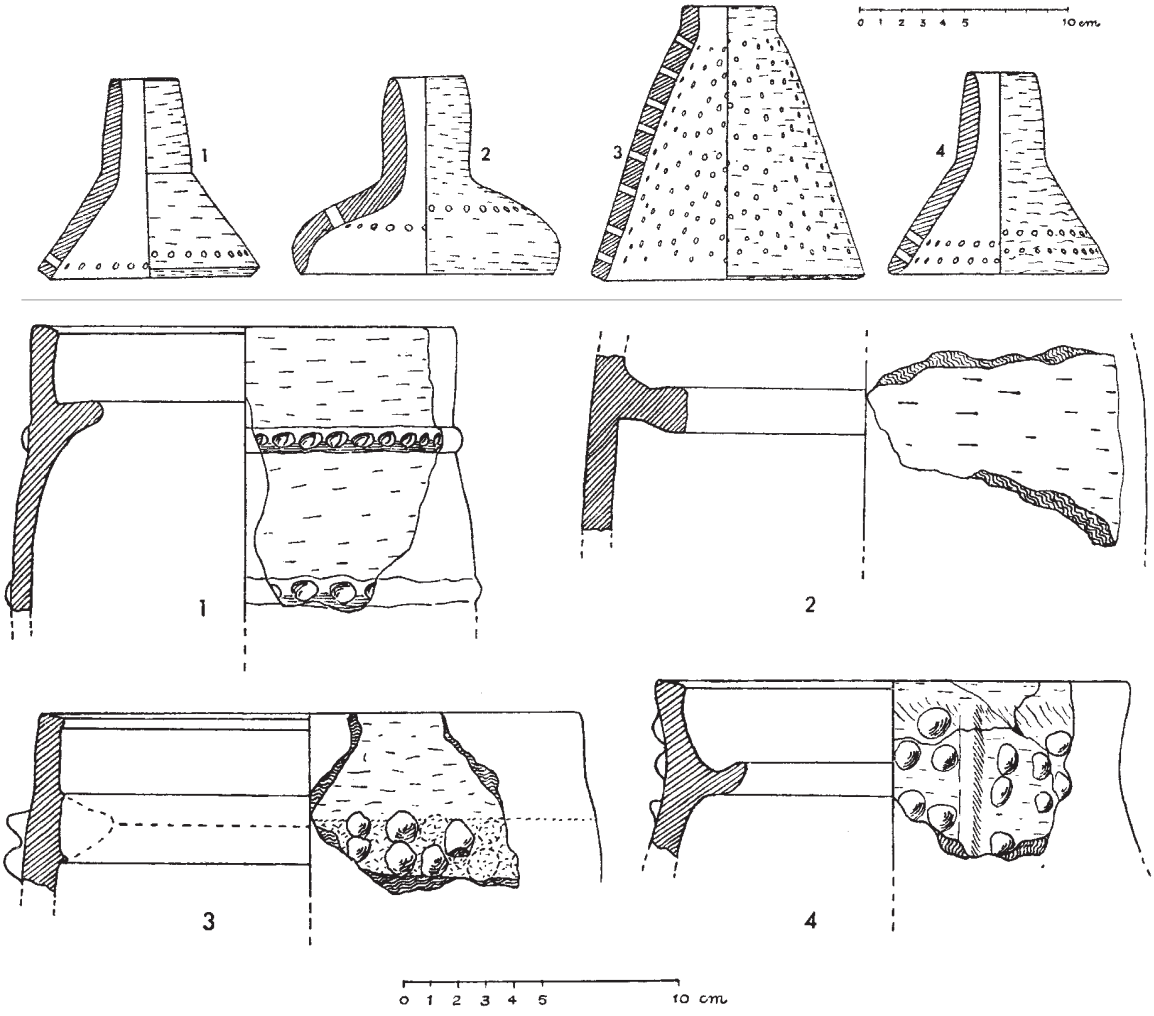

Figure 4.2 Apennine Bronze Age milk boilers. Pots with internal ledge: 1: Frasassi cave (Genga AN); 2: San Fortunato (Genga AN); 3: Fabriano (AN); 4: Conelle di Arcevia (AN). Lids: 1, 2 and 4: Belverde di Cetona (SI); 3: Casa Carletti (Cetona SI) (after Puglisi 1959, figs 4 and 7).

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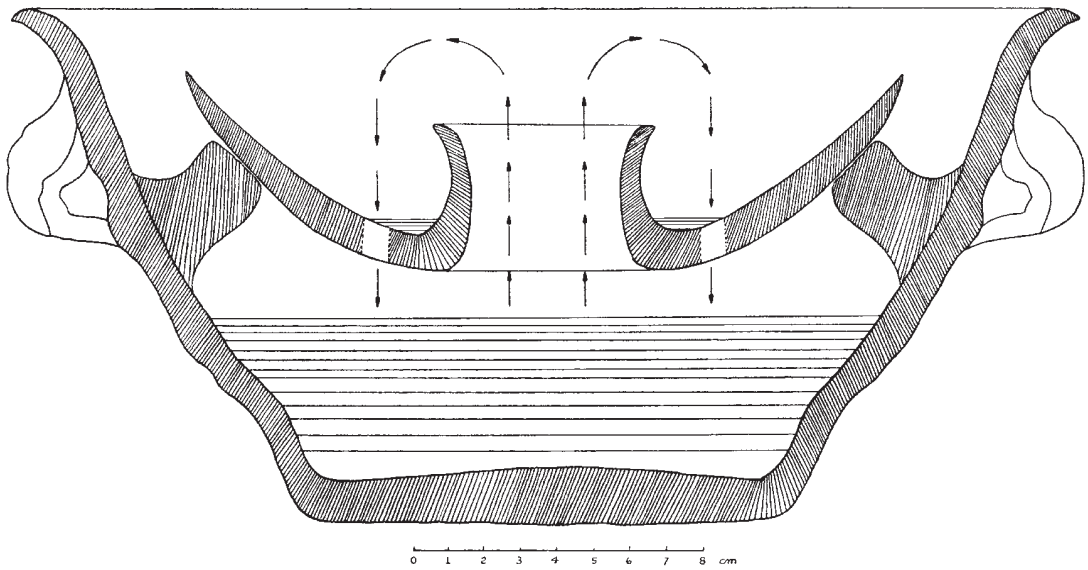

