

Some Considerations on Salt exploitation at Trieste Karst in Prehistory*

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Trieste

Introduction

Two recent Symposia – *Early symbolic systems for communication in southeast Europe* (Karlovo, Bulgaria, April 2002) and *Settlements and settling from Prehistory to the Middle Ages* (Pula, Croatia, November 2002) – gave me the opportunity to revise the results of the studies on the Trieste Karst carried out since the early 1990s from the viewpoint of the motivations that might explain the rather intensive use of a relatively high number of caves in prehistory.¹

Among the many interesting elements that have emerged from these studies, the evidence for pastoralism is undoubtedly the most relevant to the subject, and has an almost certain correlate in the significant presence of rare, foreign valuables. But these same elements are often mentioned in the archaeological literature as indirect indicators, with others, of salt exploitation / production – and saline have represented one of the basic economic resources of the north-eastern Adriatic coasts since at least the beginning of the Venetian Republic in the 8th century AD till few decades ago, or even to the present in certain cases.

On these grounds, and with reference to recent publications of both general archaeological and local ethno-historical character,² I have elaborated the idea that salt might be one of the components of the Karst place value already in the late prehistory. Geomorphological characteristics

* This paper represents partly modified version of paper presented at the International Colloquium *The Prehistoric and Protohistoric Archaeology of Salt*, which took place in Piatra-Neamt (Romania), 21-24 October 2004.

¹ Montagnari Kokelj 2003a, 2003b.

² Weller 2002a; Solarstvo, 2001.

and ethno-historical data would suggest a similar role for salt also in Istria, the peninsula immediately to the south-east of the Trieste Karst, but this area has entered my examination only marginally so far.

As I have done in the previous articles, I want to stress that at present my idea is essentially a working hypothesis, due to the lack of field investigations as well as of studies specifically aimed at testing this possibility. In this paper I will reconsider the data which can support the hypothesis and extend the analysis, though again on the basis of *a posteriori* re-examination, to some protohistoric contexts where direct indicators seem to be present.

Location

“Implantation proche de la source salée“ is one of the indirect indicators of salt exploitation / production listed by Olivier Weller ³ and then used and expanded by other scholars ⁴ in the case of marine salt the vicinity of a site or a territory to the coast is clearly a prerequisite.

Nevertheless, the vicinity is not sufficient in itself, since “Tous les points d’une côte ne sont pas favorables à la cueillette ou à l’extraction du sel”.⁵ The best conditions are represented by non-rocky coastal plains, crossed by the estuaries of watercourses which provide fresh water, particularly suitable for processing the brine, on the one hand, and favour the transit towards the interior, on the other hand. Specific coastal areas of the Trieste Karst and Istria match these characteristics.

The Karst and Istria belong to a region called *Caput Adriae*, which is situated on the northern shore of the Adriatic Sea and covers the easternmost part of Northern Italy, the south-western part of Slovenia and the western part of Croatia (i.e. the Istria Peninsula) (Fig. 1). An alluvial plain lies to the west, while to the south-east there are the mainly sandstone hills of Ciceria (north-western Dinaric Alps).

The Trieste Karst occupies the south-western area of the Classical Karst, a plateau of low rounded hills and low mountains ranging from 100-200 m to 800-900 m above sea level, with a few major peaks reaching the maximum height. The outcropping rocks are chiefly limestones, crossed by two flysch belts (marly and sandstone formations), a dozen kilometres wide: the first runs through central Istria in ESE-WNW direction and borders the Gulf of Trieste as a thin rim; the second lies parallel

³ Weller 1999, 297.

⁴ See, for instance, Tasić 2000; Monah 2002; Morère 2002.

⁵ Gouletquer 2002, 27

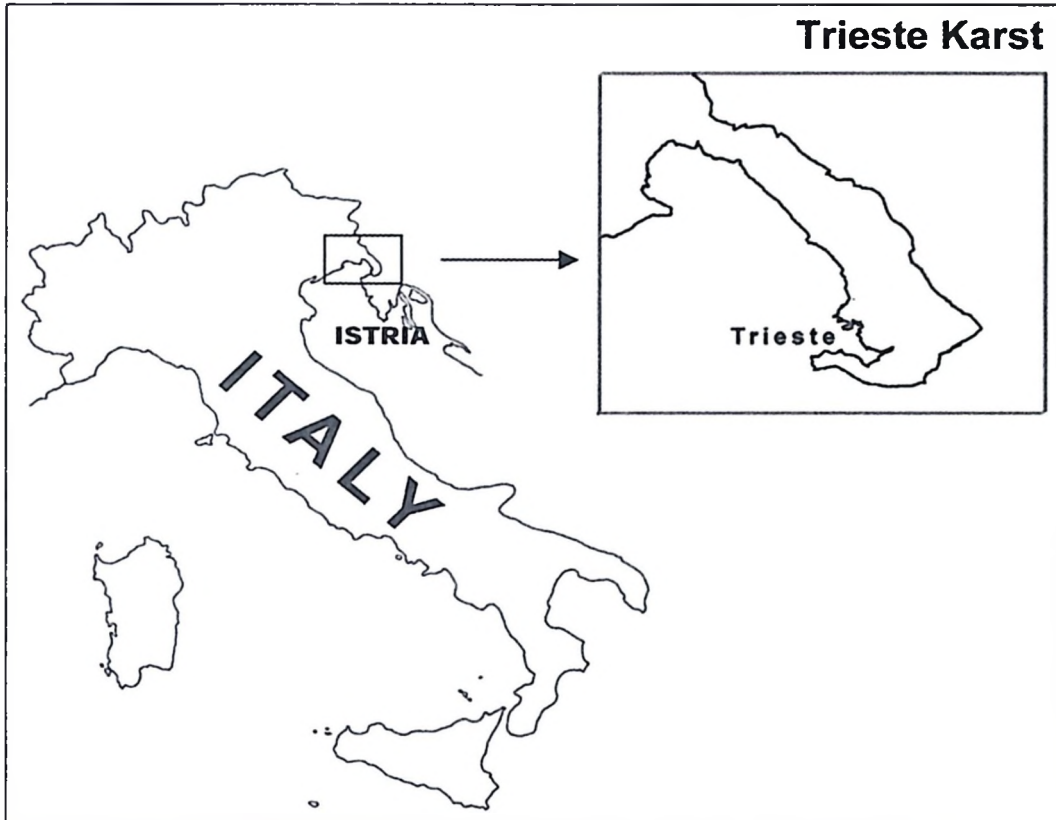


Fig. 1. Location map of the Trieste Karst and Istria (elaboration: Anna Rossi – Department of Geological, Environmental and Marine Sciences, University of Trieste)

to the first one, ca. 20 kilometres to the north, and then bends northwards bordering the Selva di Tarnova.

The limestone area is typically karstic, with wide rock outcrops and heavy clayish soils (*terra rossa*) mainly concentrated in randomly scattered dolines, which represent the principal places where non-intensive cultivation has been practised traditionally. A nearly continuous soil cover is present in the flysch areas, but it is sometimes rather heavy due to a high percentage of clay, never very thick, and limited in extension, always less than a few kilometers along the watercourses or the coast.

Due to these characteristics, and due to a general scarcity of water, this territory is basically unsuitable for cultivation and more appropriate for animal grazing, as a long tradition shows, but this activity would not offer sufficient means of maintenance throughout the year. From the purely geomorphological point of view, the alluvial plains lying to the west – the Friuli Plain – and to the south-east – parts of the Istria Penin-

sula – represent the ideal complementary areas to integrate a year-round subsistence.

At present water has a seasonal character, at least up to a certain extent. The rain falls more regularly in specific periods of the year, when it percolates through natural holes and caves, fills otherwise dry ponds and influences the hydrologic regime of the few local perennial springs, watercourses and small lakes: the fairly numerous springs and small lakes around Duino, in the western part of the Trieste Karst, where the Timavo River re-emerges from its underground course to flow into the sea, and two streams, Rio Ospso and Torrente Rosandra, and some springs in the Rosandra valley, in the eastern part.

As to the morphology of the coast, a falesia (rocky cliffs) in the central part of the Gulf of Trieste separates the ancient tidal flats, actually a sandy beach and coastal alluvial plains, corresponding to the mouth of the Timavo, to the west, from the coastal alluvial plains at the mouths of Rosandra (Valle di Zaule) and Ospso (Valle delle Noghere) to the east (Fig. 2).

Significantly, these areas are the only landing places along the coast, very close to the penetration routes towards the interior, along the Brestovizza valley, Iamiano, Pietrarossa and Selz to the Vipacco valley to the west, and through the Ospso and Rosandra valleys to the east.

