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The sources and distribution of archaeological obsidian in Northern Italy

Introduction

This paper describes further studies carried out at the University of Bradford as part of a continuing project on obsidian distribution and provenance. Northern Italy is an important area in terms of obsidian since it lies at the northern boundary of the Mediterranean source distributions. The few determinations of geological provenance carried out on artefacts from this area have suggested that Sardinian obsidian was used almost exclusively here (Cornaggia et al., 1963; Dixon et al., 1968; Hallam et al., 1976). Two exceptions, pieces of Pontine Island obsidian, have been identified at Vlačica Jama near Trieste and Arene Candide in Liguria (Dixon et al., 1968; Cornaggia et al., 1963 respectively). The aims of this report are to give a detailed account of the archaeological occurrences of obsidian in this area and to present further analyses.

Archaeological obsidian in Northern Italy

Finds of obsidian are comparatively rare in Northern Italy. Some 1200 pieces have been reported from a total of 40 sites (listed in Table 1) and of these 950 came from one site, Pescale in Emilia, leaving a mere 250 pieces spread amongst the remaining 39 sites. Details of the contexts of these obsidians are given in Appen-

dix 1. It should be noted at the outset that the cultural attribution of many of the obsidian finds is uncertain and most come from sites with multiperiod occupation, where they are often surface finds or, in the case of excavated finds, unstratified. Even where a sample of obsidian has been found in a stratified layer on a multi-period site, the quantities are such that it is always possible that it may be derived from a lower level or even introduced from a higher one. Only where a number of fragments clearly cluster in one phase on such sites, as at Arene Candide or Pescale, can attribution be given with any security. Campegine remains one of the most satisfactorily datable obsidian finds, being stratified in a one-period occupation. The available data on the chronology of North Italian obsidian finds and sites is summarized in Tables 2a and 2b.

Probably the earliest obsidian from Northern Italy is the scraper found in the Final Epigravettian, Mesolithic layer V at Arma dello Stefanin, Liguria. This early evidence in the Western Mediterranean for the exploitation of obsidian sources is supported at the site by the fact that level V is separated from the Neolithic levels by an intervening Epigravettian Layer IV and is unlikely to be an intrusion from Neolithic levels.

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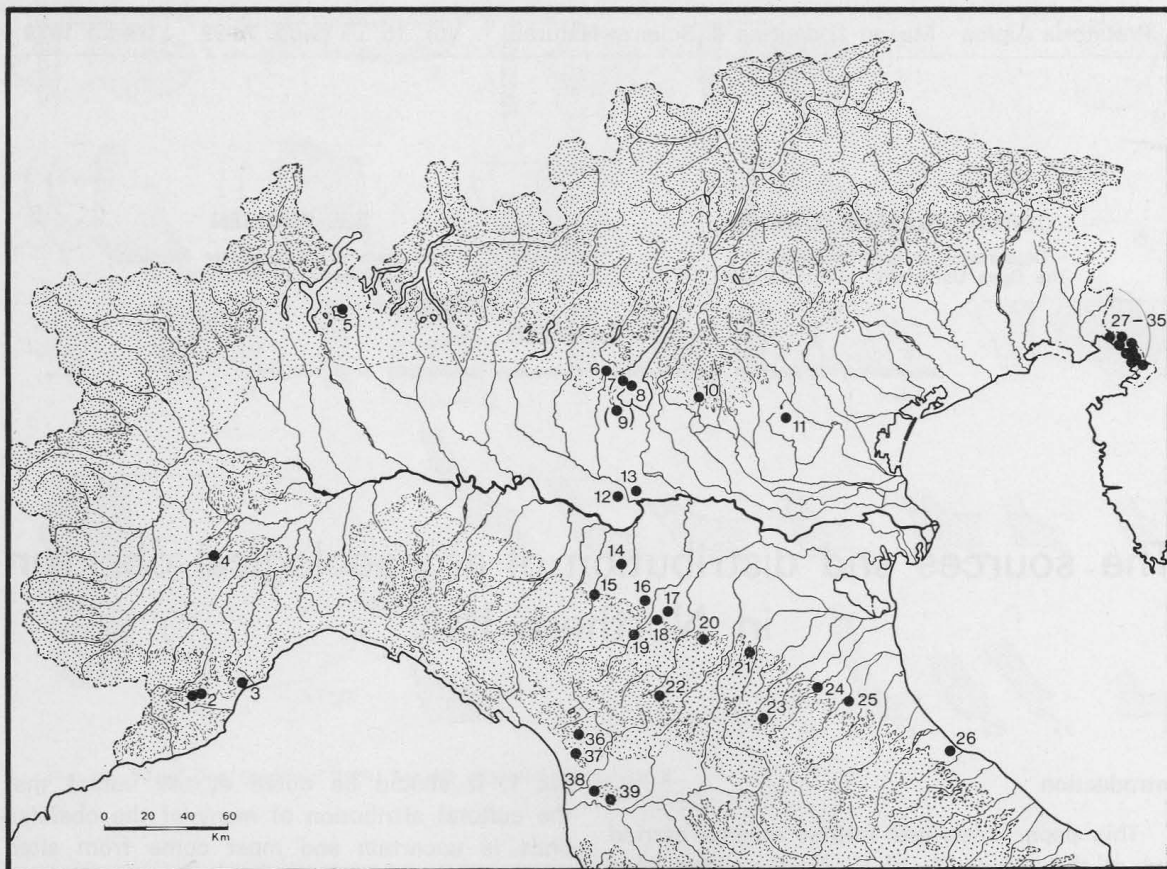


Fig. 1 - Distribution of sites producing obsidian in Northern Italy.

The C14 dates for the Final Epigravettian point to a period immediately preceding the appearance of the Neolithic. In this respect it may be comparable with the evidence for the beginning of the obsidian trade in the Aegean where obsidian exploitation started during the final stages of the Mesolithic at Franchthi just prior to 6000 B.C. (Aspinall et al., 1972).

The earliest Neolithic obsidian is again found in Liguria, in Impressed Ware contexts at Arene Candide, where it occurs throughout the whole Neolithic sequence. The contemporary Early Neolithic groups of the Po plain, the Fiorano, Vhò, Fagnigola, Isolino and Gaban groups, were not receiving obsidian as far as we can judge from currently available data. There is, however, evidence of long distance procurement of raw materials at this stage with jade and other alpine rocks being used for axes in sites on the Central Po Plain (e.g. at Vhò; Bagolini et al., 1977).

During the initial stage of the Square-mouthed Pottery culture (Finale-Quinzano), obsidian is again present in Liguria at Arene Candide

and possibly for the first time in the Po Valley where the obsidian at Alba may date to this phase. We have more certain evidence for obsidian imports into the Po Plain in Middle VBQ times, where it is certainly associated with this phase at Campegine, Campo Balano and Casatico and probably at Chiozza. It can be seen from the summary of contexts in Table 2b that, where the obsidian can be assigned to a specific period within the Square-mouthed Pottery culture, four out of the five contexts are the middle phase, the Rivoli-Chiozza phase (c. 3500 B.C.), with the sites being predominantly to the south of the River Po in Emilia and Romagna. Besides being geographically closer to the obsidian sources, both these regions lack good quality local flint sources, a factor in the use of obsidian in this region. It has been demonstrated by geological analysis that most of the flint from Campegine, a middle VBQ site in Emilia, was imported from pre-Alpine sources, probably the Monti Lessini area in the Veronese (Crema-schi in Cazzella et al., 1976). Rock crystal, probably from the western Alps, was also being