Figure 4.3 Puglisi's reconstruction of how an Apennine milk boiler may have functioned (after Puglisi 1959, fig. 11).

ist economy, such as those in the Sentino Gorge, and some sites would have been under snow for much of the winter, making them most likely to be transhumant pastoralists' summer camps, like Campo Pericoli (Pietracamela TE; *c.* 2000 m.a.s.l.) and the Grotta a Male (L'Aquila AQ; *c.* 950 m.a.s.l.) in the Gran Sasso massif (Trump 1966:110; Barker 1981:156).

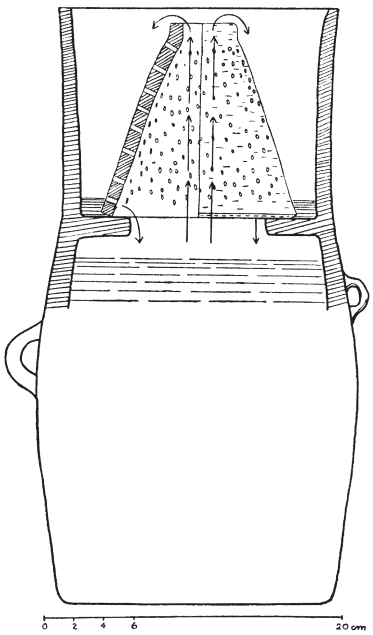

Figure 4.4 Puglisi's reconstruction of how an Apennine milk boiler may have functioned so as to avoid losing milk that boiled over (after Puglisi 1959, fig. 8).

Although it is now clear that the Apennine Bronze Age encompassed a wide range of economic behaviour, including sedentary lowland agriculture (Barker 1981:153–158), it is highly likely that cheese was produced in the Middle and Late Bronze Age Apennines. Now this does not of course mean that this cheese was necessarily matured and hardened, though in the absence of refrigeration hard cheese would be much easier to preserve for long periods and to transport. On the other hand, fresh, soft cheese would have to be regularly transported to consumers, necessitating regular journeys to the hot lowlands.

Secondly, let us consider the literary evidence. Here our sources seem to be very explicit. Homer describes the use of hard cheese in Book XI of the *Iliad*: the Thessalian hero Machaon is wounded, and Nestor takes him to his hut, where they are served a restorative cocktail of wine in Nestor's famous cup; goat's cheese was grated over this wine (like a dusting of parmesan on a pasta dish) and then barley was sprinkled (*Iliad* XI, 638–640). Although this drink seems strange to modern palates, it is also attested in the *Odyssey*, where the sorceress Circe serves a similar cocktail, sweetened with honey, to Odysseus' sailors (*Odyssey* X, 229–243).

So, if cheese was grated in the prehistoric Mediterranean, what is the evidence for cheese graters? Cheese graters are known from 9th century BC warrior's tombs at Lefkandi on Euboea and from rich 7th century BC tombs in western peninsular Italy (Ridgway 1997), and their forms are strikingly similar to that of a modern cheese-grater (Ridgway 1997: figs 2, 3, 5). It has been convincingly argued that the presence of these artefacts in warrior and princely graves indicates the practice of 'drinking from Nestor's Cup' in imitation

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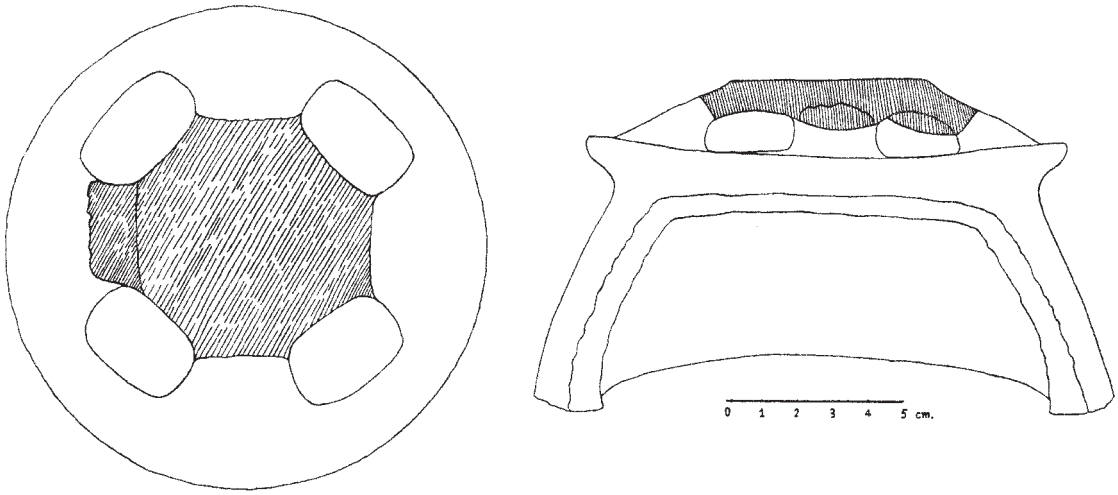

Figure 4.5 Pot stand, Grotta di Pertosa (SA) (after Puglisi 1959, fig. 15).