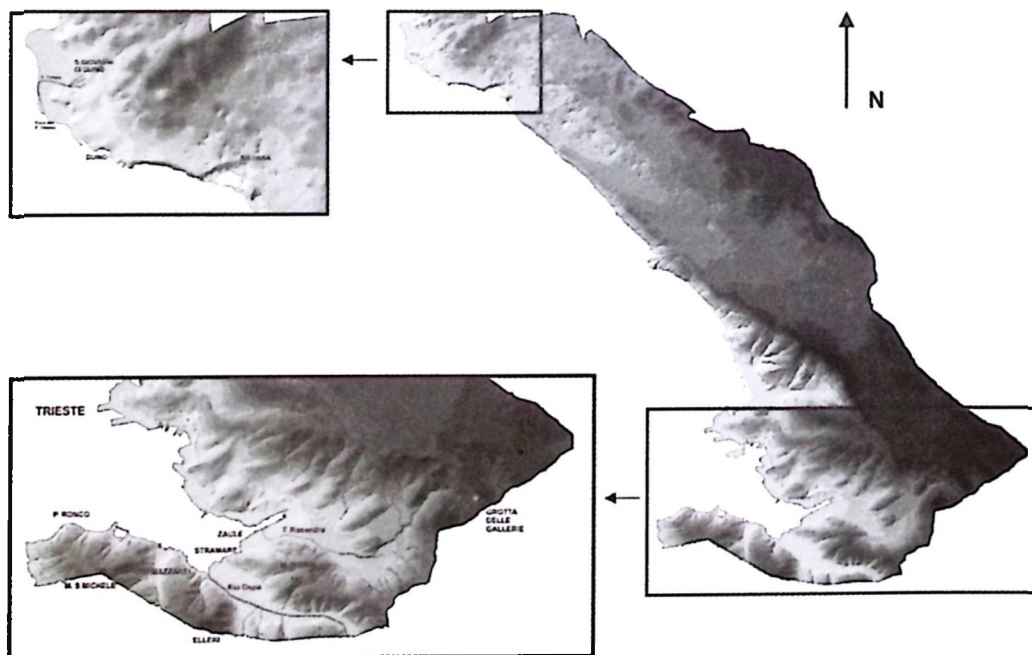


Fig. 2. 3D Model of the Trieste Karst (elaboration: Anna Rossi – Department of Geological, Environmental and Marine Sciences, University of Trieste)

Tidal flats and coastal alluvial plains are present also in Istria, starting immediately beyond the promontory of Muggia, where the Risano River flows into the Bay of Capodistria, and further to the south.

Ethno-historical data

What is particularly important at this point is that, if we check historical documents concerning the recent and less recent past, saline are reported in all these locations, including parts of the now urbanized area of Trieste, where saline did exist already in the 12th century AD⁶ and till the first half of the 18th century.⁷

Salt production has received great attention from historians, who document it from at least the beginning of the Republic of Venice in the 8th century AD till few decades ago, or even to the present in certain cases.⁸ In Istria, saline are in fact still active near Sicciole, while the most important centres of production around Pirano and Capodistria functioned till the second half of the 1960s and 1912 respectively; other, smaller centres along the southern coast of the peninsula – such as Isola, Rovigno, Orsera, the Brioni Isles, etc. – were suppressed sometime at the beginning of the 19th century. The saline of Muggia, Servola and Zaule to the south of Trieste were closed around 1830.

This situation has favoured detailed studies of salt production and trade, based largely on historical documentation but also on direct observation. Many data on the methods, structures and artefacts used in processing marine salt, as well as on the socio-economic conditions of the people involved in this activity, are now available in the specialistic literature,⁹ and can be used to make hypotheses on past forms of salt exploitation.

In particular, in spite of the climatic oscillations recorded during the Holocene, with the consequent variations in humidity and sunlight, a character which is very likely to be common to both historical and more ancient forms of salt exploitation in the area under examination is seasonality. Modern sources indicate that the activity in the saline starts at the beginning of May, when the spring rains are less frequent and the sun becomes gradually warmer, and ends towards the middle or the end of September.

The intensity of the sun is in fact a key factor in a process essentially based on the evaporation of marine water and the collection of salt

⁶ Bertacchi 1995, col.121.

⁷ Vocci Sau 1995, 81.

⁸ Adshead 1992; Starec 2001.

⁹ See, for instance, Solarstvo, 2001.

crystals: when a certain quantity of sea water is enclosed and spread over a wide surface, this process is significantly favoured. The traditional structure of the saline is formed by a series of usually rectangular, contiguous enclosures, surrounded by sections of different canals: the main artificial ones, that let the sea water in and residual waters out, secondary canals departing from the former, and in certain cases natural water-courses too, such as the Dragogna River till 1958 in the saline of Sicciole. The enclosures are separated by earthen mounds, that are normally reinforced along the side facing the sea.

At flood tide the sea water is allowed to enter a special area, 50-70 cm deep, where impurities are left to deposit. After a few days the brine is transferred to the inner part of the structure, where it passes into successive salt pans at intervals of time sufficient to increase the salt concentration through evaporation.

At the beginning of the season these passages require many days, as the process of evaporation is slow and the water percolates through the ground that has not yet become hard enough: the practice of spreading additional salt on the surface of the pans is often used to speed crystallization. Later on, the layers at the bottom of the pans solidify and favour the formation of a more compact and drier salt.

Since the 14th century a special mixture of micro-organisms, chalk and clay has been applied during the preparation of the bottom of the pans in order to improve the quality of the produce – the resulting salt is in fact whiter and purer. The quality cannot be maintained unchanged till the end of the season, due to the gradual deterioration of the structures: the salt becomes greyish – it is called significantly *sal negro* (black salt) – and inedible, and can be used only to feed animals.

The maintenance of the structures and all the processing operations are traditionally carried out by using simple tools, largely made of wood, sometimes even of leaves and stone. Wooden containers, similar to those used to prepare the dough, are used also to transport the salt to the stores after it has been collected, preferably every second or third day, at sunset, by using rakes, and let drip in small heaps along the mounds. Moulds or other containers of definite shape and weight to condition salt before it enters the trade circuit are not specifically mentioned.

The stores are part of the ground floor of the buildings along the main canals of the saline that can be used by salt workers as temporary habitations, when their homes are too distant from the salt plants to be reached daily.

In historical times whole family groups used to work in the saline: they were farmers, fishers and boatmen in the rest of the year, as the seasonal character of salt production implies that this activity cannot represent the exclusive means of maintenance of those who practise it.

Pastoralism

Seasonality is a characteristic shared also by another economic activity attested in both modern and ancient times in the Karst and in some contiguous territories: transhumant pastoralism.

As Inja Smerdel shows clearly, the Trieste Karst was an integral part of the sheep transhumant pastoralism documented from the mid-19th to the mid-20th century AD in western Slovenia and northern Istria, and pastoral transhumance used to be practised by the Vlachs before the arrival of the Slovenes.¹⁰ Over the whole area this practice – which was but one of the various components of the economic system – was a form of “reduced transhumance” rather than of “long distance” one, of “reverse” type in the case of the Trieste Karst, as permanent abode and winter pasture were located along the Gulf of Trieste and the coasts of Istria, while the inland meadows of Monte Nanos were used for summer grazing. Similar movements of flocks and herds towards Monte Nanos, Monte Re and Monte Nevoso are recorded already by historical documents dating back to 1499 AD.¹¹

But the two forms of transhumance are not mutually exclusive. Evidence of “long distance” transhumance can in fact be found in the 19th century, when shepherds used to move their flocks on a year-round cycle from Transylvania to the Friuli Plain crossing the Trieste Karst (*ibidem*). Further back, in Roman times, when stock rearing was an important economic activity in northern Adriatic regions, tradesmen operated from these regions as far as *Dacia*, ca. corresponding to the area of contemporary Romania (comprising Transylvania again!) – and the appellation *conductor pascui, salinarius* given to one of these tradesmen¹² is fundamental to prove the connection between pastoralism and salt production and trade.

This connection is well documented in the anthropological literature,¹³ but seemingly less so in archaeological studies. I have been able to find only few cases of direct correlation: for instance, Nicolae Ursulescu, while discussing the sources characterized by low salt contents and limited flow in Moldova (such as, for instance, Prohozești-Siliște, Poduri, Bacau), underlines their only local importance and seasonal utilization, and adds “Il est possible que l’activité de recristallisation du sel ait été complétée par celle de l’élevage, elle aussi saisonnière”.¹⁴ Nevertheless, there are general statements that the development of animal husbandry

¹⁰ Smerdel 1999.

¹¹ Boschian et alii 2000, 348.

¹² Verzar Bass 1987, 268.

¹³ As an example, Orme 1981, in particular 170, 191, 256.

¹⁴ Ursulescu 1995, 491.

would be at the origin of salt exploitation.¹⁵ Moreover, “élevage et voies de transhumance“ do appear among the indirect indicators – or correlates – of salt exploitation / production listed by Nuria Morère in a recent article regarding Spain, together with “peuplement, toponymie, industries annexes (salaison, pourpre) ...des éléments de prestige, des preuves d’un commerce important et l’existence d’élites sociales qui ne s’expliquent par aucune autre richesse“.¹⁶

Although the interplay of all these elements could almost certainly be ascertained in historical contexts by a careful analysis of written sources, such a correlation is much more difficult to prove in prehistory, but in my opinion it can be postulated when the coexistence of at least some of these elements is demonstrated.

As to pastoralism and transhumance, the pre-eminent role of sheep / goats breeding among the economic activities of the prehistoric and protohistoric communities of the Karst has been known, on archaeozoological grounds, since the very beginning of local archaeological research in the last decades of the 19th century. Sedimentological and soil micro-morphological analyses, that at present are probably the best methodologies to identify on-site animal husbandry,¹⁷ have recently demonstrated that some of the most important caves (four through direct analysis, others through critical re-examination of published and unpublished data) were used as stables starting from the Neolithic.¹⁸ The deposits of these caves are in fact characterized by layered heaps of ashes and charcoal with high quantities of spherulites and phytoliths, which are typical of *grottes bergeries* as defined since the early 1970s in the French Midi region: specialized flock-parking sites, usually located on plateaux, visited seasonally by shepherds moving from complementary open air settlements in lowlands or valleys. Like in France and Liguria, also in the Karst this specialized land and site use has recurrent cultural correlates, i.e. a decrease in the number of artefacts, often combined with a relatively high presence of exotic materials.

Exotic materials

These two aspects, and in particular the presence of materials which can be interpreted as rare, foreign valuables, though somehow perceivable through a perusal of the old literature, have been highlighted

¹⁵ Gouletquer et alii 1994b, 123.