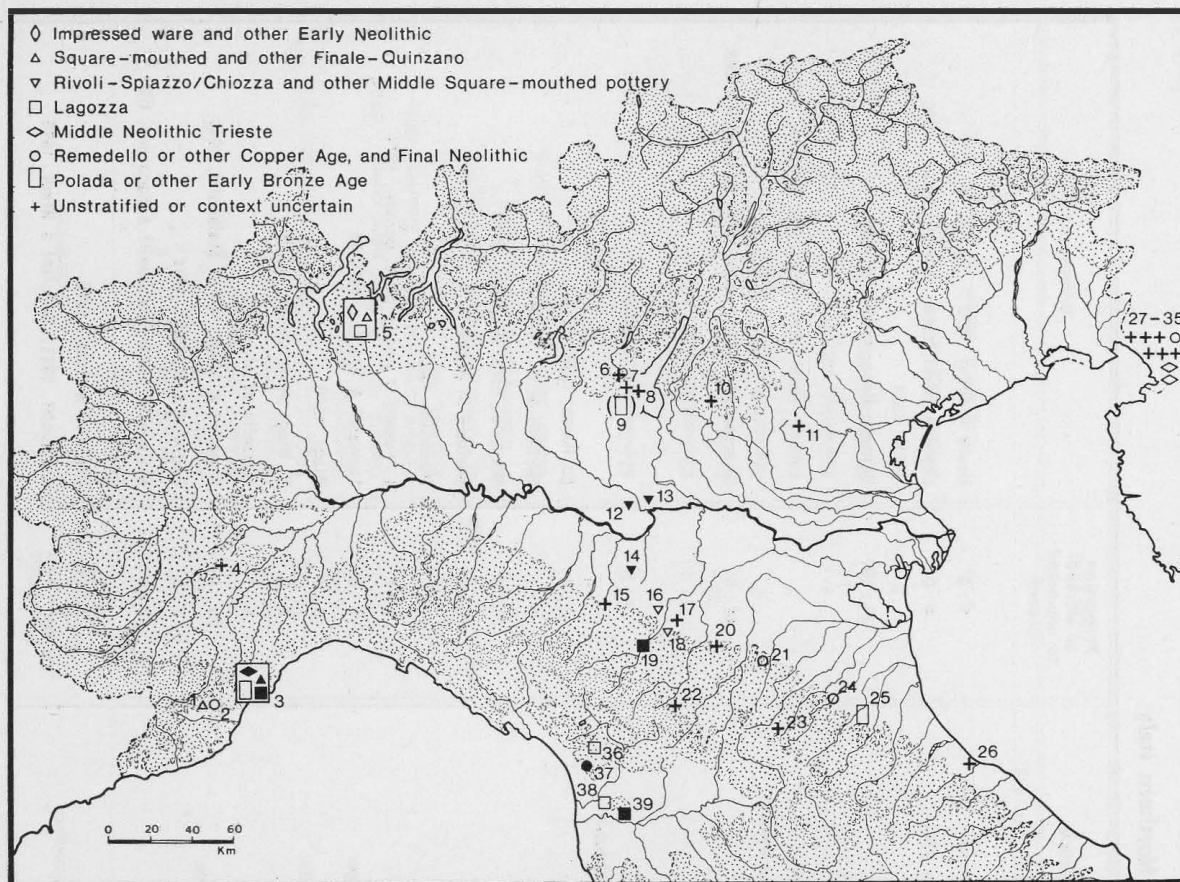


Fig. 2 - Distribution of obsidian finds in Northern Italy by period.

used at Campegine at this time. This reliance on foreign raw material may have contributed to the popularity of obsidian in this region.

So far no obsidian from Square-mouthed Pottery contexts has been found to the north of the Po, apart from the slightly dubious association at Isolino in Lombardy and the uncertain association at Bellori. The presence of some of the most prolific flint deposits in the whole of Italy in the Central Pre-Alps, especially in the Monti Lessini, may have been an inhibiting factor on the trade in obsidian north of the Po River in VBQ times.

That the VBQ, especially in its middle phase, was involved in widespread trade contact can be further demonstrated by its trans-alpine links with Aichbühl and other contemporary groups North of the Alps (Barfield, 1973). Spondylus beads and jade axes may have been part of this traffic (Barfield, forthcoming).

The obsidian from the Trieste caves cannot be closely related to well-defined cultural assemblages, since firstly the cultural sequence has not been very clearly defined or dated, and

secondly several pieces are from unstratified contexts. There seems, however, to be a strong correlation with the Middle Neolithic Vlaška group.

The Late Neolithic obsidian in Northern Italy is closely linked to the Lagozza culture. The total volume of obsidian imports increases during this phase (Table 2a), mostly as a result of the 950 pieces from Pescale and a possible 52 Lagozza pieces from Grotta dell'Onda. Also, it is at this stage that obsidian may be in more widespread use north of the River Po (uncertain associations at Isolino, Monte Covolo, Rocca di Manerba). However, there is an overall decrease in the number of sites with obsidian in the Lagozza period, from eleven in the Middle Neolithic, to six in the Late Neolithic.

The question of post-Neolithic use of obsidian in Northern Italy is nuclear. Several associations occur apparently with Chalcolithic assemblages although none of these is in a secure stratigraphical position. The obsidian from Persolino would appear to be with Copper Age material, but the precise cultural definition of

Obsidian finds in Northern Italy

Site	Province	Number of pieces of obsidian	Cultural context	Proportion of worked to unworked pieces	References
Arma dello Stefanin	Savona	1	Final Epigravettian	1 : 0	Leale Anfossi, 1972
Arma di Nasino	Savona	4	Impressed Ware With VBO and Final Neolithic	4 : 0?	Leale Anfossi, 1968; Alessio et al., 1968
Arene Candide	Savona	39	Impressed ware (??) Middle Neolithic (??) Late Neolithic (15?) Polada (2) Remainder context unknown	20 : 19?	Bernabò Brea, 1946 and 1956
Isolino di Varese	Varese	49	Early Neolithic? (2) VBO? (5) Proto-Lagozza? (1) Lagozza? (3) Copper Age? (1) Remainder context unknown	44 : 5	Guerreschi, 1979; Fusco, 1978; Malavolti, 1948
Alba	Cuneo	1	?	0 : 1	Lo Porto, 1956
Monte Covolo	Brescia	1	Late Neolithic?	0 : 1	Barfield et al., 1975-76
Rocca di Manerba	Brescia	1	Lagozza?	1 : 0	Borrello, 1973; Brogiolo, 1973
Sasso di Manerba	Brescia	2	?	0 : 2?	Barfield in press
Polada	Brescia	?	Early Bronze Age?	?	Radmilli, 1963
Bellori	Verona	1	?	0 : 1	L. Fasani & Aspes pers. comm., 1974
Grotta G. Perin	Vicenza	1	Lagozza or Copper Age	1 : 0	Leonardi & Broglio, 1962-63
Casatico di Marcaria	Mantua	9	Middle VBO	8 : 1	Biagi, 1978
Spineda	Cremona	2	Middle VBO	2 : 0	P. Biagi pers. comm., 1979
Razza di Campegine	Reggio Emilia	6	Middle VBO	5 : 1	Cazzella et al., 1976
San Polo d'Enza	Reggio Emilia	40	?	25 : 15	Bagolini & Biagi, 1976; Malavolti, 1948
Chiozza	Reggio Emilia	2	Middle (?) VBO	2 : 0	Bagolini & Barfield, 1971
Villa Agazzotti	Modena	2	Neolithic	2 : 0	Malavolti, 1948; Mansuelli & Sacarani, 1961; Scarani, 1963
Fiorano	Modena	4	VBO?	3 : 1?	Bagolini & Biagi, 1976
Pescale	Modena	ca. 950	Lagozza	ca. 600 : 350	Malavolti, 1953; Bagolini & Biagi, 1976

Site	Province	Number of pieces of obsidian	Cultural context	Proportion of worked to unworked pieces	References
Bazzano	Bologna	1	?	0 : 1	Scarani, 1963
Grotta Farneto	Bologna	1	Copper or Bronze Age	0 : 1	Malavolti, 1948
Rocca Corneta	Bologna	1+?	?	0 : 1	Scarani, 1957 & 1963
San Giovanni in Misileo	Ravenna	1	?	0 : 1	Scarani, 1973
Villa Persolino	Faenza	20	Copper or Bronze Age	10 : 10	Malavolti, 1948; Orsi, 1903; Scarani, 1963
Bertarina di Vecchiazzano	Forlì	3	Bronze Age?	0 : 3	Santarelli, 1886
Misano Adriatico	Forlì	1	Middle Neolithic	0 : 1	Gentili, 1972; P. Biagi pers. comm., 1976
Grotta all'Onda	Pisa	52	Lagozza?	?	Grifoni Cremonesi, 1971; Courtin, 1967; Borrello, 1977
Grotta della Tartaruga	Trieste	3+?	Neolithic	?	G. Almerigogna pers. comm., 1975
San Oulrino	Trieste	1	Neolithic?	1 : 0	P. Cassola pers. comm., 1975
Vlaška Jama (= Rothgartle Hohle & Grotta del Pettlorosso)	Trieste	4+?	Middle Neolithic?	?	Moser, 1894; Barfield, 1971a, 1971b
Grotta dell'Orso di Gabrovizza	Trieste	1	?	1 : 0	Marchesetti, 1890
Riparo di Monrupino	Trieste	3	Vlaška Group	2 : 1	Cannarella et al., 1973-74
Grotta Lonza	Trieste	1	?	?	Lonza, 1975
Grotta degli Zingari	Trieste	1	?	?	Marzolini, 1972
Jama na Dolech Nabresna	Trieste	?	Neolithic	?	Moser, 1903; Malavolti 1952; Barfield, 1971
Grotta dell'Ansa	Trieste	1	Copper Age	?	Marzolini, 1975-77
Buca delle Fate Sud	Lucca	1	Copper Age?	1 : 0	Fornaclari, 1966
Grotta del Leone	Pisa	?	?	?	Radi, 1974
La Romita di Asciano	Pisa	1	?	1 : 0	Peroni, 1962-63
Grotta Pollera	Savona	3+?	Early Neolithic Level XXII (1) Impressed Ware (1) Middle Neolithic Level XVII (1)	3 : 0	P. Biagi pers. comm. to S.E.W., 1979
Totals		1.215		738 : 416	

¹⁾ VBO = Vasi a Bocca Quadrata (Square-mouthed Pottery Culture).

²⁾ 'Proportion of worked to unworked pieces' means proportion of retouched pieces and blades to waste pieces and cores.

TABLE 2a

Chronology of obsidian finds in Northern Italy

		Mesolithic (Final Epi- gravettian)	Neolithic (period unknown)	Early Neolithic	(Middle Neolithic)					Late Neolithic (Lagozza)	Copper Age	Early Bronze Age	Unknown
					Danilo/ Vlaška	VBO (Phase unknown)	Early VBO	Middle VBO	Late VBO				
No. of obsidian finds	dating fairly certain	1	5	2	3	2	7	15	0	950*)	0	0	—
	dating uncertain	0	1	9	4	9	0	2	0	73	3	5	—
Totals		1	6	11	7	11	7	17	0	1023	3	5	122+?