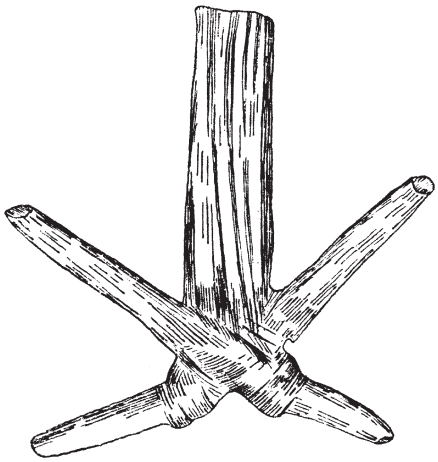

Figure 4.6 Whisk, Grotta di Pertosa (SA) (after Puglisi 1959, fig. 13).

of the Homeric heroes (Ridgway 1997). Cheese graters are also attested in later domestic contexts and classical literature. It is perhaps superfluous for me to point out that cheese must be relatively hard in order to be suitable for grating.

The *Iliad* and *Odyssey* were most probably written down in the 8th century BC, in Ionic Greek with 'some Euboean veneer' (Willcock 2012), which makes the cheese-graters found at Lefkandi on Euboea all the more significant. The Homeric epics may reflect practices of the later Bronze Age: certainly West (1998:190) argues that "… the grated cheese … belongs to a traditional account that is many generations older than our *Iliad*". Cheese is certainly mentioned in two Linear B tablets from Pylos, Un718 and Un1185, though it is not clear whether it was hard or soft (Ventris and Chadwick 1956:282–283; Bendall 2007:221).

If hard cheese was available in the Early Iron Age and perhaps the later Bronze Age Mediterranean, then why not in the Bronze Age Alps?

Archaeological evidence for high upland pastoral settlements

Let us now consider the evidence from the Bronze Age southern Alps. Firstly, there seems to be no doubt that high altitude Alpine grazing was used from at least the Early Bronze Age. There is evidence for seasonal pastoralism both in the upland areas of the Veneto (Migliavacca 1985:40–48; cf. De Guio 1994:166–168) and in the Trentino to the north. Here the Middle Bronze Age site of Dosso Rotondo (Storo TN) was established in a newly-deforested area at 1876 m.a.s.l. (Bassetti *et al.* 2008; Mottes and Nicolis 2004). The excavators have suggested that the large quantities of charcoal found at the site may be the result of boiling milk for cheese-making (Bassetti *et al.* 2008:123). Nearby, at 1810m above sea level, there was a contemporary insubstantial site at Malga Vacil (Storo TN), which is unlikely to have been occupied all year round (Marzatico 2001:379, note 61 on p. 411; 2007:169–173, figs 2–10). A flint sickle blade found at Malga Vacil has been interpreted as documenting the cutting of grass fodder (Marzatico 2007:169, 173, fig.7). It is likely that seasonal pastoralism was also practised at around 1700m in the Early and Middle Bronze Age at Mandrom de Camp (Brentonico TN; Mottes *et al.* 1999:89), and a similar interpretation has been suggested for the Castelir di Bellamonte (Predazzo TN), which is situated at 1548m above sea level in the Val Travignolo (Leonardi and Leonardi 1991:100).

A number of high altitude sites in the Alto Adige / Südtirol, deeper into the Alpine chain, are also best explained as being for seasonal grazing; these include a number of sites around the Sella pass at 2000–2250m

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above sea level (Selva di Val Gardena / Wolkenstein in Gröden BZ – Bagolini and Tecchiati 1993:50–51) and Lech Sant (Santa Cristina Valgardena / Sankt Christina in Gröden BZ) at 2096m above sea level; the material from this site includes a bronze sickle fragment, possibly for cutting fodder (*ibidem*). Finally, Umberto Tecchiati has argued that there is indirect evidence for cheese production at the Middle Bronze Age fortified settlement of Sotćiastel (Badia / Abtei BZ), a permanent site situated at *c.* 1400m above sea level. This includes evidence for the slaughter of high numbers of new-born or foetal cattle (17 of 33 individual cattle for which age at death could be determined, some 51%), fitting well Payne's (1973) classic kill-off pattern for milk production. This culling of calves was perhaps aimed at obtaining rennet for cheese-making (Tecchiati 1998:384–5; Riedel and Tecchiati 1998a:293–294), though it may also suggest slaughter motivated by a lack of winter fodder.