¹⁶ Morère 2002, 184, 185.

¹⁷ See Montagnari-Kokelj 2003b.

¹⁸ Boschian et alii 2000.

by the systematic re-examinations and complete editions of pre-protohistoric findings from the most important of the ca. 160 archaeological caves investigated in the past, that unfortunately had remained largely unpublished till the early 1990s when a specific research project started.¹⁹ The indications of these studies are further supported by recent and less recent characterization analyses of various materials. Such analyses – in spite of general problems concerning in particular the different degree of reliability of the determinations depending on the nature of the raw materials, on the one hand, and the difficult definition of the mechanisms of introduction of foreign objects into a specific archaeological context, on the other hand – give an important contribution to identify the origin of artefacts recognized as non-local on archaeological grounds.

Among exotic materials found in Karst caves, for instance, the few artefacts made of obsidian, presumably datable to the Neolithic, would all come from Lipari (Aeolian islands), in southern Italy, with the exception of one single item from the Carpathian basin, more precisely from the sources of Szöllöske and Malá Toroňa in Slovakia.²⁰

The number of greenstone polished tools is on the contrary rather high, amounting to 50. A small lot of shaft axes, datable to the Copper Age / Early Bronze Age, was examined in the second half of the 1990s, and the results exclude their origin from north-western Italian sources, and point to a probably eastern provenance from geological deposits still unidentified. The existence of a good sample of other artefacts of different typology (mainly axes / adzes and ornaments) and chronology (from the Neolithic to the Early Bronze Age), not yet analysed, should allow to check the hypothesis of a non-western origin throughout the late prehistory.²¹

At present the reliability of the characterization analyses of flint is lower in comparison with that of obsidian and greenstone, and studies aimed at investigating the composition of different flint assemblages on the basis of regional maps of chert deposits are just at the beginning in Northern Italy.²² Nevertheless, there are rather sound elements to say that the post-Mesolithic materials found in the Karst caves – usually quite few, when not limited to single pieces – are mostly foreign to the local context. In certain cases macroscopic analysis allows to assume that their origin could be traced to the Lessini mountains to the west, but in many others the problem remains open.

Pottery is somehow comparable with flint as far as reliability of characterization analyses and initial state of research are concerned. But pottery is the class of materials that has been studied traditionally on

¹⁹ See bibliography quoted in Montagnari- Kokelj 2003a; 2003b.

²⁰ Williams- Thorpe et alii 1984.

²¹ Montagnari-Kokelj et alii, in press a.

²² Montagnari Kokelj et alii 2003; Montagnari Kokelj et alii, in press b.

comparative typological grounds, and in the case of the Karst such studies indicate a strong orientation towards regions to the east and south-east, with few elements pointing to the west, throughout the late prehistory.

Neolithic *rhyta*

In particular, connections with Neolithic sites all along the Adriatic coast as far as the Peloponnese in Greece and in the inner Balkans too (Bosnia, Kosovo) are shown by a peculiar pot on four legs with a wide oblique opening and a handle, often richly decorated, called *rhyton* (Fig. 3). This pot is typical of the local Early-Middle Neolithic, traditionally indicated as Vlaška Group: fragments belonging to 17 different vessels, coming from 10 caves and 1 rock-shelter, have been identified so far.²³



Fig. 3. *Rhyton* from Smilčić, Dalmatia
(after Praistorija jugoslovenskih zemalja, II, Tab. 85)

²³ Montagnari Kokelj et alii 1993; 1996.

A ritual, symbolic interpretation has been proposed for this vessel by most scholars, but according to Chapman the *rhyton* could be identified as a salt pot.²⁴ In addition, in his recent study on fragmentation he suggests that “salt pot [= *rhyton*] fragments are ideal exemplars of the principle of the ‘synecdoche’ (*pars pro toto*) on which relations of enchainment relied for their operation in the late prehistory. This category of vessels can be identified from often quite small fragments, allowing the symbolic meanings of the vessels to be transferred through the trade in sherds”.²⁵ Significantly, the data of the Karst are consistent with this statement, in terms of both fragmentation – there are in fact no complete *rhyta*, legs are largely prevailing and handles are also present – and connections with remote areas indicated by typological similarities.²⁶

Although Chapman’s interpretation of *rhyta* fragments can be considered highly speculative, in my opinion it correlates the functional and economic importance of salt with its symbolic value and with the active role of objects as means of social communication. Objects, and particularly foreign ones, possess cultural biographies²⁷: they may change status in the course of their displacements, may shift from functional to non-functional role, from economic to symbolic, may be commoditized in a reversible or irreversible way. These changes are ultimately dependent upon the contexts through which objects are moved.²⁸ Archaeologically, only the last spatial and temporal context in the life of an object is known with certainty: if exotic artefacts are found in caves, their intentional deposition and probable symbolic meaning can be reasonably sustained, as in such cases the value ascribed to objects and the value ascribed to places are mutually reinforced. The connection between symbolism, sacredness, liminality and caves is in fact a concept widely acknowledged by scholars.²⁹ And the constant interplay of economic, social and symbolic aspects in the life of prehistoric societies – as well as in that of transhumant shepherds – is also accepted by the large majority of scholars who study trade and exchange, “since the distinction between symbolic and economic is a peculiarly modern western concept”.³⁰

If *rhyta* had actually served to preserve, to store salt (almost certainly not to produce it), their presence in caves of a territory repeatedly used by transhumant shepherds would add a less indirect element to sustain the hypothesis that the natural formation of salt pans along the

²⁴ Chapman 1988; 2000.

²⁵ Chapman 2000, 67.

²⁶ Montagnari Kokelj 2003b, 86-88.

²⁷ see, for instance, the contributions in Appadurai 1986.

²⁸ Edmonds 1993, 73.

²⁹ See Montagnari Kokelj 2003b, note 85, for selected bibliography.

³⁰ Scarre 1993, 3.

shores of the Karst represented a strong motivation, if not the main one,³¹ for such frequentation already in the Neolithic.

A sustainable hypothesis?

Besides the presence of *rhyta*, the data presented so far would indicate the coexistence in the Trieste Karst of elements indicated by Olivier Weller and other scholars as indirect indicators of salt exploitation / production (see above), namely a relative continuity of occupation throughout the late prehistory (but also in later periods) of a high number of caves located at a maximum distance of 8-10 km from the sea, the source of salt; the evidence of a specialized use of caves as stables by transhumant shepherds in a good number of cases; the presence of exotic objects of quite different and far-off provenance in many cave deposits. Two other factors play a fundamental role, i.e. the geo-morphological characteristics of the coast, that would have remained basically unchanged during the Holocene,³² and a history of salt production that written sources allow to trace back to Roman times.

If all these data are taken into consideration, and if one compares natural, historical and prehistoric evidence – and in particular the map of distribution of *rhyta* (Fig. 4) with the maps of the saline around Trieste and in Istria drawn in 1525 by Pietro Coppo (Fig. 5), of the salt sources in the Balkans (Fig. 6), of the “reduced transhumance” between the Trieste Karst, Istria and Slovenia (Fig. 7), of transhumant movements vs. Neolithic sites in the Dinaric Alps (Fig. 8) and of modern transhumance on a larger scale, from Greece to the northern Adriatic regions (Fig. 9) –, in my opinion there are sound elements to support the hypothesis that the Karst might have been the north-westernmost outpost of a pastoral network extended over many hundreds of kilometres already in the Neolithic, and that salt was a key element of the system.

The hypothesis assumes that shepherds knew about the economic potentiality of this area – through personal experience as well as oral tradition transmitted from generation to generation, from group to group on the occasion of trade exchanges, fairs, gifts, brides, ceremonial exchanges... – and came repeatedly to collect salt formed by solar evaporation in natural ponds along the coast; the simple collection in the periods of the year when the sun was at its highest intensity and evaporative power, i.e. in late spring and summer at this latitude, did not imply any arrangement of the area nor the use of tools that might leave traces destined

³¹ See Gouletquer 2002,28; 2002a,126.

³² Marocco 1991.

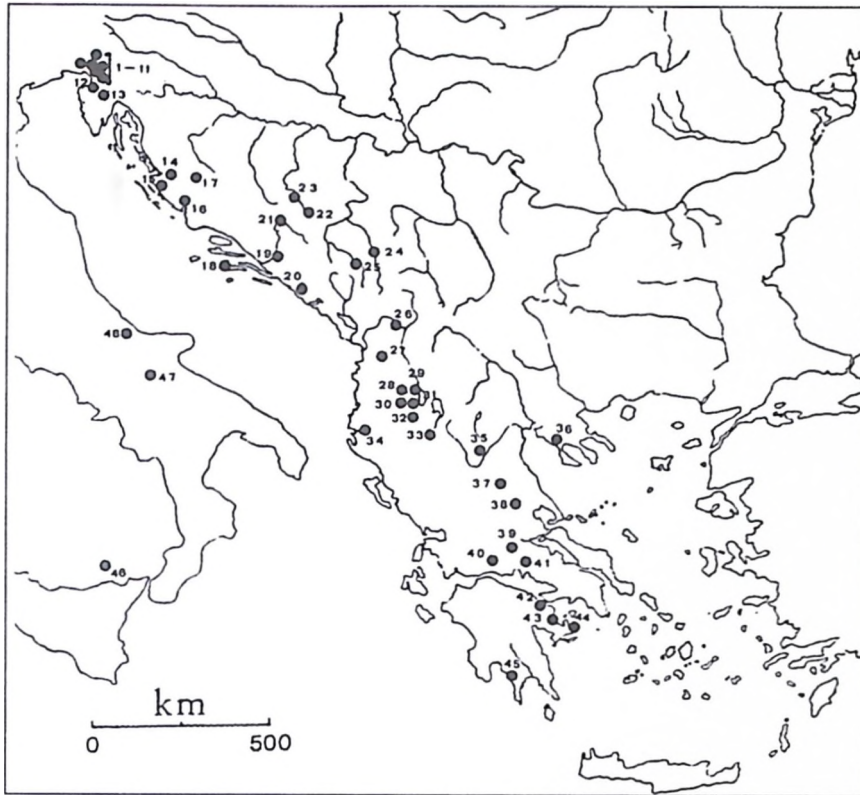


Fig. 4. Map of distribution of rhyta (after Montagnari Kokelj et alii 1993, fig. 1)