TABLE 2b

Chronology of sites with obsidian in Northern Italy

		Mesolithic (Final Epi- gravettian)	Neolithic (period unknown)	Early Neolithic	(Middle Neolithic)					Late Neolithic (Lagozza)	Copper Age	Early Bronze Age	Unknown
					Danilo/ Vlaška	VBO (Phase unknown)	Early VBO	Middle VBO	Late VBO				
No. of obsidian finds	dating fairly certain	1	3	1	1	2	1	3	0	1	0	0	—
	dating uncertain	0	1	2	1	2	0	1	0	5	3	3	—
Totals		1	4	3	2	4	1	4	0	6	3	3	18

A site may be included in the table more than once, where it has obsidian in more than one cultural context.

VBO = Square-mouthed Pottery.

*) These 950 are from Pescale.

TABLE 3

Proportions of obsidian source material in Northern Italy

Site	Period	Sardinia			Lipari	Pontine Is	Carpa- thian	Unknown source
		SA	SB	SC				
Arene Candide	Early and Middle Neolithic & Lagozza		1* (MN) 1 (EN)	1 (EN)	1 (Lag)	2+1***		
Bellori	?							1
Chiozza	VBO				2			
Fiorano, Cava Nuova	VBO?				3			
Grotta dell'Ansa	Copper Age?				1			
Grotta Lonza	?				1			
Grotta G. Perin	Lagozza or Copper Age	1*						
Grotta della Tartaruga	Neolithic				1		1	
Grotta degli Zingari	?				1			
Isolino di Varese	Neolithic	12+1*			1			
Misano	Middle Neolithic							1
Monte Covolo	Late VBO/ Lagozza?	1*						
Pescale	Lagozza?	5+2*						
Razza di Campegine	Middle VBO				3			
Riparo di Monrupino	Middle Neolithic				2			
Rocca di Manerba	Lagozza?	1*						
San Polo d'Enza	?	8+1		1*	1			
San Quirino	Neolithic?				1			
Villa Agazzotti, Formigine	Neolithic		1		1			
Vlašca Jama	Middle Neolithic?				2	1**		
Grotta Pollera	Early and Middle Neolithic			1 (EN) 1 (MN)	1 (EN)			
Totals		32	3	4	22	4	1	2

* Data from Hallam et al., 1976.

** Data from Dixon et al., 1968.

*** Data from Cornaggia et al., 1963.

VBO = Square-mouthed Pottery Culture.

this material is uncertain. The obsidian from Sasso di Manerba is unstratified, but may relate to the Chalcolithic assemblage on the site. A single sherd of Serra d'Alto pottery from this site cannot be related chronologically to other material on the site, although a correlation with the obsidian in this case would be an attractive hypothesis. Other possible Copper Age associations include Isolino and Grotta dell'Ansa.

As regards Bronze Age obsidian, the Grotta Farneto piece may be of this period since occupation prior to the Early Bronze Age is not at

all certain. The Bertarina site may have pre-Bronze Age levels, but the obsidian here is nevertheless tentatively assigned to the Early Bronze Age. The find of obsidian at Polada has not been verified.

The question of whether the obsidian was imported as unworked pieces or as finished artefacts is difficult to resolve without more reliable information on the proportions of waste pieces recovered from sites. However, the available information is included in Table 1, column 5, which lists the proportions of worked of fi-

nished pieces of obsidian from a site, to waste pieces and cores. Unretouched blades are included in the first category, since their predominance in the obsidian assemblage at many sites (see Appendix 1) suggests that they were used in this state. On the basis of these figures, there is little evidence for on-site working; the number of waste pieces is only about half the number of finished pieces, suggesting the import of largely finished artefacts. The picture may, of course, be distorted by the discarding of waste chips and flakes in older excavations. It is notable, however, that even recent excavations with thorough finds recovery procedures have sometimes produced single pieces of obsidian, for example, at Monte Covolo and Rocca di Manerba.

Analysis of obsidians

Fifty-seven pieces of archaeological obsidian were analysed for five trace elements and two major elements, in order to compare their compositions with obsidians from the major geological sources and thus determine the place of origin of the archaeological pieces. Analysis was done by Instrumental Neutron Activation (INAA), at the University of Bradford, following the procedure described by Hallam et al. (1976), but using a different multi-element pottery standard, NPS-1, prepared at the Bradford laboratories and calibrated against Perlman Standard Pottery (Hunter, 1975). The analysis was non-destructive and samples were returned to museums 1-2 years later. Precision is 5% for La, 6-8% for Na, Sc and Fe and 10-15% for Co, Cs and Ce.

The results were compared directly with earlier analyses carried out at Bradford using the same technique (Hallam et al., 1976) which included both geological source obsidian from the Mediterranean and archaeological pieces. It was not therefore necessary for us to analyse further geological specimens at this stage. Analytical results are given in full in Appendix 3 and shown graphically in Figure 2, where average figures for the Mediterranean obsidian source groups are also given (data from Hallam et al., *op. cit.*). These source groups are: Lipari (Li); Pontine Isles (P.I.); Pantelleria (Pa); and three chemically distinct groups all from Sardinia and all believed to come from Monte Arci, designated SA, SB and SC. The exact locations within Sardinia of these last 3 sources have not yet been established.

Comparison with Hallam's data was excellent and it could be concluded that 25 of our samples belong to group SA, 2 to SB, 3 to SC, 22 to Lipari and 2 to the Pontine Isles sources. In addition 1 piece was assigned to a Carpathian source group from South-eastern Slovakia (Carpathian 1). This Carpathian piece, which may be seen to differ clearly analytically from the Mediterranean sources (Figure 2; Appendix 3), was identified by comparison with 47 analyses of Central European source obsidian, carried out at the University of Bradford (Thorpe, 1978). A further 2 samples could not be matched with any known source. They were compared with analyses of Aegean, Armenian and Near obsidians (data in Aspinall et al., 1972; Thorpe, 1978; Mc Daniels, 1976), but still could not be provenanced. Table 3 and Figure 3 summarize all the data now available on the provenance of North Italian obsidians.

Trade patterns and mechanisms

The work of Hallam et al. (1976), based on relatively few analyses, indicated the almost exclusive use of Sardinian obsidian in North Italy. However, now that the more detailed study proposed in that article has been carried out for this area, it is clear that the picture has changed considerably. Sardinia is only 1 of 4 sources providing obsidian for Northern Italy. Although the majority (39 analysed pieces, 32 of them from the SA source. Table 3) still comes from Sardinia, a significant proportion (22 pieces) comes from Lipari, with the Pontine Isles and Carpathians providing a very small amount in coastal areas. It is important to note that in fact more sites have been shown to be using Liparian obsidian than Sardinian: 15 sites with Lipari material, 9 with Sardinian. The areas occupied by these two source distributions are not separate, but overlap considerably (figure 3). The situation is further complicated by several sites which utilized obsidian from more than one source, for example Arene Candide with SB, SC, Lipari and Pontine Isles obsidian or San Polo with SA, SC and Lipari. Perhaps the most interesting overlap of sources is that seen at Grotta Tartaruga where Liparian and Carpathian obsidians are both found.

A study of the chronological variation in source use over such a large period (7th to 2nd millennium) is made difficult by the lack of securely stratified and dated obsidian finds in Northern Italy. On present evidence we see that