Sheep/goat dominate the Bronze Age faunal assemblages of both the Trentino and the Alto Adige / Südtirol: for example at Sotćiastel they are 45.8% MNI (=minimum number of individuals), compared to cattle 40.3% and pigs 5.5% (Riedel and Tecchiati 1998a:288, tab.1), while at Albanbühel (Bressanone / Brixen BZ) the MNI ratio is sheep/goat 60.71%, cattle 24.55% and pig 7.14% (Riedel and Tecchiati 1998b:325). There are a few exceptions, such as the relatively low site of Dos Grum di Cadine (Trento TN), at 647 m.a.s.l., where cattle are 56% of bone remains, sheep 30% and pigs 13% (Riedel and Tecchiati 2001:107–108, 112). At Fiavé sheep/goat were 51.9% of the bone remains, cattle 28.5% and pig 6.5% (Jarman 1976:543, table 20). More than 40% of cattle were slaughtered at Fiavé in the first two years, probably to promote milk production and almost all cattle were slaughtered before they reached 5 years old: it may be assumed that this was when they ceased to be productive milkers (Jarman 1976:543, table 10; Gamble and Clark 1987:427). There was a similar slaughter pattern for sheep/goat, with more than 50% culled in their first two years (Jarman 1976:544, table 11).

Simple calculations of the relative numbers of livestock present do not of course tell us their relative contribution to the economy of a site. For example, Barker (1983, table 5) suggests that prehistoric sheep/goat are likely to have each provided just 60lbs of meat each (some 27kg), while cattle provided some 500lbs (around 227kg) of meat each, which is some 8.3 times more. Clearly, animals slaughtered at a young age, such as the calves at Sotćiastel (as we have seen, around 51% of cattle) or Albanbühel (where almost half the cattle were killed under 4 months of age – Riedel and Tecchiati 1998b:325), will have made a much less significant meat contribution to diet.

Assessing milk yields of prehistoric cattle, sheep and goats is very difficult as these have changed dramatically through time as a result of selective breeding, and they vary according to animal diet, stage of lactation and also from individual to individual. Cattle milk yields are higher than those of goats, which are higher than those of sheep, not least because goats have a longer lactation (up to 300 days of milking, compared with sheep, which have up to 250 days of milking; Boyazoglu and Morand-Fehr 2001:6). Moreover the different species' milk has different properties, with sheep's milk the most suitable for cheese-making and goat's milk being the most easily digestible (Boyazoglu and Morand-Fehr 2001:6; Park *et al.* 2007:89, 92). This means that although sheep/goat were numerically more common in the Bronze Age Trentino and Alto Adige / Südtirol, they may not necessarily have made the most significant contribution to diet.

Salt

Salt is required for cheese-making as a preservative and a flavour-enhancer, and although Mediterranean sea salt would probably have been relatively easily available to pastoralists in the southern Alps it is useful to reflect that rock salt was mined at Hallstatt in the Upper Austrian Salzkammergut from the 15th century BC onwards (Reschreiter and Kowarik 2009). It is worth noting that in the 1st century BC, Varro (*Res Rusticae* 2, 11, 5) writes that rock salt is preferable to sea salt for cheese-making: "Qui aspargi solent sales, melior fossilis quam marinus" ("Those who sprinkle salt prefer mineral salt to sea salt"; translation: Hooper 1967:415). Moreover, salt is not just an important part of the cheese-making process: I have observed rock-salt licks used as a method of controlling stock left to graze unattended in the Apennines around U Puzzu di Ertola (Rezzoaglio GE; 23 May 2002); since the animals will return to the salt at regular intervals they can be easily recaptured if need be. Of course, such mechanisms for stock control mean that fencing is unnecessary and will be almost impossible to detect archaeologically. Finally, salt solution is used in the preparation of rennet extract (O'Connor 1993:6).

The origins of hard cheese production

None of these classes of evidence securely date the production of hard cheese in the southern Alps to the Bronze Age, but I have established 1) that there *was* high altitude pastoralism and 2) that hard cheese was known in the Italian peninsula in prehistory. It seems perverse to argue that despite the availability of the Mediterranean technology of hard cheese production, it was not adopted in the southern Alps to transform the milk produced on the Alpine pastures into a form that was suitable for storage and transportation. The simplest, the most parsimonious, explanation for the presence of high altitude sites in the Bronze Age Trentino and Alto Adige / Südtirol is that they were used in an Alpine economy based on dairy production, the production of hard cheese.

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The pastoralism–metallurgy nexus

Let us now explore the importance of pastoralism in the Bronze Age southern Alps.

Over one hundred copper smelting sites have been identified in the Val Sugana area, in the southern Trentino (Preuschen 1973; Šebesta 1992; Perini 1992; Marzatico 1997; Pearce 2007:77–81). The smelting sites are located at more than 1000m above sea level, and are close to water, either ponds or streams. They seem to document metal production on an enormous scale, and Bayesian modelling of radiocarbon dates from the Acqua Fredda battery of furnaces at the Redebus pass (Bedollo TN) indicates that they were in use between the *second half of the 13th to the 9th century cal BC* (Marzatico *et al.* 2010:131–135).

Most of the smelting sites documented by slag heaps are in proximity to mineral outcrops, but there is an important concentration of smelting sites on the Mesozoic limestone Lavarone–Vézzena–Luserna plateau and, to a much lesser extent, on the northwestern margins of the Altipiano dei Sette Comuni nearby. These areas are situated at some distance from major copper resources (Preuschen 1973:144). In some sectors of the Lavarone–Vézzena–Luserna plateau there seems to have been much smelting activity, and there are many slag heaps and concentrations of batteries of furnaces, so much so that Preuschen (1973:134) calls the smelting evidence at Malga Principi in the Val Morta (Luserna TN) "la più importante installazione fusoria mai vista" ("the most important smelting facility ever seen"). It is not clear how long the sites remained in use or how many were in use at the same time, but we must imagine the presence of a substantial labour force on the plateau.