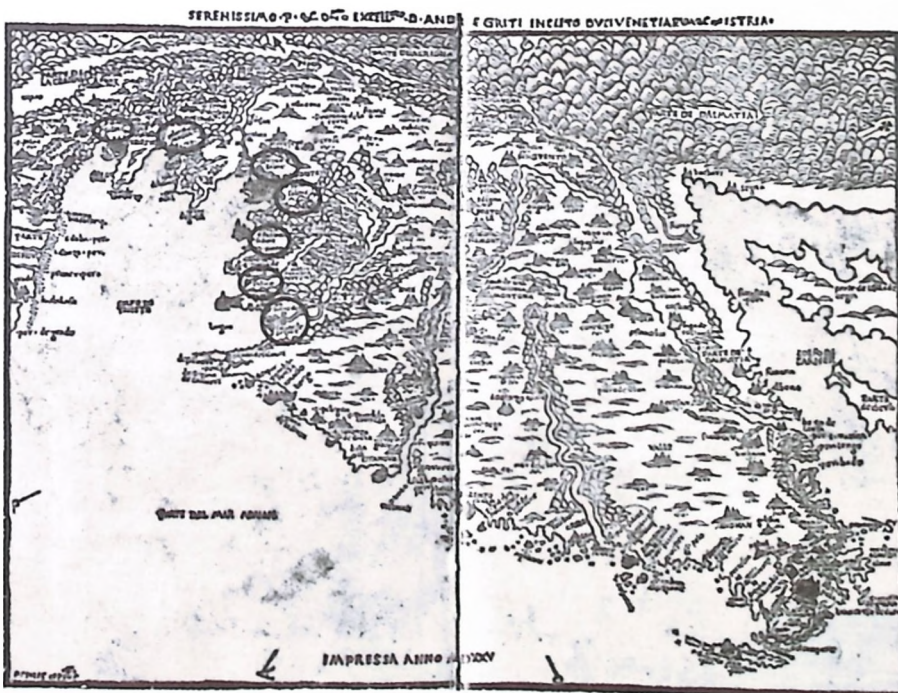


Fig. 5. Map of the saline around Trieste and in Istria drawn in 1525. by Pietro Coppo (after Lago 1989, fig. 69)

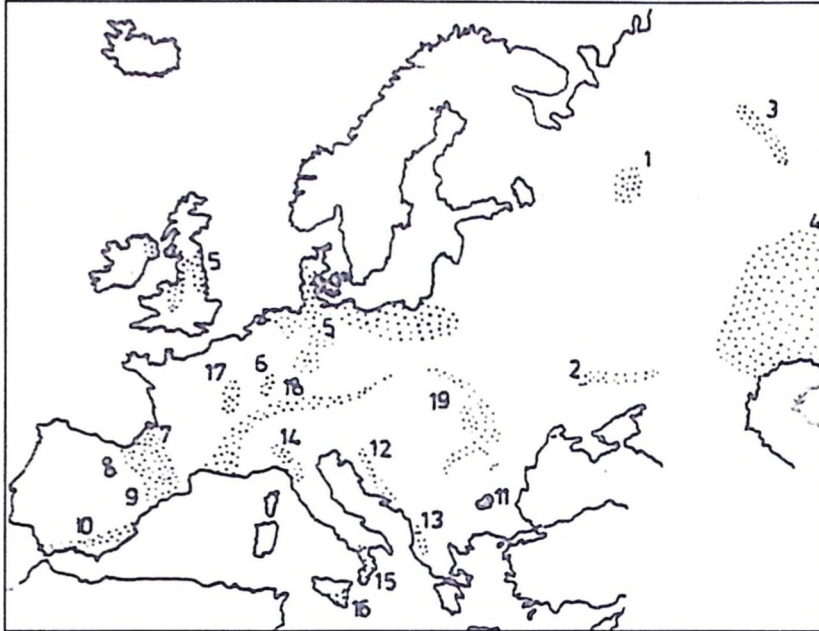


Fig. 6. Map of the salt sources in the Balkans (after Monah 2002, Fig. 1)

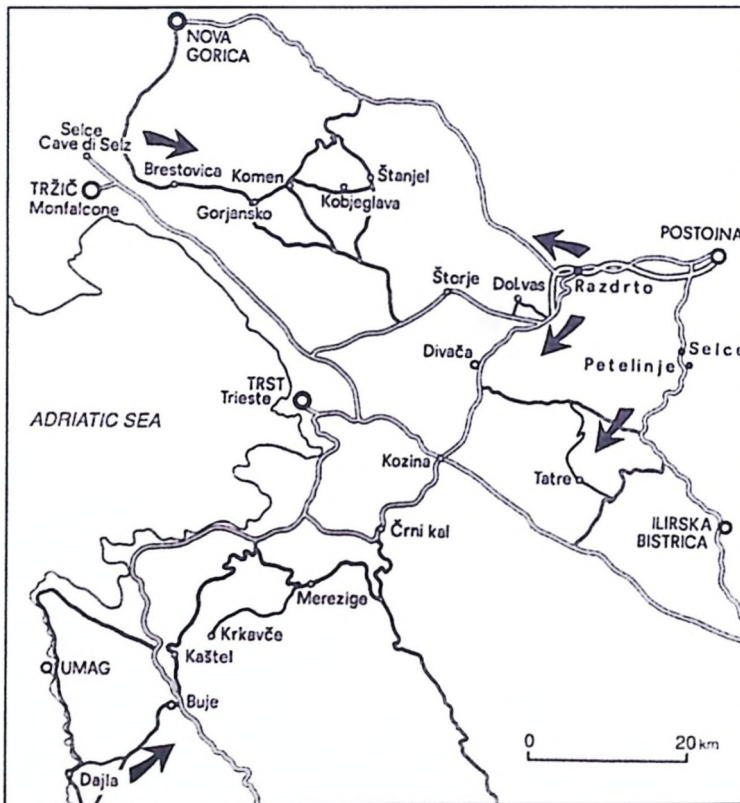


Fig. 7. Map of the "reduced transhumance" between the Trieste Karst, Istria and Slovenia (after Smerdel 1999, Fig. 1)

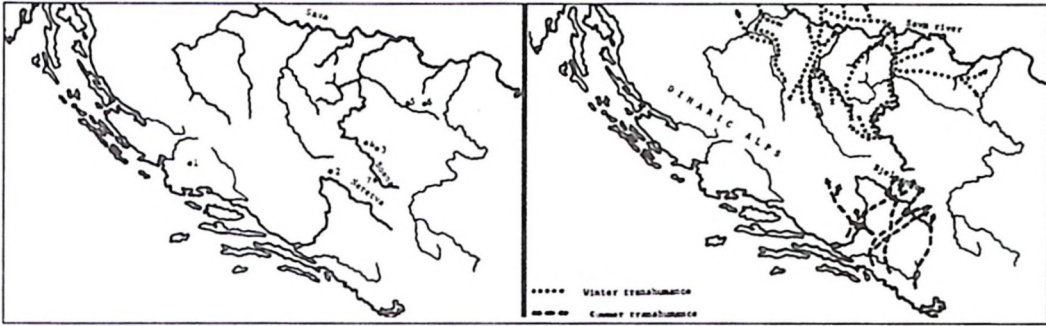


Fig. 8. Map of transhumant movements vs. Neolithic sites in the Dinaric Alps (after Sterud 1978, Fig. 17,3 vs. Fig. 17,4)