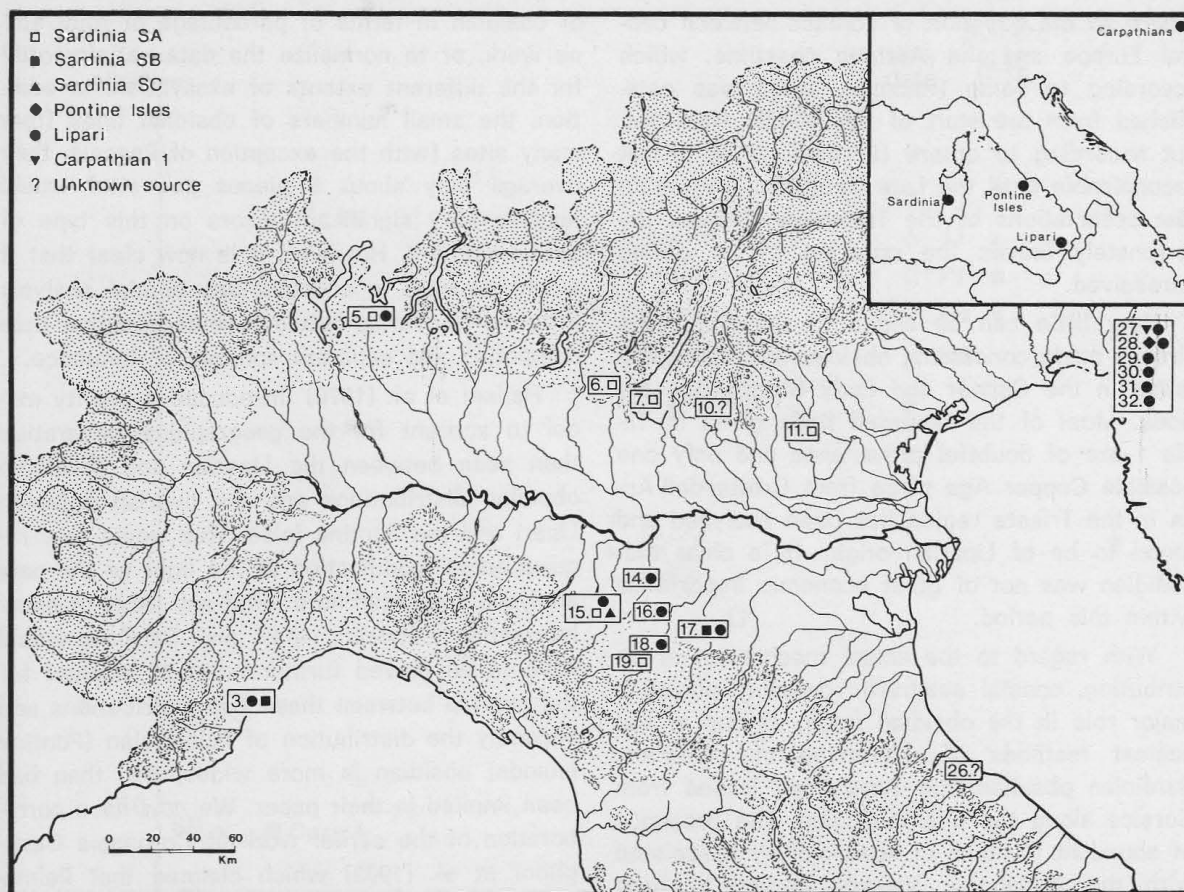


Fig. 3 - Attribution of archaeological obsidian samples to geological source groups, using I.N.A.A. Data from Hallam et al. (1976) are average values for each source group, including both archaeological and geological samples. Not all SA analyses are plotted due to lack of space.

Sardinian obsidian is the first to appear in the archaeological record (at Arene Candide and Grotta Pollera), though it is interesting to note that this is SB and SC material, not the later more popular SA type. This occurrence of Sardinian obsidian is not surprising considering it is the nearest available source and also its early use on Corsica. These early finds therefore suggest traffic directly connected with sea-faring and little penetration of areas away from the Ligurian coast.

Sardinian obsidian continued in use throughout the Neolithic period, into the Lagozza culture, when it seems to predominate in abundance over the other sources. This link between Lagozza and Sardinia is seen also in its western aspect, the southern French Chassey culture (Hallam et al., 1976) and it is interesting to note that at Pescale, where all 7 analyses to date have proved to be Sardinian, the Lagozza pottery shows features which link the assem-

blage to the Southern French Chassey and which are not present elsewhere in North Italy (Borrello, 1978). In a recent article Tanda has demonstrated that jade was probably one of the commodities reciprocated in the obsidian trade from Sardinia (Tanda, 1978).

By the Middle Neolithic period Liparian obsidian was also reaching North Italy and at this stage seems to predominate over Sardinian (5 VBQ and Vlašca sites have Liparian obsidian, as opposed to only 2 with Sardinian). The evidence suggests, therefore, at least among sites in the Po Plain, a culturally and chronologically linked source distribution, with Lipari material of greater importance in VBQ sites and Sardinian in Lagozza sites.

Pontine Isle obsidian is at present restricted to coastal sites in Liparia and the Trieste area and does not seem to have penetrated inland.

The occurrence of Central European obsidian at the Grotta della Tartaruga is of interest with

regard to the question of contact between central Europe and the Adriatic coastline, which according to some (Radmilli, 1973) was established from the start of the Middle Neolithic, but according to others (Barfield, 1971) is not recognisable until the Late Neolithic. The uncertain associations of the Tartaruga obsidian unfortunately leaves the question of its dating unresolved.

Very little can be added to the comments already made concerning obsidian source exploitation in the Copper and Early Bronze Age periods. Most of the recorded finds given in Table 1 are of doubtful provenance and only one possible Copper Age piece from Grotta dell'Ansa in the Trieste region has been analysed and found to be of Liparian origin. It is clear that obsidian was not of great economic importance within this period.

With regard to the actual mechanism of distribution, coastal sea-traffic probably played a major role in the obsidian trade, as one of the easiest methods of dispersion of materials. Sardinian obsidian may have been landed from Corsica along the Ligurian coast. The presence of abundant obsidian at sites closely associated with the Appennine Valleys leading to pass routes, such as San Polo and Pescale on the Secchia, and the presence of isolated finds of obsidian high in the Appennines further south, suggest the use of a number of routes across the mountains, perhaps from landfalls in Tuscany and southern Liguria. Liparian obsidian may have been brought in stages up either east or west coasts of Italy, making use of the same Appennine passes from a western coastal route, or alternatively may have been derived from even more indirect down-the-line trading links with central and southern Italy, where Liparian obsidian was widely used (Hallam et al., 1976). The predominantly Liparian obsidian in the Trieste region would probably be derived from Adriatic trade; obsidian occurs on Danilo sites further south on the Dalmatian coast and trans-Adriatic traffic can be demonstrated for this area. As yet none of this obsidian from the Dalmatian coast has been made available for analysis, but its most likely sources are the Liparian and Pontine isles.

The sparseness of reliable numerical data on North Italian obsidian finds makes spatial analysis difficult for this area. In the majority of cases, it is not possible to express the amounts

of obsidian in terms of percentage of total stone work, or to normalize the data satisfactorily for the different extents of excavation. In addition, the small numbers of obsidian finds from many sites (with the exception of Pescale, they average only about 6 pieces per site) would lead to very significant errors on this type of data treatment. However, it is now clear that it would be best to consider any spatial analysis in terms of overlap between sources, rather than competing and separate spheres of influence.

Hallam et al. (1976) introduced a gravity model to account for the geographical separation then seen between the Liparian and Sardinian obsidian distributions and the overlap between Lipari and the Pontine Isles. This would now require some modification in the light of the new analyses presented here. First any locus of equal interaction between Lipari and Sardinia would have to be moved further north to account for the overlap between these two distributions and secondly the distribution of Palmarolan (Pontine Islands) obsidian is more widespread than had been implied in their paper. We now have corroboration of the earlier work of Cornaggia Castiglioni et al. (1963) which claimed that Palmarolan obsidian was present at Arene Candide in Liguria. Two of the samples excavated recently by Tinè and Maggi and assigned to the Middle Neolithic period are Palmarolan in origin. These results would not be sufficient to alter the Pontine Isles interaction zone, but the combination of these data together with earlier findings of Pontine Island obsidian on the Tremiti Islands and in the Trieste region are strongly suggestive of maritime activity and weaken the argument for the distributions of Pontine Island and Lipari obsidians being governed by the same inverse power law. This model requires contemporaneous exploitation of both types of obsidian at the one site and implies a limit to the size of the lithic tool kit with a preference for one type of material. There is no evidence as yet to test the model and it would be difficult to distinguish between competition and different rates of fall-off from the two sources.

The dominance of the obsidian finds in North Italy by the 950 pieces from Pescale provides a problem in any theory of trade mechanism. Although insufficient data is available to allow us to compare the ratios of obsidian to flint at this site with others in Northern Italy, there is