A number of hypotheses have been suggested to explain this concentration of smelting sites, located at some distance from copper resources. The floor of the Val Sugana, where the nearest major source of copper is situated (Preuschen 1973:126), is at about 500m above sea level while the Lavarone–Vézzena–Luserna plateau towers over it at 1200m above sea level; the plateau is reached by steep paths up the south side of the Val Sugana. It is likely that the ore was dressed at the mines to eliminate as much gangue and country rock as possible, as at the prehistoric copper mine of Monte Loreto (Castiglione Chiavarese GE – Maggi and Pearce 2005), but the transportation of the ore would be very difficult, especially in the absence of modern metalled roads.

Ernst Preuschen (1973:144) argued that the ore was transported to the Lavarone–Vézzena–Luserna plateau because of the need to seek alternative supplies of timber, arguing that fire-setting, the fabrication of props and scaffolding, ore roasting and smelting had caused a shortage of wood in the areas around the mines. We now know much more about traditional methods of woodland management (Moreno 1990) and it is no longer thought that prehistoric metallurgy necessarily led to deforestation (e.g. Marshall *et al.* 1999). Certainly roasting and smelting are complex operations which required large amounts of wood or charcoal and a substantial labour force (Marzatico 1997:575–576; Šebesta 1992:9–10; cf. Zschocke and Preuschen 1932:66–67).

Armando De Guio and I proposed an alternative, multi-factorial model to explain this transportation of copper for smelting to the Lavarone–Vézzena–Luserna plateau, high above the copper mines (Pearce and De Guio 1999). We agreed with Preuschen (1973:144) that the area provides a good supply of timber for fuel, but our argument is premised on the fact that the Lavarone–Vézzena–Luserna plateau and the nearby Altipiano dei Sette Comuni are ideal areas for summer grazing. Indeed De Guio (1994:166–168) argued that the Altipiano dei Sette Comuni (situated to the southwest of the Lavarone–Vézzena–Luserna plateau) was used for summer grazing by transhumant herders during the Middle and Recent Bronze Age just as it was in the Middle Ages and in fact its Middle and Recent Bronze Age material culture shows strong links to the Po plain below. We suggested that cheese produced on the upland plateaux during the summer months would have provided a major source of protein for the workforce engaged in smelting the copper ore – and Šebesta (1992:9–10) suggests that up to 200 people (woodcutters, charcoal-burners, smelters etc.) may have been involved in the whole process at a typical smelting facility.

Our model (Pearce and De Guio 1999), however, has not been accepted by all workers (Cierny and Marzatico 2002:264–265; Cierny *et al.* 2004:147–148; Marzatico 2007:174). In part this is because it takes a very modernist 'formalist' (Dilley 1996; Durrenberger 1996) approach, positing that the Bronze Age Po plain constituted a 'market' for Alpine copper production and that cheese was exchanged as part of these transactions (Cierny and Marzatico 2002:284; Marzatico 2007:174–175). However, surprisingly, our argument that hard cheese was produced in the later Bronze Age Alps and that this production mirrored the traditional Alpine economy of the historical period has also been contested. It is therefore appropriate to explore this further.

Cheese and smelting

Giuseppe Šebesta (1992:8) noted that areas of prehistoric copper smelting very frequently correspond to modern day Alpine pasture. He argued that tree-cutting for fuel and the poisoning of vegetation by the by-products of smelting created forest clearings that were then exploited by pastoralists for summer grazing, which led to the opening up of Alpine pasture. On the other hand, De Guio and I stressed that metallurgy and pastoralism seem to have a strong association in the archaeological record (Pearce and De Guio 1999; Maggi and Pearce 2010; cf. Orme 1981:269). Furthermore both areas,

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the Lavarone–Vézzena–Luserna plateau and the Altipiano dei Sette Comuni, are Mesozoic limestone: this means that the location of suitable grazing areas (*malghe*) is conditioned by the availability of water. Water is also extensively used in the smelting and as we have seen copper smelting sites were located near to water resources (Šebesta 1992:171). We argued that the continuing importance of these same areas for Alpine grazing and dairy production until the present day confirms their suitability for cheese production (Pearce and De Guio 1999).

We suggested that most of the milk products produced on the Lavarone–Vézzena–Luserna plateau, where the smelting sites were located, would have been consumed locally by the metallurgical and support workforce. The transhumant pastoralists from the Po plain who exploited the summer grazing on the Altipiano dei Sette Comuni, on the other hand, may have traded the cheese which they produced during the summer with the metallurgical workers to the north, as one commodity in the Bronze Age 'market economy' which we posited (they will clearly have also traded other commodities, such as the livestock they brought with them – Cierny and Marzatico 2002:265; Cierny *et al*. 2004:148).

The traditional Alpine economy: A 'storage culture'

The classic ethnography describing the traditional Alpine economy is *Balancing on an Alp* (Netting 1981). Netting (1981:34) describes the economy as based on storage and notes that "Without the techniques of preserving the products of summer for winter consumption and building up a stock of subsistence insurance against bad years and temporary climatic fluctuations, continued peasant life in the Alps would have been impossible". It is perhaps not superfluous to stress that hard cheese is an essential part of the system.