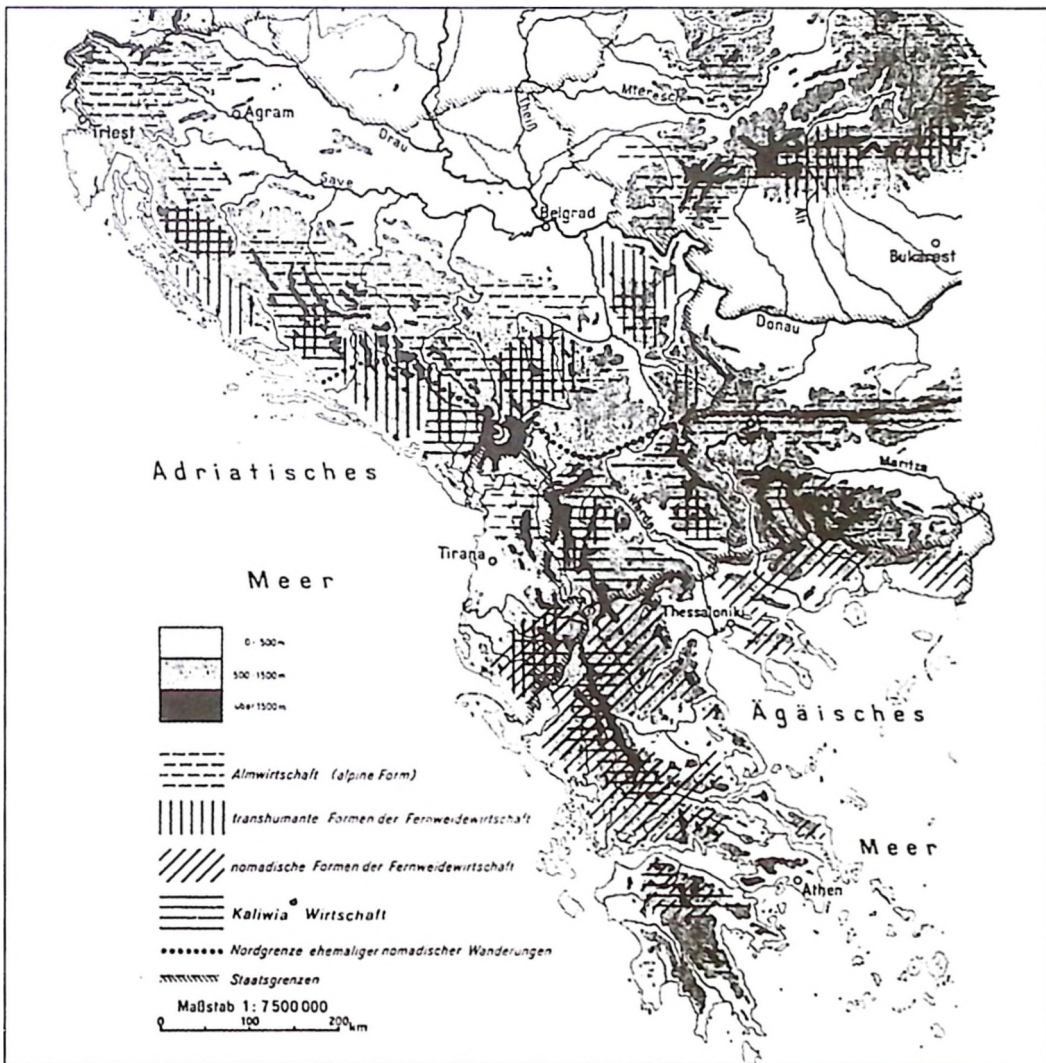


Fig. 9. Map of modern transhumance from Greece to the northern Adriatic regions (after Beuermann 1967, map 17)

to survive (it is interesting to note that even in the historical periods of maximum production under market conditions, when the saline of Istria and Dalmatia were structured in a way comparable to the present, the technique was solar evaporation and the tools used to process salt were always basically made of wood).

Occasional seasonal exploitation rather than systematic production during the Neolithic and presumably till the beginning of the Bronze Age can be sustained on the basis of the data on local land use in these periods outlined above, which would indicate a utilization of the marine salt essentially aimed at satisfying the needs of the local communities and the groups of shepherds moving to, or through, the Karst, and would exclude an intensive production for exportation.

“Fabrication naturelle” vs. ” fabrication ignigène”

If simple collection is the case, a consequence is the almost complete lack of traces: “s’il s’agit d’une fabrication naturelle, simple évaporation par action des agents climatiques, il n’y a aucun indicateur objectif à part la présence d’une source salée à proximité, d’un terrain inondable ou d’un lac salé”.³³ But there are also local factors that make the search for traces very difficult, if not impossible. The main one is represented by the history of the areas where salt extraction presumably took place: on the one hand, where salt production ended sometime in the past, like in the case of Trieste, Servola, Zaule and Muggia, the process of urbanization has almost certainly cancelled any trace of both historical and possible prehistoric activities; on the other hand, in the many situations where saline have remained active nearly to the present, in particular in Istria, obliteration can be due to the overlapping of salt works.³⁴

Although these premisses do not change, if an artificial technique, i.e. the use of fire to speed up crystallization, was used to extract salt – a possibility that cannot be excluded *a priori* –, some material evidence should be found: “s’il s’agit d’une fabrication ignigène, les témoins seraient les quantités de tessons, dans des proportions et quantités inconnues sur d’autres sites, les traces de feu et des fosses imperméabilisées”.³⁵ That is the *éléments de briquetages* in the broad acceptation proposed by Pierre Gouletquer and Marie-Yvane Daire: “Un atelier de briquetages ou atelier de bouilleur de sel peut donc être défini comme suit: il s’agit d’un établissement de traitement du sel (marin ou géologique) par la chaleur arti-

³³ Morère 2002, 184.

³⁴ See Liot 2002, 96-97.

³⁵ Morère 2002, 184.

ficielle d'un foyer. Typiquement, il présente un ou plusieurs fourneaux, comportant des aménagements de briques plus ou moins complexes; ces dernières sont destinées à soutenir, au dessus du fourneau, des récipients ou moules à sel tous semblables dans une même production (augets, barquettes, cornets ou godets cylindriques). En outre, ces ateliers comportent généralement des structures de stockage (cuves ou bassins) de la matière première (saumure...) destinée à l'évaporation. Par extension, le mot "briquetages" a été appliqué aux objets en argile eux-mêmes et l'on parle couramment "d'éléments de briquetages"³⁶.

In this definition, that clearly photographs a complex salt processing site, firing places as well as ceramic implements used in the process are referred to as *briquetages*. But actually the identification of both can be problematic, as ethno-historical and archaeological data show an extremely high variability, from the combination of simple vessels raised on pedestals above a clay floor on which a fire would be lit³⁷ to real kilns,³⁸ from spool-shaped and pillar-shaped pedestals to troughs or pans, crucible-shaped, chalice-like and conical vessels.³⁹ Moreover, different vessels would be used for the different operations of concentration of the brine and further conditioning of the salt crystals into beakers or moulds, to dry off into transportable cakes of specific weight; still other containers could be used to transport the salt water from the source to the processing site, if the two are separate, and to store the produce at various stages in the procedure.⁴⁰

These operations, and consequently their material evidence, are not necessarily all present in all salt-producing areas, because of the interplay of geo-environmental and socio-economic factors and, to a certain extent in a less degree, chronology. Given that "autarcie des moyens de production, techniques rigoureusement adaptées aux conditions locales, nécessité dans l'immense majorité des cas d'une gradation préalable à la cristallisation constituent les grandes constantes de la fabrication du sel",⁴¹ "la diversité de méthodes observables à travers le monde paraît alors intimement liée à celle des contextes environnementaux et au type de ressource salifère exploitée; elle répond aussi à la qualité du produit recherché (type de sels, cendres salées, sel en grains ou bloc de sel) et aux spécificités de la demande".⁴²

³⁶ Gouletquer et alii 1994a, 10.

³⁷ Gouletquer et alii 1994b, fig. 85.

³⁸ Hees 2002, fig. 7; 10.

³⁹ Harding 2000, 249-251; fig. 7,4.

⁴⁰ Among others, see for instance Morère 2002, in particular pp. 185,187.

⁴¹ Gouletquer et alii 1994b, 128.

⁴² Weller 2002b.

The geo-environmental conditions, and in particular latitude and climate, are discriminative as to the basic alternative between the natural technique – sun and wind – and the artificial one – fire – applied to concentrate the brine⁴³: “Le principe selon lequel les techniques d’extraction du sel sont rigoureusement adaptées aux possibilités locales a pour corollaire qu’elles échappent pratiquement aux variations temporelles et aux progrès technologiques extérieurs: les marais de la côte atlantique fonctionne comme devaient fonctionner les marais de l’époque romaine et avant ceux-ci les marais du Néolithique. Les seules mutations seront des variations internes provoquées par la fluctuation de la demande, ainsi que les aménagements imposés par les variations des conditions naturelles, oscillations des transgressions marines et changements climatologiques notables par exemple.”⁴⁴ Unfortunately, quite often a precise reconstruction of the variations of the local micro-climate is lacking,⁴⁵ and so it is at present for the region under examination. But if macro-periods are considered, one can assume that the decrease in temperature and increase in humidity corresponding to the Sub-Boreal might have caused a shift from natural to artificial methods – maybe temporary, or combining both techniques – also in the Karst and in Istria.

At present there are no evidence of a transitional phase: artificial methods are nevertheless attested at the time of the important cultural phenomenon represented by the construction of fortified structures, *castellieri*, on hilltops in the Karst, Istria and part of Dalmatia, that started ca. at the beginning of the 2nd millennium and lasted till the second half of the 1st millennium BC. *Castellieri* represent a momentous change in settlement pattern, with consequent socio-economic developments indicative of more stabilized long-distance exchange / trade relationships.⁴⁶ In the light of the accent generally put on the role played by exchange / trade networks in augmenting salt production, and on the more regular and extensive evidence of *briquetages* and *ateliers de briquetages* in the Bronze Age and particularly in the Iron Age,⁴⁷ if the identification of *éléments de briquetages* in high number in the *castelliere* of Elleri, less than 1 km from the coast of the Bay of Muggia, and more sporadically in others again not far from the coast, and of a firing place at Stramare, an open-air site on the shore of the bay, is correct, the combination of natural and cultural changes might have brought about the use of an artificial technique in salt extraction that have left tangible traces.

⁴³ For a more detailed differentiation see Gouletquer et alii 1994b, 127-128.

⁴⁴ Gouletquer 2002b, 126-127.

⁴⁵ See for example Edeine 1975, in particular pp. 5-6, for a discussion of possible implications relative to the Atlantic coast.

⁴⁶ Bandelli et alii 2005.

⁴⁷ See, for instance, Gouletquer et alii 1994b, 129; Harding 2000, 251-254.