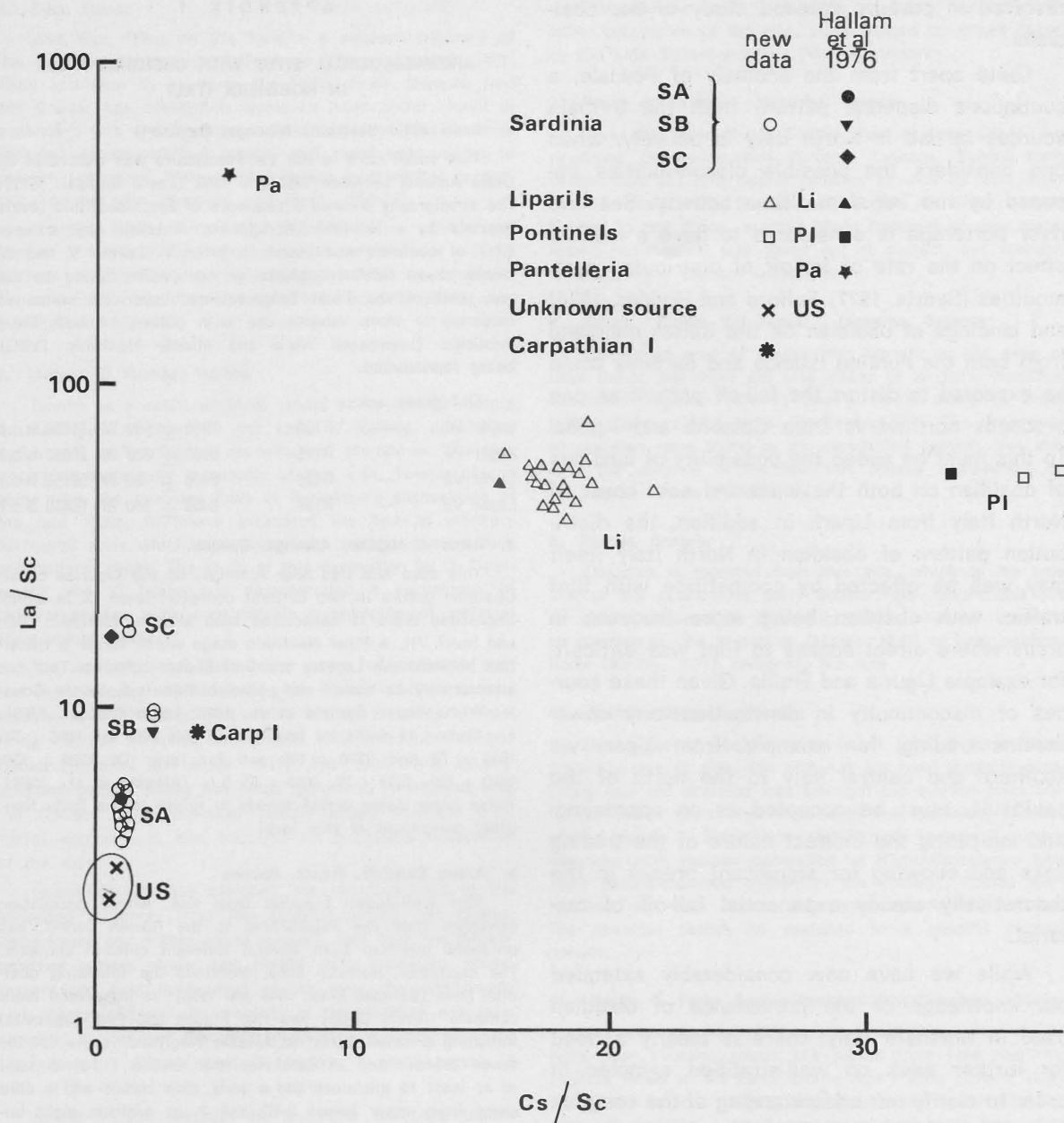


Fig. 4 - Geological provenance of obsidian on sites in Northern Italy.

clearly a marked contrast between Pescale and other sites in the Emilian Plain. This anomalous site could be incorporated in a down-the-line model by considering Pescale as a « central place » (Renfrew, 1975), collecting and re-distributing obsidian to the surrounding region. Unless we assume that the inhabitants of Pescale were visiting the sources themselves (unlikely in view of the inland position of the site), it is necessary to invoke one of several models of trade to account for the discontinuity in obsidian

abundance. Of those listed by Renfrew (1975) either freelance (middleman) or emissary trading perhaps with an additional middleman would allow a long-distance marine trade without the increasing sophistication implied by colonial trade and part-of-trade mechanisms. The middleman concept is not entirely satisfactory as an explanation for Pescale since the effect of middleman trading is more likely to reduce the rate of fall-off within the trading distance of the middleman. Pescale is simply an anomaly which might be

resolved in part by detailed study of the obsidians.

Quite apart from the anomaly of Pescale, a continuous dispersal pattern from the 3 main sources in use in North Italy is unlikely, when one considers the possible discontinuities imposed by the initial maritime activity. Sea and river portage is considered to have a marked effect on the rate of fall-off of distributed commodities (Sydris, 1977; Fulford and Hodder, 1974) and landings of obsidian on the Italian mainland from both the Pontine Islands and Sardinia could be expected to distort the fall-off pattern as one proceeds northwards from Calabria and Apulia. To this must be added the possibility of landings of obsidian on both the west and east coast of North Italy from Lipari. In addition, the distribution pattern of obsidian in North Italy itself may well be affected by competition with flint traffic, with obsidian being more frequent in areas where direct access to flint was difficult, for example Liguria and Emilia. Given these sources of discontinuity in distribution, any down-the-line trading, for example, from Lipari via southern and central Italy to the north of the peninsula, must be accepted as an approximation indicating the indirect nature of the trading links and allowing for significant breaks in the theoretically steady exponential fall-off of material.

While we have now considerably extended our knowledge of the provenance of obsidian used in Northern Italy, there is clearly a need for further work on well-stratified samples in order to clarify our understanding of the complex interaction between the sources used in this area.

Acknowledgments

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APPENDIX 1

ARCHAEOLOGICAL SITES WITH OBSIDIAN FINDS IN NORTHERN ITALY

1. Arma dello Stefanin, Albenga, Savona¹⁾

This small cave in the Val Pennavaira was excavated by Leale Anfossi between 1952 and 1962 (Leale Anfossi, 1972). The stratigraphy showed a sequence of Epipalaeolithic levels overlain by a Neolithic occupation. A small side scraper (R1) of obsidian was found in layer V. Levels V and IV relate to an intensive phase of occupation dating to the very end of the Final Epigravettian. Layer III contained evidence of more random use with pottery of both Early Neolithic (Impressed Ware and Middle Neolithic (VBO) being represented.

C14 dates are:

Layer IV	—	R109	7850 ± 100 BP (5850 b.c.)
Layer IV	—	R145	8800 ± 300 BP (6850 b.c.)
Layer Va	—	R126	8100 ± 90 BP (6150 b.c.)
Layer Vb	—	R148	8400 ± 100 BP (6450 b.c.)

2. Arma di Nasino, Albenga, Savona.

This cave site lies near Albenga, on the Ligurian coast. Obsidian occurs in two cultural contexts: level IX in which Impressed Ware is associated with Middle Neolithic VBO, and level VII, a Final Neolithic stage which forms a transition between the Lagozza and Bell Beaker cultures. This can alternatively be called early Chalcolithic (c.f. Monte Covolo: White Ware; Barfield et al., 1978; Leale Anfossi, 1968).

Carbon 14 dates for level VII of this site are 1695 ± 70, 1815 ± 70 and 2730 ± 100 and for layer IX 4330 ± 120, 4520 ± 120, 4330 ± 70, 4065 ± 65 b.c. (Aiessio et al., 1968). These latter dates would appear to relate to the Early Neolithic component of this level.

3. Arene Candide, Finale, Savona

This well-known Ligurian cave site, whose occupation stretches from the Palaeolithic to the Roman period, has produced obsidian from several different cultural contexts. The excavator, Bernabò Brea, mentions the following obsidian finds (Bernabò Brea, 1946 and 1956): in Impressed Ware contexts (levels 28-25) two fine blades and five fragments, including a small burin; in Middle Neolithic levels (24-14) seven pieces; and in Late Neolithic levels (13-9) a total of at least 14 bladelets and a core. One blade and a core came from upper levels 3-4D and 3. In addition eight unstratified pieces from earlier excavations are preserved in the Pegli museum making a total of 39 pieces.

A triangular arrowhead in the Pegli Museum is mentioned by Courtin (1967) but not by Bernabò Brea.

Carbon 14 dates from Arene Candide are as follows:

Impressed ware levels:	4270 ± 55 b.c.
Square-mouthed pottery (Finale-Quinzano phase):	3515 ± 50 b.c. and 3488 ± 135 b.c.

Before leaving Arene Candide we should note that the sloping stratigraphy of this site made excavation difficult. In view of this, and the references to later finds of obsidian, clearly one cannot place absolute reliance on Bernabò Brea's figures for numbers of obsidian per level. However, it does seem certain at least that the obsidian is distributed throughout the whole Neolithic occupation of the site.

¹⁾ The numbers relate to those on the distribution maps.

4. Alba, Cuneo

This site, lying on the Tanaro, a western tributary of the Po, was excavated by Traverso (Traverso, 1898, 1901, 1909) and later by Lo Porto (Lo Porto, 1956). Beneath Iron and Bronze Age occupation levels Lo Porto found 'fondi di capanne', pits and hearths of Neolithic date. The material included square-mouthed pottery and many axes, some of jadeite. Impressed Ware is also known from earlier excavations on the site (Bagolini and Biagi, 1972-74).

Amongst material from Alba (Cuneo) in the private collection of Gallizio, Lo Porto notes the existence of a large nucleus of obsidian from which blades have been struck. No evidence of obsidian use was found actually at the site by Lo Porto himself.

5. Isolino di Varese, Varese

Isolino is a small artificial island some 33 x 80 metres in size, just off-shore in the Lago di Varese, consisting entirely of archaeological deposits and structures. Obsidian occurs comparatively frequently at this site. Twelve pieces came from the recorded finds of Bertolone's excavations of the late 1950s. Bertolone excavated the site in arbitrary horizontal spits which often contained pottery of more than one cultural phase. The study of this excavation by G. Guerreschi and V. Fusco has demonstrated a succession of cultural phases with considerable overlapping of material (Guerreschi, 1979).

The earliest inhabitants were users of pedestal post and handled cups which pre-date the square-mouthed pottery occupation of the site, and which belong to an Early Neolithic cultural complex comparable with Fiorano, Vhò and Gaban (Bagolini and Biagi, 1977). The succeeding square-mouthed pottery phase has been tentatively correlated with the Chiozza square-mouthed pottery phase (Barfield L.H., 1971a) and was in turn followed by a Lagozza occupation of the site.

Guerreschi at first assigned the obsidian finds to the following cultures: from the Lagozza period, six blades, three flakes and a chip (none worked); and from the square-mouthed pottery phase, two blades, also unworked. However, in the final publication of the site, the stratigraphy was reappraised and the majority of the obsidian was relegated to the end of the VBO phase, the distribution being as follows: 1 Copper Age, 3 Lagozza, 1 proto-Lagozza, 5 VBO, 2 Early Neolithic (Fusco, 1978).

In the Varese Museum are a further thirty-five blades and one core of obsidian. The Museo Castello Sforzesco in Milan also holds an obsidian blade whose provenance is recorded as the Lago di Varese. One further piece exists, a blade which was analysed at the Bradford Laboratories (Hallam and Warren, private correspondence). All this obsidian in grey or black, often striated with some inclusions, and is generally transparent.