Conclusions

Much of what I have discussed is invisible to archaeologists and my argument is based on logic and surmise. However if we are to understand mountain landscapes we have to understand the economies which made their exploitation possible.

Sheep, goats and cattle all produce milk and for this resource to be useful for human communities it has to be made available for their consumption. Milk produced on high upland pasture can only be consumed in the lowlands if it is transformed into a form that can be easily stored and transported. Hard cheese is ideal for storage and transportation, and the availability of the technology (and salt) for its production suggests that it is highly likely to have been produced on the high summer pastures of the Bronze Age southern Alps.

Bibliography

Bagolini, B. and Tecchiati, U. 1993. Osservazioni sul popolamento delle valli ladine tra Neolitico ed età del Bronzo nel quadro della preistoria del bacino atestino. In *Archeologia nelle Dolomiti. Ricerche e ritrovamenti nelle valli del Sella dall'età della Pietra alla Romanità. Catalogo della Mostra*, pp. 47–55. Vigo di Fassa: Istitut Cultural Ladin 'Majon di Fashegn' / San Martin de Tor: Istitut Cultural Ladin 'Micurà de Rü'.

Barker, G. 1981. *Landscape and Society: prehistoric central Italy*. London: Academic Press.

Barker, G. 1983. Neolithic subsistence in the central Po plain. In P. Biagi, G.W.W. Barker and M. Cremaschi (eds.) *La stazione di Casatico di Marcaria (Mantova) nel quadro paleoambientale ed archeologico dell'Olocene antico della Val Padana centrale*, pp. 45–68, 116–119. Studi Archeologici 2. Bergamo: Istituto Universitario di Bergamo.

Bassetti, M., Dalmeri, G., Mottes, E. and Nicolis, F. 2008. La frequentazione delle alte quote nell'età del Bronzo. Il sito di Storo – Dosso Rotondo. In E. Mottes, F. Nicolis and G. Zontini (eds.) *Archeologia lungo il Chiese. Nuove indagini e prospettive della ricerca preistorica e protostorica in un territorio condiviso fra Trentino e Lombardia. Atti del 1 convegno interregionale, Storo, Teatro dell'Oratorio, 24–25 ottobre 2003*, pp. 107–127. Judicaria Summa Laganensis 18. Tione: Centro Studi Judicaria.

Bendall, L.M. 2007. *Economics of Religion in the Mycenaean World: resources dedicated to religion in the Mycenaean Palace economy*. Monograph 67. Oxford: Oxford University School of Archaeology.

Boyazoglu, J. and Morand-Fehr, P. 2001. Mediterranean dairy sheep and goat products and their quality: a critical review. *Small Ruminant Research* 40/1:1–11.

Cierny, J., and Marzatico, F. 2002. Note sulla cronologia relativa dei siti fusori e sulla circolazione del metallo. In A. Giumlia-Mair (ed.) *I bronzi antichi: produzione e tecnologia. Atti del XV Congresso Internazionale sui Bronzi Antichi organizzato dall'Università di Udine, sede di Gorizia, Grado-Aquileia, 22–26 maggio 2001*, pp. 258–268. Monographies instrumentum 21. Montagnac: Éditions Monique Mergoil.

Cierny, J., Marzatico, F., Perini, R., and Weisgerber, G. 2004. La riduzione del rame in località Acqua Fredda al Passo del Redebus (Trentino) nell'età del Bronzo Recente e Finale. In G. Weisgerber and G. Goldenberg (eds.) *Alpenkupfer – Rame delle Alpi*, pp. 125–154. Der Anschnitt, Beiheft 17. Bochum: Deutsches Bergbau-Museum.

De Guio, A. 1994. L'Altipiano di Asiago dal Bronzo Medio all'inizio dell'Età del Ferro. In *Storia dell'Altipiano dei Sette Comuni. I: Territorio e istituzioni*, pp. 157–178. Vicenza: Neri Pozza.

Dilley, R. 1996. Market. In D. Levinson and M. Ember (eds.) *Encyclopedia of Cultural Anthropology* 3:728–732. New York: Henry Holt and Co.

Durrenberger, E.P. 1996. Economic anthropology. In D. Levinson and M. Ember (eds.) *Encyclopedia of Cultural Anthropology* 2:365–370. New York: Henry Holt and Co.

Forster, E.S. and Heffner, E.H. 1954. *Lucius Junius Moderatus Columella: On Agriculture, vol. II, Res rustica V–IX*. London: Heineman and Cambridge, Massachusetts: Harvard University Press.

© J.R. Collis Publications

Gamble, C., and Clark, R. 1987. The faunal remains from Fiavé; pastoralism, nutrition and butchery. In R. Perini *Scavi archeologici nella zona palafitticola di Fiavé-Carera. Parte II: Campagne 1969–76: Resti della cultura materiale: metallo – osso – litica – legno*, pp. 423–445. Patrimonio storico e artistico del Trentino 9. Trento: Provincia Autonoma di Trento, Servizio Beni Culturali.

Hooper, W.D. 1967. *Marcus Porcius Cato On Agriculture; Marcus Terentius Varro On Agriculture*. Revised by Harrison Boyd Ash. London: Heineman and Cambridge, Massachusetts: Harvard University Press.