Theoretically, one can not exclude the possibility of a gradual increase in salt exploitation, nor the use of fire to accelerate the concentration of the *saumure*, already in earlier periods. A transition from a direct use of sea water, without any intentional treatment, to the use first of the brine itself, then of “sel recristallisé... briqueté à l’aide d’un moule”⁴⁸ is in fact conceivable. Analogously, the conditioning of salt into more or less standardized forms could date from the Neolithic, because “pains de sels, à partir du sel côtier, [can be obtained] en formant des boules enroulées dans des feuilles, qui étaient ensuite séchées sur les cendres d’un foyer pour qu’elles durcissent”⁴⁹, and, according to Weller and Gouletquer, “la fabrication de pains de sel avait commencé avant les briquetages...l’apparition des premiers moules à sel [could have taken place] à la fin du Néolithique”.⁵⁰

Nevertheless, the spring of an intensified salt production, associated with an extensive use of *moules à sel*, would be the development of more complex societies, where the value of salt as socio-economic and pre-monetary means of exchange / trade would be accentuated.⁵¹ It is almost certain that the symbolic meaning of salt was strictly connected with its utilitarian function from the beginning of exploitation, and highly probable that the use of fire added a “magic” dimension to the transformation of a liquid (the brine) into a solid (salt).⁵² But the data available at present for the Karst area, while suggestive of prestige and symbolism in connection with salt from the Neolithic (if salt extraction actually started in that period), do not show any signs of presence of complex societies before the time of *castellieri*.

Bronze and Iron Age evidence

The identification of *ateliers de briquetages* and *éléments de briquetages* is often highly problematic, and even more so when it is based on a re-interpretation *a posteriori* of contexts never put into relation with salt before.⁵³ This is the case of certain vessels found in the *castelliere* of Eleri, near Muggia,⁵⁴ where surveys, non-stratigraphic investigations and systematic excavations were carried out in the years 1946-54, 1976-81, 1985-92. More or less open conical vessels, usually on a low foot often

⁴⁸ Monah 1990, 389-390.

⁴⁹ Liot 2002, 95.

⁵⁰ Weller et alii 2002, 134.

⁵¹ See, for instance, Monah 2002, 143; Gouletquer 2002, 27.

⁵² Morère 2002, 187.

⁵³ See Harding 2000, 249-251 for comments.

⁵⁴ Il Civico Museo Archeologico di Muggia 1997.

with visible finger prints outside, with smooth inner surface and rough outer walls, of rather coarse fabric and manufacture, normally highly fragmented (Fig. 10-11), have been found in great number in the non-stratigraphic investigations, and in hundreds in layer 20 of the 1985-92 excavations, dated to the Recent Bronze Age, where they represent almost the only attested type of vessel (*ibidem*, and personal communication of Giusto Almerigogna). Numerous spool-shaped pedestals and pedestals with splaying feet and either flat or conical upper part (Fig. 12) come mostly from the non-stratigraphic investigations, during which also remains of grates and feet to sustain them were found (Fig. 13-14). In my opinion all these pieces could reasonably be interpreted as *éléments de briquetages* – the conical vessels as moulds to obtain salt cakes of approximately standardized forms. In any case, the presence of a pond near the access to the *castelliere*, i.e. a source of fresh water, is a further element to support the hypothesis.

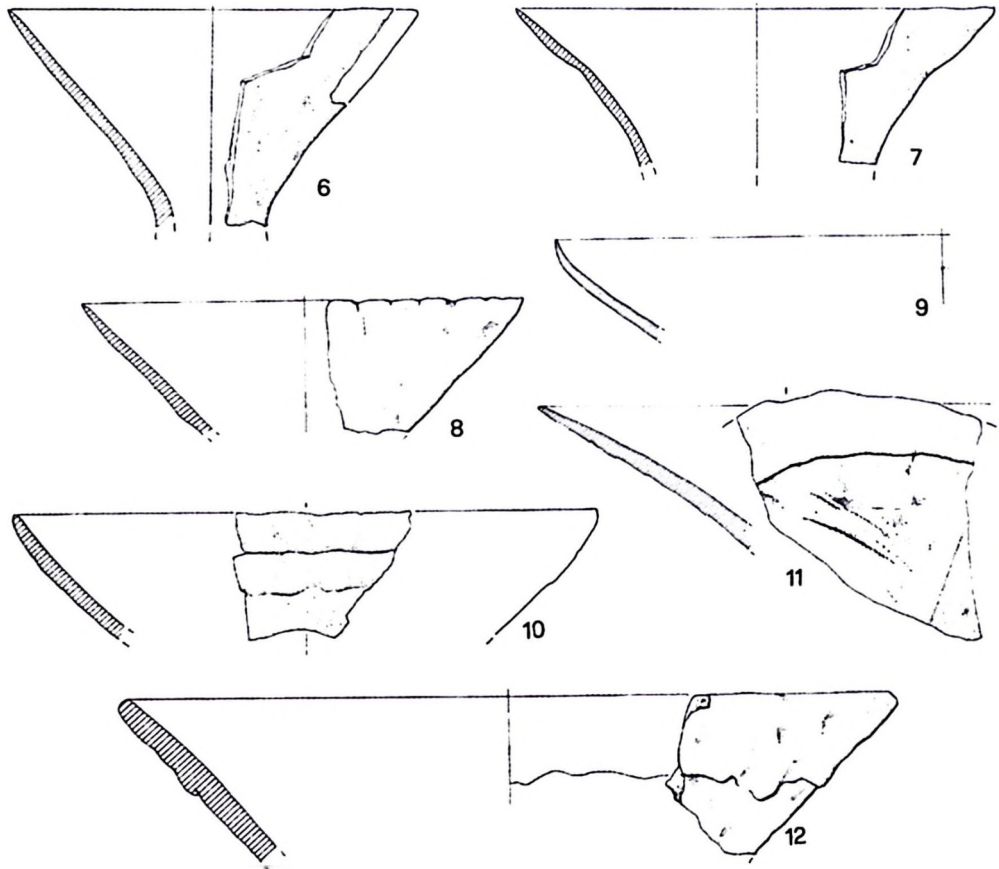


Fig. 10. *Conical vessels interpreted as éléments de briquetages from the castelliere of Elleri (Muggia, Trieste) (after Lonza 1981, Tab. 39)*

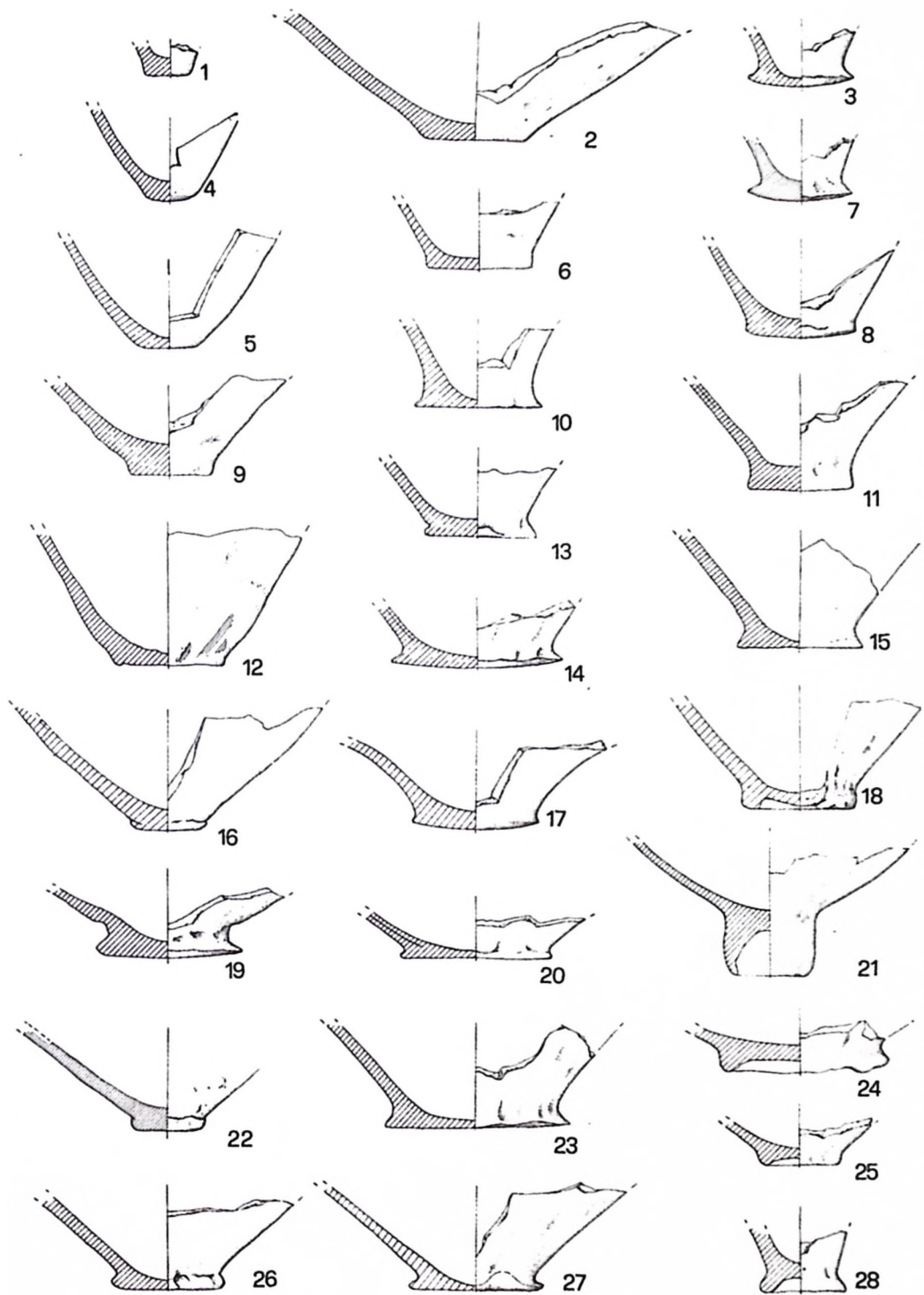


Fig. 11. Lower parts of conical vessels interpreted as *éléments de briquetages* from the *castelliere* of Elleri (Muggia, Trieste) (after Lonza 1981, Tab. 40)