The obsidian mentioned above makes a total of fifty pieces, fewer than the 'over fifty' recorded by Fernando Malavolti, writing about the site in 1948 (Malavolti, 1948).

6. Monte Covolo, Villanuova sul Clisi, Brescia

This site lies on the Chiese River, and has produced evidence of occupation in the Late Neolithic, Chalcolithic, Beaker and Early Bronze Age periods. The square-mouthed pottery and Lagozza phases form one apparently contemporary assemblage at this site (Barfield et al., 1975-76). One piece of unstratified obsidian only was found here, a small

grey translucent chip. It probably relates to the Late Neolithic occupation of the site, characterized by mixed Lagozza and Late Square-mouthed Pottery elements.

7. Rocca di Manerba, Manerba, Brescia

This site, near Monte Covolo west of Lake Garda, has produced Square-mouthed Pottery, Lagozza, Polada Early Bronze Age and Bell Beaker remains as well as later deposits (Brogiolo, 1973; Borrello, 1973). The obsidian is again limited to one piece, a small blade fragment of grey translucent obsidian. It was found out of context, but probably relates to the Lagozza occupation.

8. Sasso, 'Riparo Val Tenesi', Manerba, Brescia

This is an area of Chalcolithic burials on the edge of Lake Garda, but there are also traces of an Early Neolithic occupation (Gaban culture) and a single shard of South Italian Serra d'Aito ware (Barfield, 1978). Two fragments of obsidian were found in an unstratified context. We may note the absence of the Neolithic phases represented on the nearby Rocca di Manerba.

9. Polada, Brescia

Obsidian is reported from this site, which is the type site of the eponymous Early Bronze Age culture and has no earlier occupation (Radmilli, 1963), however there is no mention of this in earlier (Munro, 1890) or later publications (Barich, 1971) concerning the site.

10. Bellori, Grezzana, Verona

One piece of obsidian was found here, a lump about $3\frac{1}{2} \times 1\frac{1}{2}$ cms in size. The site has not been properly excavated, and the obsidian was amongst the surface finds collected. These finds, now housed in the Prehistory Section of the Museo di Storia Naturale, Verona, include a pottery fragment with incised decoration of Rivoli-Castelnovo type (late Square-mouthed pottery in the Veneto), Polada ware handles, and Late Bronze Age type unperforated handles. The obsidian cannot be assigned to a specific cultural horizon.

11. Grotta G. Perin, Sengia Bassa di San Cassiano, Vicenza

The material from this site, which lies in the Berici Hills near Vicenza, covers the period from Late Neolithic Lagozza times to the Early Bronze Age Polada Culture (Leonardi, and Brogiolo, 1962-63, and unpublished finds). The one piece of obsidian, a small grey translucent blade from layer B, was found with transverse arrowheads of Lagozza type as well as Chalcolithic and Early Bronze Age material. Lagozza pottery has also been recognized from here (P. Biagi, private communication).

12. Campo Balano, Spineda, Cremona

This settlement, probably of the Rivoli-Chiozza stage of the VBO, has produced finds of obsidian (P. Biagi, private communication).

13. Casatico di Marcaria, Mantua

This is a large settlement of the Rivoli-Chiozza stage or the VBO culture. Finds include nine obsidian blades (Biagi, 1978).

14. Razza di Campegine, (Fondo Paglia), Reggio Emilia

This is an open site, where a number of rubbish pits of Middle Neolithic Square-mouthed Pottery (Chiozza phase)

have been excavated by the Museum of Reggio Emilia (Cazzella et al., 1976). Earlier excavations carried out by Brizio, Chierici and Bernardi revealed wells and pits, with evidence of both Fiorano and Square-mouthed Pottery occupation (Barfield, 1971b). There are six pieces of obsidian from Razza from the recent excavations, five blades and a chip, all of grey translucent material. Three of the blades are unusual in being retouched, one forming a side scraper. The obsidian is assigned to a Middle Square-mouthed Pottery context, the Chiozza phase. The same context is also of interest for the fact that the majority of the flint used was imported from Monte Lessini to the north of the Po Plain, and that rock crystal, presumably from the Western Alps, was also used.

15. San Polo d'Enza, Reggio Emilia

The excavation of this site was carried out in the late 19th century by Chierici, but the material from his collection has been studied more recently at the Reggio Emilia Museum. Some forty pieces of obsidian came from this site, including two cores, and several retouched blades. Most of the pieces are small blade fragments, but about one third of the obsidian consists of waste flakes. The obsidian here is grey or grey/black, mainly translucent, but includes some black opaque pieces. Some of the pottery from the site is assigned to the Middle Neolithic, probably middle square-mouthed Pottery (Bagolini and Biagi, 1976) but a copper axe from here might indicate later occupation (Scarani, 1963). Malavolti refers briefly to some of the obsidian here (Malavolti, 1948).

16. Chiozza, Scandiano, Modena

Chiozza was already the scene of prehistoric activity in the Fiorano period of the Neolithic. Carbon 14 dating for this phase at Chiozza gives an age of 4050 ± 200 b.c. (Bagolini, 1972). The main settlement however belongs to the second stage of the Square-mouthed Pottery Culture in Emilia, which corresponds with the first Neolithic occupation on the Rocca di Rivoli, giving rise to the term Rivoli-Chiozza for this phase (Barfield and Bagolini, 1971). This Rivoli-Chiozza horizon at Chiozza is in fact also mixed with some material referable to the first stage of the Square-mouthed Pottery tradition (Finale-Quinzano). From the material excavated between 1939 and 1941 by De Buoi, Degani and Zambotti, we have two blade fragments of obsidian probably to be assigned to the Rivoli-Chiozza phase (Bagolini and Barfield, 1971). The two pieces of obsidian examined are of dark grey, only slightly translucent material.

17. Villa Agazzotti, Formigine, Modena

Excavated in 1871, 'fondi di capanne', (hut floors or storage pits, depending on one's interpretation) were recorded (Mansuelli and Scarani, 1961 and Scarani, 1963). The assemblage probably dates to the Neolithic but the absence of pottery prevents closer dating. Two small obsidian blades come from the site, both grey and translucent. These blades are also mentioned by Malavolti (1948).

18. Fiorano, (Cava Nuova), Modena

Industrial excavation of a brick earth quarry has yielded four pieces of obsidian from this locality. Three of these have been examined and all are small blade fragments, one with fine retouch. The material is grey and striated, and two of the pieces are fairly transparent. All the pieces of obsidian have been tentatively assigned to a middle Square-mouthed Pottery phase (Bagolini and Biagi, 1976).

19. Pescale, Prignano, Modena

At this site Middle phase Square-mouthed Pottery (Rivoli-Chiozza) material is associated with the somewhat enigmatic Emilian third phase of this culture. Some doubt now exists about this third phase. We must await the full study of the site before this problem is resolved²). The use of the site as a type site for a Pescale phase has been reviewed (Bagolini and Barfield, 1971) and now we must suggest that the Lagozza occupation directly succeeds the middle phase of the Square-mouthed Pottery culture as in Liguria. An important Lagozza assemblage was recovered from this site (Malavolti, 1952; Bagolini and Biagi, 1976) and Early Neolithic Fiorano and Beaker material was also found.

The site is important for the quantity of obsidian recovered. The number of pieces of obsidian recovered from Pescale stands at about 950, which far exceeds the numbers found at any other site in Northern Italy. The total weight amounts to 431 grams. These obsidians are at present under study with the remainder of the material from Pescale, but Malavolti gives us a description of the obsidian (Malavolti, 1953). Over 813 of the pieces are blades, and he notes that retouch is rare. The remainder of the obsidian includes an arrowhead, six scrapers, six cores, and two polished pieces, and also at least 100 waste chips. Malavolti describes the obsidian as normally shiny black or dark material, transparent when in thin pieces. Two pieces examined at Bradford are grey and slightly transparent.

Unfortunately much of the obsidian was surface collection and therefore cannot be assigned stratigraphically to any culture. However, of pieces found during excavation, Malavolti notes that the majority came from the upper levels of the site, 28.5% weight from layer I and 25.7% weight from layers II/III. He assigns fifteen pieces (4.4%) to the upper levels of the fondi di capanne. This might suggest that obsidian relates to the Lagozza occupation, a view held also by Bagolini and Biagi (1976).

We should note here that the site of Pescale is by no means fully excavated and further investigation of the site might well increase the number of obsidian finds still further.

20. Bazzano, Bologna

An obsidian core was found here in isolation in the Apennine foothills (Scarani, 1963).

21. Grotta Farneto, S. Lazzaro di Savena, Bologna

This site has material from the Early and Late Bronze Age. However there is some dispute as to whether earlier Chalcolithic deposits exist here as well. Some of the arrowheads and pot sherds may well be Chalcolithic and the cave may have been occupied by the Chalcolithic people using the nearby rock shelter for burial (Scarani, 1963; 1956-64). A single chip of obsidian was found here (Malavolti, 1948).

22. Rocca Corneta, Lizzano in Belvedere, Bologna

This is a cave in which was found a core, probably of obsidian. Scarani (1956-64 and 1963) states that, there are objects probably of obsidian and mentions a nucleus.

²) Bagolini and Biagi (1976) have suggested, following Malavolti, that the Square-mouthed Pottery assemblage here represents a later stage than that found at Chiozza or Campegine, on account of the greater variety of decoration. This view needs further confirmation in our opinion.