Jarman, M. 1976. Prehistoric economic development in sub-Alpine Italy. In G. de G. Sieveking, I.H. Longworth and K.E. Wilson (eds.) *Problems in Economic and Social Archaeology*, pp. 523–548. London: Duckworth.

Karg, S. 1998. Winter and spring-foddering of sheep/goat in the Bronze Age site of Fiavè-Carera, northern Italy. *Environmental Archaeology* 1:87–94.

Leonardi, P. and Leonardi, G. 1991. Il 'Castelir' di Bellamonte in Val Travignolo. In P. Leonardi (ed.) *La Val di Fiemme nel Trentino dalla Preistoria all'alto Medioevo*, pp. 68–100. Calliano: Manfrini.

Maggi, R. and Pearce, M. 2005. Mid fourth-millennium copper mining in Liguria, north-west Italy: the earliest known copper mines in Western Europe. *Antiquity* 79 (303):66–77.

Maggi, R. and Pearce M. 2010. Changing subsistence structures and the origins of mining in the Ligurian Apennine mountains. In P. Anreiter, G. Goldenberg, K. Hanke, R. Krause, W. Leitner, F. Mathis, K. Nicolussi, K. Oeggl, E. Pernicka, M. Prast, J. Schibler, I. Schneider, H. Stadler, T. Stöllner, G. Tomedi and P. Tropper, (eds.) *Mining in European History and its Impact on Environment and Human Societies; Proceedings for the 1st Mining in European History-Conference of the SFB-HIMAT, 12–15 November 2009, Innsbruck*, pp. 283–287. Innsbruck: Innsbruck University Press.

Marshall, P.D., O'Hara, S.L. and Ottaway, B.S. 1999. Early copper metallurgy in Austria and methods of assessing its impact on the environment. In A. Hauptmann (ed.) *The Beginnings of Metallurgy*, pp. 255–264. Der Anschnitt, Beiheft 9. Bochum: Deutsches Bergbau-Museum.

Marzatico, F. 1997. L'industria metallurgica nel Trentino durante l'età del bronzo. In M. Bernabò Brea, A. Cardarelli and M. Cremaschi (eds.) *Le Terramare; la più antica civiltà padana*, pp. 570–576. Milan: Electa.

Marzatico, F. 2001. L'età del Bronzo Recente e Finale. In M. Lanzinger, F. Marzatico and A. Pedrotti (eds.) *Storia del Trentino, I; la preistoria e la protostoria*, pp. 367–416. Bologna: Il Mulino.

Marzatico, F. 2007. La frequentazione dell'ambiente montano nel territorio atesino fra l'età del Bronzo e del Ferro: alcune considerazioni sulla pastorizia transumante e 'l'economia di malga'. *Preistoria Alpina* 42:163–182.

Marzatico, F., Valzolgher, E. and Oberrauch, H. 2010. Dating the later Bronze Age metal production in the south-central Alps. Some remarks on the relative and absolute chronology of the Luco / Laugen Culture. In P. Anreiter, G. Goldenberg, K. Hanke, R. Krause, W. Leitner, F. Mathis, K. Nicolussi, K. Oeggl, E. Pernicka, M. Prast, J. Schibler, I. Schneider, H. Stadler, T. Stöllner, G. Tomedi and P. Tropper (eds.) *Mining in European History and its Impact on Environment and Human Societies; Proceedings for the 1st Mining in European History-Conference of the SFB-HIMAT, 12–15 November 2009, Innsbruck*, pp. 129–143. Innsbruck: Innsbruck University Press.

Migliavacca, M. 1985. Pastorizia e uso del territorio nel vicentino e nel veronese nelle età del Bronzo e del Ferro. *Archeologia Veneta* 8:27–61.

Moreno, D. 1990. *Dal documento al terreno; storia e archeologia dei sistemi agro-silvo-pastorali*. Bologna: Il Mulino.

Mottes, E. and Nicolis, F. 2004. Storo – Dosso Rotondo (Trento): un sito di alta quota dell'Età del Bronzo in Valle del Chiese. *Annali del Museo*, *Gavardo*, 19 (2001–2):80–88.

Mottes, E., Nicolis, F. and Tecchiati, U. 1999. Aspetti dell'insediamento e dell'uso del territorio nel III e nel II millennio a.C. in Trentino–Alto Adige. In P. Della Casa (ed.) *Prehistoric Alpine Environment, Society and Economy; papers of the international colloquium PAESE 1997 in Zurich*, pp. 81–97. Universitätsforschungen zur prähistorischen Archäologie 55. Bonn: Rudolf Habelt.

Netting, R. McC. 1981. *Balancing on an Alp: ecological change and continuity in a Swiss mountain community*. Cambridge: Cambridge University Press.

O'Connor, C.B. 1993. *Traditional Cheesemaking Manual*. Addis Ababa: International Livestock Centre for Africa.

Orme, B. 1981. *Anthropology for Archaeologists; an introduction*. London: Duckworth.

Park, Y.W., Juárez, M., Ramos, M. and Haenlein, G.F.W. 2007. Physico-chemical characteristics of goat and sheep milk. *Small Ruminant Research* 68/1–2:88–113.

Payne, S. 1973. Kill-off patterns in sheep and goats; the mandibles from Aşvan Kale. *Anatolian Studies* 23:281–303.