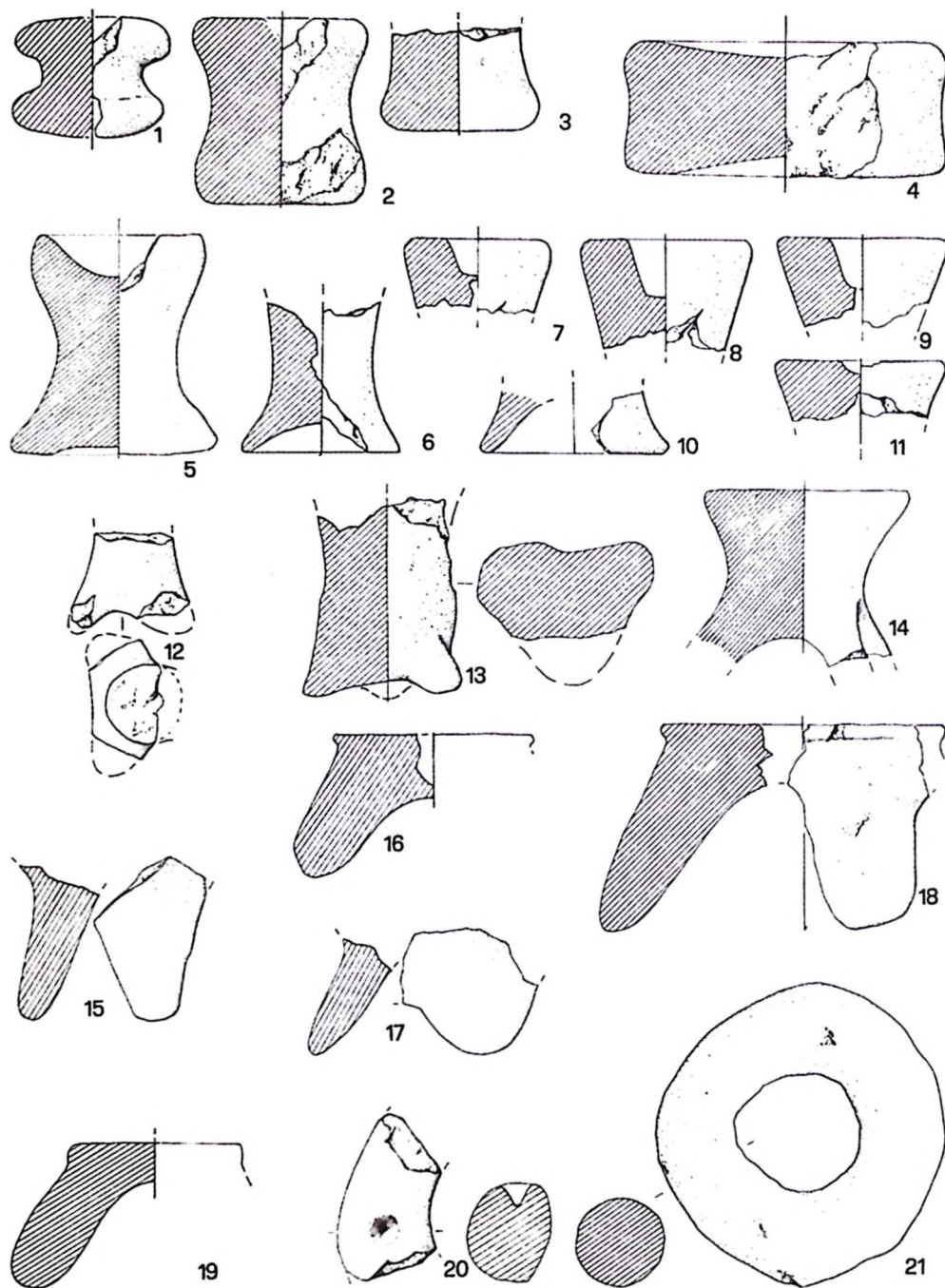


Fig. 12. Spool-shaped pedestals and pedestals with splaying feet from the castelliere of Elleri (Muggia, Trieste) (after LONZA, 1981, Tab. 43)

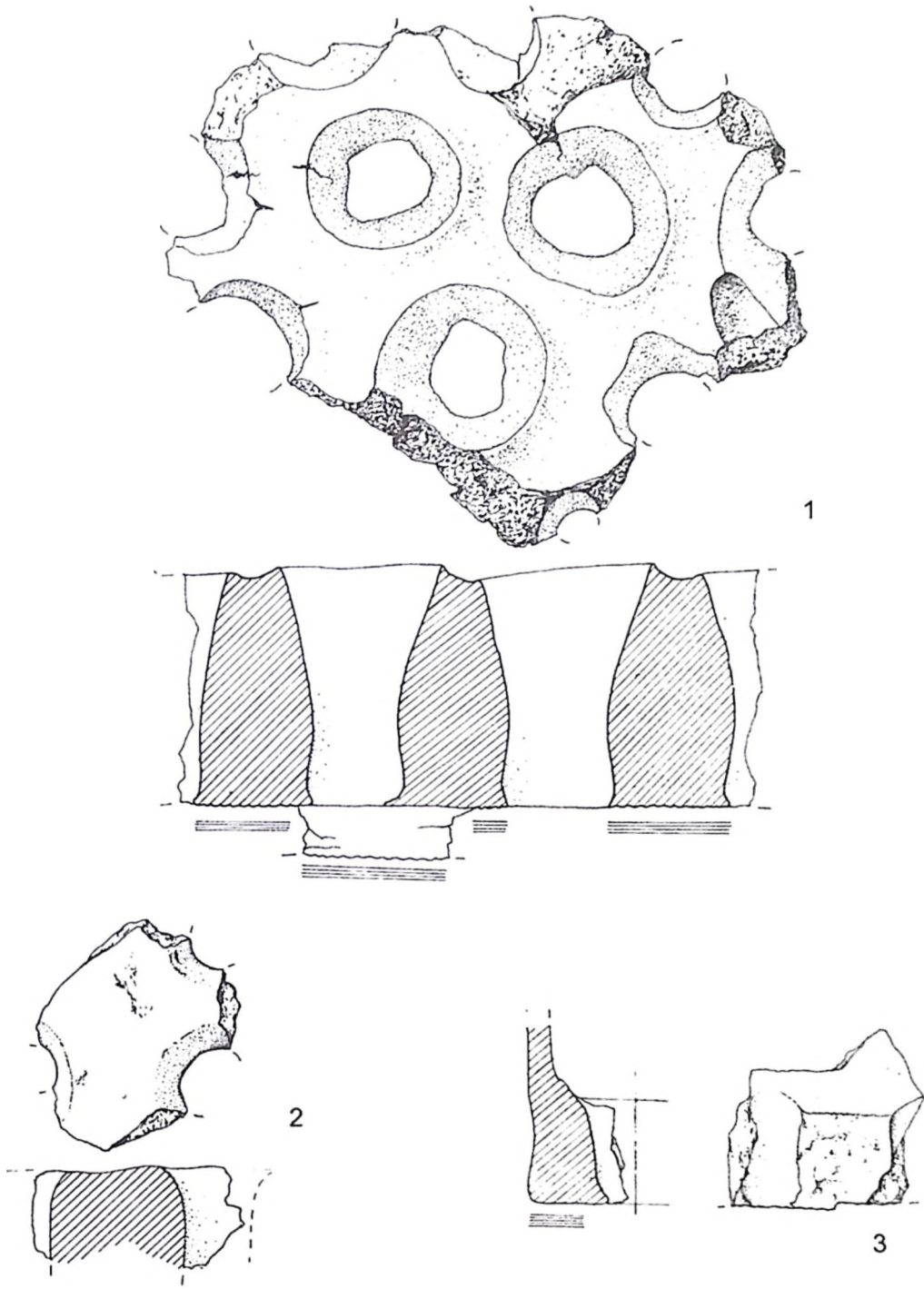


Fig. 13. *Remains of grates from the castelliere of Elleri* (Muggia, Trieste) (after Lonza 1981, Tab. 45)



Fig. 16. Saline at the mouth of Rio Osopo (Valle delle Noghere) in a photo of 1971 (after Me vien in mente, 1997)