23. San Giovanni in Misileo, Casola Valsenio, Ravenna

An isolated obsidian core from 'terreno lavorato' was found here (Scarani, 1963).

24. Villa Persolino, Faenza, Ravenna

Fondi di capanne were found at Persolino, and Scarani (1963) notes the recovery of material from several cultures at this site, including Copper Age and Polada material. Orsi (1903) also refers to later material of Iron Age and Roman date. Lunates of flint are perhaps the most convincingly Chalcolithic artifacts.

Scarani refers to ten cores of obsidian, ten blades and 'various other fragments'. Orsi speaks only of 'fragments of blades of obsidian'. We may also note his reference to small cross-shaped flint pendants, paralleled at Bertarina di Forlì, another site in the Romagna from which there is obsidian. The obsidian from Persolino may still be at the Museo Civico di Bologna, where it was housed when Malavolti referred to it in 1948.

25. Bertarina di Vecchiavazzo, Com. and prov. Forlì

Santarelli referred in 1886 to three cores of obsidian from Bertarina. However, the material does not otherwise seem to include anything earlier than the Bronze Age (Scarani, 1963). Like Persolino, the site features are only pits (fondi di capanne). It is open to question whether the obsidian is of Bronze Age date (paralleled perhaps at Farneto and Poiada) or whether its occurrence should suggest to us an earlier occupation of the site. In the report, the obsidians of Bertarina are assigned tentatively to the Early Bronze Age.

26. Misano Adriatico, Forlì

An obsidian fragment was found here with flint flakes, in a pit associated with probable Middle Neolithic pottery, including 'figulina' (Gentili, 1972).

27. Grotta della Tartaruga, Trieste

At least three pieces of obsidian (including a flake and a blade, both grey and translucent), were found by G. Almerigogna of the Soprintendenza of Trieste. The cultural sequence covers the period from Mesolithic to Iron Age (Cannarella, 1975-77), and G. Almerigogna refers to the context of the obsidian as Neolithic (private communication).

28. Vlaška Jama (Rothgartle Hochle, and Grotta del Pettirosso), Trieste

This cave was investigated by Dr. Moser of Vienna in the 1890s. At least four pieces of obsidian were found (Moser, 1894; Barfield, 1971a, 1971b), and they are now kept in the Prähistorisches Arbtellung of the Naturhistorisches Museum of Vienna. The obsidian includes a blade and a flake, both grey and translucent. The main deposit from the cave appears to be Middle Neolithic, the Vlaška facies of Danilo, but later material was also present.

29. Riparo di Monrupino, Monrupino, Trieste

This rock shelter contained a Middle Neolithic deposit (Vlaška group) with less abundant trances of Chalcolithic and Iron Age occupation above (Cannarella et al., 1973-74). At least three pieces of grey translucent obsidian, two blades and a flake, came from the Neolithic level F.

30. Grotta degli Zingari, Sgonico, Trieste

This cave produced Neolithic and later finds, including a piece of obsidian (Marzolini, 1972).

31. San Quirino, Trieste

This site, probably Neolithic, produced one piece of grey translucent obsidian (P. Cassola, private communication).

32. Grotta dell'Orso di Gabrovizza, Trieste

This site is a cave with predominantly Late Neolithic and Chalcolithic occupation but with some Bronze Age material as well (Marchesetti, 1890; Cannarella, 1959). An obsidian blade was found by Marchesetti.

33. Grotta Lonza, Monrupino, Trieste

This cave has Mesolithic to Chalcolithic and later deposits (Lonza, 1975), and produced a single fragment of obsidian, from an unspecified level.

34. Jama na Dolech, Nabresina, Trieste

The cave of Jama na Dolech was excavated by Moser between 1898 and 1902 (Moser, 1903) and produced material of Vlaška and Late Neolithic periods (Barfield, 1971).

35. Grotta dell'Ansa, San Pelagio, Trieste

This cave site contains a stratified sequence covering a period from Middle Neolithic to the Bronze Age (Marzolini, 1975-77). A truncated obsidian blade was found in the Chalcolithic layer 'e'. There is no guarantee that it is in fact contemporary with this layer however.

36. Grotta dell'Onda

For a general account of this cave see Grifoni Cremonesi 1971. The material from Grotta dell'Onda, taken from excavations carried out at the end of the last century, is housed in the Department of Anthropology and Palaeontology, University of Pisa, and the Museo Preistorico, Firenze, and includes Lagozza, Bronze Age and possibly Fiorano elements. Some 52 retouched and unretouched blades and a core have come from different excavations. The obsidian consists of a number of grey blades and a core. They are probably to be associated with the Lagozza occupation on the site.

37. Buca delle Fate Sud, Camaione, Lucca

Cave with six arrowheads, one of which was in obsidian, pottery, perforated shells and human bones. Probably a Copper Age burial cave (Fornaciari 1976).

38. Grotta del Leone, Agnano, Pisa

Cave with evidence of occupation or burials from Late Neolithic to Chalcolithic, producing a core and blades of obsidian (Radi, 1974).

39. La Romita, Asciano, Pisa

Cave with stratigraphy covering period from Middle Neolithic to Bronze Age. Level 13A, Lagozza, produced an obsidian blade (Peroni, 1962-63).

The following obsidian finds have notified since the preparation of the paper.

40. Grotta Pollera, Savona

Site with at least 3 blades of obsidian, 2 from Early Neolithic Levels and one from Middle Neolithic Level XVII, excavated by G. Odetti.

41. Grotta dell'Edera, Savona

Obsidian from a Middle Neolithic layer (excavations by G. Odetti, 1977), has been attributed to Pontine Islands.

List of samples analysed

Group	Run No.	District	Site	Cultural context	Object	Collected by	From	Reference
SA	364/1	Lombardy	Isolino di Varese	Neolithic?	blade		G. Guerreschi	4737
SA	364/2	"	"	"	blade fragment		"	7961
SA	364/3	"	"	"	chip		"	6407
SA	365/1	"	"	"	blade		"	4774
SA	365/2	"	"	"	"		"	6406
SA	365/3	"	"	"	"		"	4736
SA	366/1	"	"	"	"		"	4694
SA	366/2	"	"	"	"		"	4751
SA	366/3	"	"	"	"		"	4775
SA	382/6	"	"	"	"		"	8606
SA	388/3	"	"	"	chip		"	6354
SA	388/4	"	"	"	flakes		"	6355
SA	373/8	Emilia	San Polo d'Enza	?	blade fragment	G. Chierici	Reggio Emilia Museum	Museo Chierici 9.595
SA	374/2	"	"	"	"	"	"	Museo Chierici 9.603
SA	374/3	"	"	"	"	"	"	Museo Chierici 9.591
SA	374/4	"	"	"	chip	"	"	Museo Chierici 9.590
SA	374/5	"	"	"	blade	"	"	Museo Chierici 9.602
SA	374/6	"	"	"	blade fragment	"	"	Museo Chierici 9.596
SA	374/7	"	"	"	"	"	"	Museo Chierici 9.584
SA	374/8	"	"	"	"	"	"	Museo Chierici 9.582
SA	401/2	"	Pescale	Lagozza	"	F. Malavolti?	"	
SA	401/3	"	"	"	"	"	"	
SA	505/8	"	"	"	blade section	?	P. Biagi	Pescale 269
SA	505/9	"	"	"	"	?	"	Pescale 276
SA	505/10	"	"	"	blade fragment	?	"	Pescale 274
SB	505/7	Modena Emilia	Villa Agazzotti, Formigine	Neolithic	"	?	"	Form. V. Gandini 222
SB	670/17	Liguria	Arene Candide	Early Neolithic Level 14	blade	S. Tinè R. Maggi	"	
SC	670/16	"	"	"	"	"	"	
SC	670/13	"	Grotta Pollera	Middle Neolithic Level XVII	"	G. Odetti	"	
SC	670/18	"	"	Early Neolithic Impressed ware	"	"	"	

Group	Run No.	District	Cultural context	Site	Object	Collected by	From	Reference
Li	670/12	"	"	Early Neolithic Level XXII	"	"	"	
Li	373/1	Emilia	Razza di Campegine	Middle VBO	"	"	Reggio Emilia Museum	1970
Li	373/2	"	"	"	"	"	"	1970
Li	373/3	"	"	"	chip	"	"	1971
Li	373/4	Modena Emilia	Fiorano Cava Nuova	VBO?	blade fragment	"	"	1970
Li	373/5	"	"	"	blade	"	"	1970
Li	373/6	"	"	"	blade fragment	"	"	1970
Li	373/7	Emilia	Chiozza	VBO	blade	G. Chierici	"	Museo Chierici S. 53 - N. 102
Li	505/5	"	"	Neolithic	"	"	P. Biagi	
Li	374/1	"	San Polo d'Enza	?	blade fragment	"	"	Museo Chierici 9.587
Li	374/9	Liguria	Arene Candide	Levels 11-12 Lagozza Culture	blade	L. Bernabò Brea	Pegli Museum Genova	B7 11-12
Li	505/6	Modena	Villa Agazzotti Formigine	Neolithic	"	"	P. Biagi	Form. V. Gandini 221
Li	500/1	Near Trieste	Vlaška Jama	Middle Neolithic?	"	"	E. Ruttkay	35285
Li	497/1	"	"	"	"	"	"	35285
Li	547/1	"	Grotta dei 'Ansa	Copper Age?	"	"	G. Almerigogna	
Li	547/2	"	Grotta degli Zingari	?	"	"	"	3499
Li	547/4	"	Grotta della Tartaruga	Neolithic	"	"	"	2759 TE 7B
Li	547/5	"	Grotta Lonza	?	blade fragment	"	"	
Li	548/1	"	San Quirino	Neolithic?	retouched blade	"	P. Cassola	
Li	548/2	"	Riparo di Monrupino	Middle Neolithic	blade section	"	A. Gerdina	E. 7 Strato D
Li	548/3	"	"	"	flake	"	"	"
Li	382/5	Lombardy	Isolino di Varese	?	blade	"	E. Arslan	
P.I.	670/14	Liguria	Arene Candide	Middle Neolithic Level 13	"	S. Tinè R. Maggi	P. Biagi	
P.I.	670/15	"	"	VBO Level 12	"	"	"	
?	388/1	Verona Veneto	Bellori	?	core	"	L. Fasani	
?	448/10	Forlì Romagna	Misano	Middle Neolithic	chip	"	P. Biagi	
Carpathian 1	547/3	Near Trieste	Grotta della Tartaruga	Neolithic	flake	"	G. Almerigogna	2673