Pearce, M. 2007. *Bright Blades and Red Metal: essays on north Italian prehistoric metalwork*. Specialist Studies on Italy 14. London: Accordia Research Institute.

Pearce, M. and De Guio, A. 1999. Between the mountains and the plain; an integrated metals production and circulation system in later Bronze Age northeastern Italy. In P. Della Casa (ed.) *Prehistoric Alpine Environment, Society and Economy, papers of the international colloquium PAESE 1997 in Zurich*, pp. 289–293. Universitätsforschungen zur prähistorischen Archäologie 55. Bonn: Rudolf Habelt.

Perini, R. 1992. Evidence of metallurgical activity in Trentino from Chalcolithic times to the end of the Bronze Age. In E. Antonacci Sanpaolo (ed.) *Archeometallurgia. Ricerche e prospettive; Atti del colloquio internazionale di Archeometallurgia, Bologna-Dozza Imolese, 18–21 ottobre 1988*, pp. 53–80. Bologna: Cooperativa Libraria Universitaria Editrice [reprinted in *Scritti di archeologia, II parte*, pp. 1121–1146. Trento: Provincia autonoma di Trento, Soprintendenza per i beni archeologici, 2004].

Preuschen, E. 1973. Estrazione mineraria dell'età del bronzo nel Trentino. *Preistoria Alpina* 9:113–150.

Primas, M. 1999. From fiction to facts; current research on prehistoric human activity in the Alps. In P. Della Casa (ed.) *Prehistoric Alpine Environment, Society and Economy; papers of the international colloquium PAESE 1997 in Zurich*, pp. 1–10. Universitätsforschungen zur prähistorischen Archäologie 55. Bonn: Rudolf Habelt.

Puglisi, S.M. 1959. *La Civiltà appenninica; origine delle comunità pastorali in Italia*. Origines. Florence: Sansoni.

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Reschreiter, H., and Kowarik, K. 2009. The start of salt mining. In A. Kern, K. Kowarik, A.W. Rausch and H. Reschreiter (eds.) *Kingdom of Salt: 7000 years of Hallstatt*, pp. 50–51. Veröffentlichungen der Prähistorichen Abteilung 3. Vienna: Natural History Museum.

Ridgway, D. 1997. Nestor's cup and the Etruscans. *Oxford Journal of Archaeology* 16/3:325–344.

Riedel, A. and Tecchiati, U. 1998a. I resti faunistici dell'abitato della media e recente età del bronzo di Sotćiastel in Val Badia. In U. Tecchiati (ed.) *Sotćiastel; un abitato fortificato dell'età del bronzo in Val Badia*, pp. 285–319. Bolzano: Istitut Cultural Ladin 'Micuá de Rü' / Soprintendenza Provinciale ai Beni Culturali di Bolzano.

Riedel, A. and Tecchiati, U. 1998b. Gli insediamenti gemelli di Albanbühel (Bressanone) e Sotćiastel. Una comparazione delle faune. In U. Tecchiati (ed.) *Sotćiastel; un abitato fortificato dell'età del bronzo in Val Badia*, pp. 323–331. Bolzano: Istitut Cultural Ladin 'Micuá de Rü' / Soprintendenza Provinciale ai Beni Culturali di Bolzano.

Riedel, A. and Tecchiati, U. 2001. Settlements and economy in the Bronze and Iron Age in Trentino–South Tyrol. Notes for an archaeozoological model. *Preistoria Alpina* 35 (1999):105–113.

Šebesta, G. 1992. *La Via del Rame*. Supplement of Economia Trentina 3 (1992), Trento [reprinted: San Michele all'Adige: Museo degli Usi e Costumi della Gente Trentina, 2000].

Tecchiati, U. 1998. Osservazioni conclusive; problemi e prospettive della ricerca. In U. Tecchiati (ed.) *Sotćiastel; un abitato fortificato dell'età del bronzo in Val Badia*, pp. 379–386. Bolzano: Istitut Cultural Ladin 'Micuá de Rü' / Soprintendenza Provinciale ai Beni Culturali di Bolzano.

Trump, D.H. 1966. *Central and southern Italy before Rome*. Ancient Peoples and Places 47. London: Thames and Hudson.

Ventris, M. and Chadwick, J. 1956. *Documents in Mycenaean Greek*. Cambridge: Cambridge University Press.

Viviani, M. 1993. *Cultura alpina tra Passato e Futuro; Bagòs: una storia della montagna lombarda*. Brescia: Grafo.

West, M.L. 1998. Grated cheese fit for heroes. *Journal of Hellenic Studies* 118:190–191 [reprinted: *Hellenica; selected papers on Greek literature and thought: Volume I: Epic*. Oxford: Oxford University Press 2011:123–127].

Willcock, M.M. 2012. Homer. In S. Hornblower, A. Spawforth and E. Eidinow (eds.) *The Oxford Classical Dictionary*. 4th edition. Oxford: Oxford University Press. Available at http://www.oxfordreference.com/view/10.1093/acref/9780199545568.001.0001/acref-9780199545568-e-3138; date accessed 25 April 2014.

Zschocke, K., and Preuschen, E. 1932. *Das urzeitliche Bergbaugebiet von Mühlbach-Bischofshofen*. Materialen zur Urgeschichte Österreichs 6. Vienna: Anthropologische Gesellschaft in Wien.

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