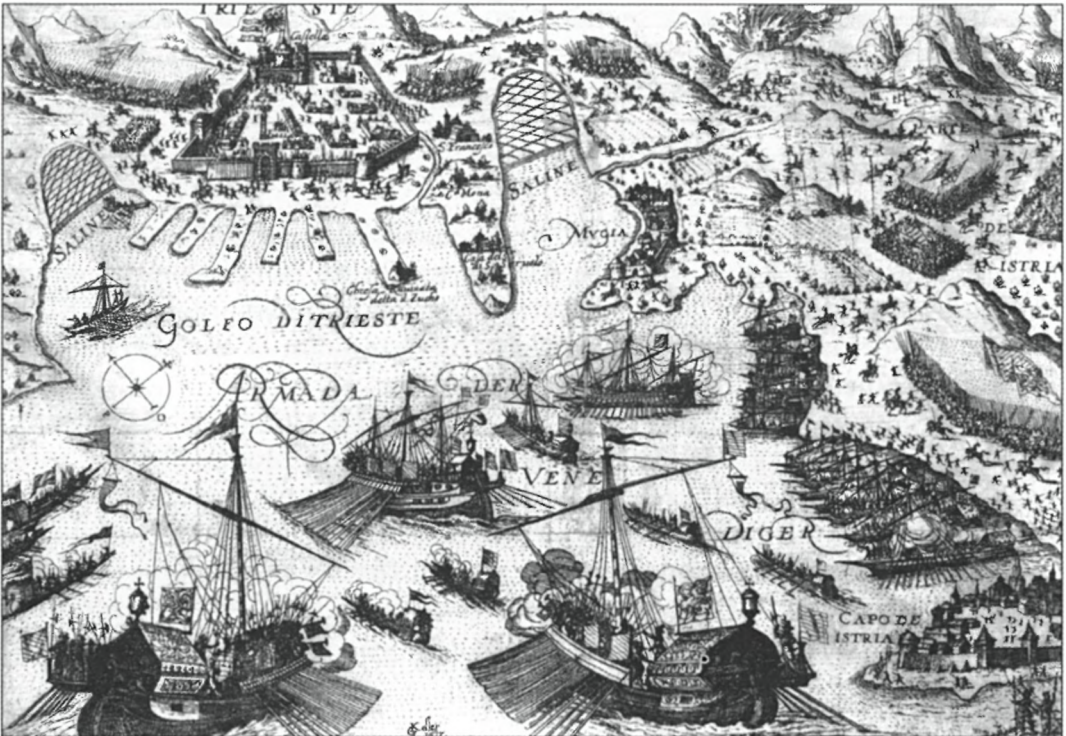


Fig. 17. Saline at the mouth of Torrente Rosandra (Valle di Zaule) and on the western side of Trieste in an engraving dated to the end of the 16th or beginning of the 17th century illustrating a siege of Trieste by the naval army of the Republic of Venice (after Steiner et alii 1986)



Fig. 18: *Valle di Zaule in a photo of the second half of last century*
(after *Me vien in mente* 1997)

like in other places where protohistoric materials are attested, such as Monte d'Oro, Monte San Michele, Mazzarei, Punta Ronco. Nevertheless, the finding at Monte d'Oro of pedestals similar to those present at Elleri is very important,⁵⁸ and might hint at the extension of the territory involved in salt production.

Moreover, single prehistoric objects, but significantly exotic ones, like a fragmentary greenstone shaft-hole axe from Monte d'Oro,⁵⁹ have been found in this *castelliere*, at Monte San Michele and, again, Stramare. More inland, in the Rosandra valley, there is a relatively high number of caves with prehistoric evidence, and among them Grotta delle Gallerie, the site with probably the highest concentration of rare, foreign valuables in the Karst.⁶⁰

⁵⁸ Lonza 1977, 71-73.

⁵⁹ Il Civico Museo Archeologico di Muggia 1997, fig. 8,3.

⁶⁰ Gilli et alii 1993.

In my opinion all these data would suggest that the whole area gravitating towards the Bay of Muggia did have a special place value already in the Late Prehistory and particularly during the Bronze and Iron Ages, and that salt was the main reason for that. There might have been a gradual evolution from occasional seasonal exploitation of salt, combined with pastoralism, in the Neolithic and presumably till the beginning of the Bronze Age, to systematic production from the Middle Bronze Age onwards, i.e. “exploitation régulière du sel, accompagnée d’un phénomène d’attraction de l’habitat et d’un contrôle plus ou moins immédiat de l’accès aux ressources salifères (concentration d’habitats et de sites fortifiés)”.⁶¹

Future research steps

It is interesting to note that moving up towards the source of Rio Osposo, and going beyond the promontory of Muggia, the Grotta di Osposo and the open-air site of Sermin would offer archaeological support to extend the hypothesis to the Slovene territory, similar from the geomorphological viewpoint to the one just discussed.

As I said at the very beginning, my study has focused only on the Trieste Karst so far: an expansion towards Istria would certainly be of great interest, but it requires not only, again, an interdisciplinary approach, but also a strict collaboration with Slovene and Croatian colleagues.

What seems feasible in the near future are archaeometrical analyses of pottery believed to represent *éléments de briquetages*, in particular those elements from Elleri mentioned before and *rhyta*.⁶²

Potential non-invasive geo-physical investigations (multi-frequency electromagnetic profiling, electric tomography, etc.) combined with chemico-physical analyses of samples of the deposits are strongly conditioned by the possibility of distinguishing between natural and disturbed profiles.

In the last 5 years ca. 40 geognostic investigations have been carried out in the area Bonifica delle Noghere and other 40 in the Piana di Zaule, with a goal – the geotechnical and environmental characterization of the soil – far from archaeology: presumably for this reason, for the consequent use of water or other liquids during the drillings to favour the penetration of the borer (water that would have washed away any salt residue), for the fact that salt was not specifically looked for in a recent re-examination of the cores, no traces of salt have been discovered. Per-

⁶¹ Weller 2002b, 170.

⁶² For the types of analysis see Chapman *et alii* 1999-2000, 18; Weller 2002b, 166.

haps, if new investigations were aimed at the search for either salt or deposits of charcoal and ashes mixed with *briquetages*, evidence of ancient salt-producing sites might be found – and the hypotheses presented in this paper might eventually be confirmed.

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Neka razmišljanja o dobijanju soli na području Tršćanskog Krasa u praistoriji

U radu se razmatraju neki aspekti ekonomike Tršćanskog Krasa u prethistoriji s obzirom na geografski položaj, geomorfološku strukturu tla, te odnose sa istočnom jadranskom obalom. Najvažnijim oblicima privređivanja u sjeveroistočnom jadranskom području u kasnijoj prahistoriji smatraju se nomadsko stočarstvo i eksploatacija soli.

Eksploatacija soli i so predstavljaju jedan od osnovnih ekonomskih resursa sjeveroistočnog Jadrana, još od osnivanja Venecijanske republike u 8. stoljeću pa skoro do danas. Na ovim osnovama, ali i u vezi sa skorijim publikacijama arheološkog te etnohistorijskog karaktera, obraduje se ideja, da je so jedna komponenta od najvažnijih vrijednosti Tršćanskog Krasa, već u kasnijoj prethistoriji. Podvučeno je da se u ovoj studiji iznosi prvenstveno radna hipoteza, isključivo zbog nedostatka terenskih istraživanja, koja bi ispitala i potvrdila pomenute mogućnosti.

Od velike važnosti za ovu temu su detaljne studije o proizvodnji i trgovini solju, većinom bazirane na historijskoj dokumentaciji ali i na direktnim observacijama. Mnogi podaci o metodama, građi i predmetima korištenim za procesiranje morske soli, kao i društveno-ekonomski uvjeti života ljudi uključenih u ove aktivnosti, sada su raspoloživi unutar specijalističke literature, te se mogu koristiti za postavljanje hipoteza o načinima eksploatacije soli u prošlosti.

Moderni izvori govore da aktivnosti oko proizvodnje soli počinju početkom maja kada su proljetne kiše manje učestale, tj. tokom jačeg sunčeva grijanja, a završavaju se oko sredine i kraja septembra. O nomadskom stočarstvu, odnosno uzgoju ovaca/koza, kao najdominantnijoj među privrednim aktivnostima prahistorijskih i protohistorijskih zajednica Krasa, zna se na osnovu rezultata paleozooloških istraživanja obavljenih još krajem 19. stoljeća.

Suvremene sedimentološke i mikromorfološke analize tla, koje su vjerovatno najbolji način za dokumentiranje uzgoja životinja, nedavno su za nekoliko veoma važnih pećina (četiri na osnovu direktnih analiza, a ostale nakon kritičke analize objavljenih i neobjavljenih izvora) pokazale da su još od neolita korištene kao staje.

Ako se razmotre spomenuti podaci, te ako ih uporedimo sa prirodnim, historijskim i prethistorijskim nalazima – posebice rasprostiranjem ritona i mapom slanih izvora oko Trsta i u Istri iz 1525. godine koju je izradio Pietro Coppo, zatim sa popisom slanih izvora na Balkanu, nomadskim kretanjima na području Tršćanskog Krasa, Istre i Slovenije, podacima iz neolitičkih lokaliteta na Dinarskim Alpama, te sa savremenim nomadskim kretanjima na širem području od Grčke do sjevernojadranskih regija, može se pretpostaviti da je Tršćanski Kras bio sjeverozapna predstraža nomadske mreže koja je već u neolitu mogla obuhvatati prostor od više stotina kilometara. So je bez sumnje bila jedan od ključnih elemenata cijelog tog sistema.

Pretpostavlja se da su stočari znali za privredni potencijal ove regije kroz lično iskustvo kao i usmenu tradiciju koja se prenosila sa generacije na generaciju, sa grupe na grupu, prilikom trgovačke razmjene, poklona, ženidbe, ceremonija. Shodno tome redovno su dolazili skupljati so stvorenu isparavanjem u prirodnim bazenima duž obale. Prikupljanje morske soli u periodu godine kada je sunce najjačeg intenziteta, u kasno proljeće i ljetu, ne implicira uređenje prostora niti korištenje alatki, koje bi se mogle sačuvati do danas. Vjerovatno je da su tadašnje, kao i suvremene alatke za prikupljanje morske soli, bile od drveta.

Povremena sezonska eksploatacija karakteristična za neolit traje vjerovatno sve do početka bronzanog doba. Na bazi gore izloženih podataka može se prihvatiti da je korištenje morske soli imalo prvenstveno za cilj zadovoljavanje potreba lokalne zajednice i pastirskih grupa koje su se kretale preko Krasa. To isključuje intenzivnu proizvodnju soli za izvoz.

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