Trace element composition of obsidian analysed

(parts per million except Fe and Na %)

Run No.	Site	Source group	Na %	La	Sc	Fe %	Co	Cs	Ce	Colour	Transp./transl.	Remarks
364/1	Isolino di Varese	SA	2.73	25.9	4.71	1.18	0.29	5.69	69.9	G	4	GS
364/2	"	"	2.82	26.4	4.85	1.23	0.53	5.31	59.0	G	4	GS
364/3	"	"	2.57	23.8	5.71	1.42	0.46	5.71	62.3	B	0-1	—
365/1	"	"	2.59	20.5	5.34	1.28	0.53	6.00	59.5	G	2	CGS
365/2	"	"	3.33	31.1	5.68	1.41	0.53	6.38	80.1	G	5	S
365/3	"	"	2.89	27.7	5.02	1.26	0.49	5.64	67.8	G	4	GS
366/1	"	"	1.91	21.9	4.82	1.17	0.58	5.68	52.6	G	5	CGS
366/2	"	"	1.82	20.9	4.65	1.12	0.42	5.38	52.4	G	4	G
366/3	"	"	2.15	24.7	5.59	1.31	0.50	6.84	72.4	G	5	G
382/6	"	"	2.19	25.2	5.50	1.34	0.54	5.96	60.4	G	3	G
388/3	"	"	2.26	25.9	5.84	1.44	0.73	6.28	75.4	G	1	GS
388/4	"	"	2.19	24.9	5.47	1.41	0.83	5.92	72.0	G	1	S
373/8	San Polo d'Enza	"	2.54	22.9	5.45	1.35	0.45	6.20	74.8	G	2	CS
374/2	"	"	3.27	29.4	5.63	1.37	0.44	5.51	76.2	G	2	GC
374/3	"	"	2.99	26.5	5.34	1.33	0.47	5.31	75.6	G	3	GS
374/4	"	"	3.05	27.1	5.49	1.36	0.64	5.73	73.4	B	1	CG
374/5	"	"	3.12	28.3	5.82	1.45	0.73	6.27	79.9	G	2	CG
374/6	"	"	2.62	22.7	5.29	1.34	0.74	5.80	73.2	G	1	CG
374/7	"	"	3.09	27.9	5.57	1.38	0.54	6.10	76.5	G	2	CG
374/8	"	"	3.64	31.4	5.50	1.37	0.71	5.39	84.0	G	1	S
401/2	Pescale	"	2.32	21.8	4.56	1.09	0.48	5.05	49.7	G	2	SG
401/3	"	"	2.35	21.3	4.29	1.11	0.55	4.89	48.7	G	2-3	GS
505/8	"	"	2.39	22.6	4.49	1.18	0.56	4.93	50.6	G	2-3	CGS
505/9	"	"	2.71	24.4	4.76	1.19	0.47	5.14	62.86	G	2	GC
505/10	"	"	2.10	23.5	5.27	1.37	0.58	5.95	75.60	G	3	G
505/7	Villa Agazzotti, Formigine	SB	2.97	34.0	3.65	1.23	0.83	8.45	79.81	G	4	G
670/17	Arene Candide	"	2.50	33.5	3.42	1.11	0.76	8.2	55	G	5	CG
670/16	"	SC	2.44	62.6	3.62	1.44	1.46	2.40	102	G	2	CGS
670/13	Grotta Pollera	"	2.58	66.5	3.90	1.56	1.54	2.6	109	G	3	GS
670/18	"	"	2.27	61.1	3.00	1.38	2.15	N.D.	91	G	5	CG
670/12	"	Li	2.88	54.4	0.98	1.20	0.32	17.6	83	G	4	G
373/1	Razza di Campegine	"	2.30	52.3	1.31	2.57	0.49	23.79	172	G	3	GS
373/2	"	"	2.35	52.3	1.13	1.36	0.31	20.23	137	G	5	S
373/3	"	"	2.98	66.4	1.04	1.16	0.32	16.56	141	G	3	CS
373/4	Fiorano, Cava Nuova	"	3.39	64.9	1.31	1.61	0.48	22.27	179	G	1	CS
373/5	"	"	2.85	55.8	1.31	1.55	0.46	22.81	179	G	5	S
373/6	"	"	3.31	63.4	1.35	1.62	0.48	23.47	180	G	4	CS

Run No.	Site	Source group	Na %	La	Sc	Fe %	Co	Cs	Ce	Colour	Transp./transl.	Remarks
373/7	Chiozza	"	2.70	51.3	1.14	1.42	0.43	21.18	150	G	1	CS
505/5	"	"	4.38	57.1	1.19	1.45	0.35	21.67	135	G	2	G
374/1	San Polo d'Enza	"	3.46	62.4	1.45	1.78	0.50	25.70	183	B	1	CS
374/9	Arene Candide	"	2.80	50.9	1.01	1.24	0.92	17.47	125	G	5	G
505/6	Villa Agazzotti, Formigine	"	4.00	66.2	0.83	1.01	0.35	15.77	98.9	G	3-4	S
500/1	Vlaška Jama	"	2.23	61.9	1.14	1.57	0.39	21.42	169	G	0-3	C
497/1	"	"	2.78	53.7	1.10	1.32	0.28	23.80	137	G	3	—
547/1	Grotta dell'Ansa	"	2.76	51.3	0.86	1.15	0.35	16.32	130	G	1-2	C
547/2	Grotta degli Zingari	"	3.13	57.7	1.02	1.32	0.33	18.67	188	G	1	C
547/4	Grotta della Tartaruga	"	3.18	56.4	1.10	1.36	0.39	21.10	187	G-Br	4	—
547/5	Grotta Lonza	"	2.59	49.4	0.90	1.18	0.29	16.59	145	G	2-3	C
548/1	San Quirino	"	3.64	67.0	1.25	1.55	0.46	21.25	141	G	3	—
548/2	Riparo di Monrupino	"	3.42	64.1	1.15	1.41	0.36	19.39	132	G	4	S
548/3	"	"	3.32	62.2	1.09	1.43	0.44	18.84	128	G	4-5	CS
382/5	Isolino di Varese?	"	2.56	63.8	1.28	1.52	0.47	23.20	159	G	4	C
670/14	Arene Candide	P.I.	3.48	85.4	1.44	1.25	0.25	54.0	120	G	2	CGS
670/15	"	P.I.	3.85	94.9	1.72	1.46	0.28	62.2	134	G	1	CG
388/1	Bellori	?	1.13	33.71	10.67	2.72	11.84	9.96	35.4	B	0	—
488/10	Misano	?	0.83	28.98	11.75	3.70	18.06	5.32	53.6	B-Br	1	—
547/3	Grotta della Tartaruga	Carpathian 1	2.44	28.02	3.29	0.76	0.22	12.76	87.2	G	3	SC

Abbreviations: Colour - B = Black, Br = Brown, G = Grey Remarks - C = Cloudy, S = Striated, G = Gritty Transparency scale after Cann and Renfrew 1964, ND = Not Determined.

ABSTRACT

Obsidian has been recorded at 40 archaeological sites in Northern Italy, ranging in time from the Mesolithic to the Early Bronze Age. The total number of obsidian finds in over 1200, 950 of these being from one site, Pescale. The main period of use of obsidian appears to have been during the Middle and Late Neolithic periods. Fifty-seven pieces of obsidian were analysed by Instrumental Neutron Activation Analysis in order to determine their geological provenance. It was shown that 22 samples came from the Lipari Islands, 31 from Sardinia and 2 from the Pontine Isles. One sample from the Trieste area originated in the Carpathian mountains in Slovakia and a further 2 samples could not be matched to any known source. These findings contradict earlier conclusions based on more limited numbers of analyses that Sardinian obsidian was used almost exclusively in Northern Italy (Hallam et al., 1976) and indicate both a wider extent of Liparian obsidian and a point of contact between Liparian and Carpathian obsidian distributions. In view of the dating problems of obsidian on most of the sites the precise chronological relationship between the Sardinian and Lipari obsidian cannot be established. However, in the Po Plain at least there is evidence for the use of mainly Liparian obsidian in the VBO culture and Sardinian in the Lagozza period. Spatial analysis must now be considered in terms of overlap between sources, rather than separate spheres of influence.

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