ISSN: 0093-4690

Volume 36

Journal of Field Archaeology



Maney Publishing

Melian obsidian in NW Turkey: Evidence for early Neolithic trade

Catherine Perlès[1], Turan Takaoğlu[2] and Bernard Gratuze[3]

[1]Université Paris-Ouest, Paris, France, [2]Çanakkale Onsekiz Mart University, Çanakkale, Turkey, [3]CNRS/Université d'Orléans, Orléans, France

Archaeological investigations carried out at the Early Neolithic coastal site of Coşkuntepe in northwestern Turkey yielded an assemblage of 110 obsidian artifacts displaying the macroscopic characteristics of the well-known obsidian deposits on the Cycladic island of Melos. Analysis of three samples from this homogeneous obsidian assemblage using both X-Ray Fluorescence and Laser Ablation High Resolution Inductively Coupled Plasma Mass Spectrometry confirmed that these artifacts were derived from Melos. The presence of these Melian obsidian artifacts at Coşkuntepe, along with a few pieces with central Anatolian macroscopic characteristics, is intriguing because intensive production of tools made of local flint was also identified at the site through the analysis of surface scatters. This finding raises the question of the status of obsidian and associated procurement systems. The presence of obsidian can be also used to argue that certain coastal villages acted as nodes of exchange for Aegean seafarers at times in the late 7th millennium B.C.

Keywords: Coşkuntepe, Greece, Melos, Turkey, Neolithic, obsidian, trade

Introduction

The Cycladic island of Melos was the main source of obsidian in the Aegean world. This raw material was exploited and distributed throughout the region from the Final Palaeolithic period until the Bronze Age (Carter 2009; Runnels 1983; Torrence 1986). The distribution of Melian obsidian has often been used to investigate the mechanisms of trade in the Aegean area, particularly during the Neolithic and Bronze Age periods (Karimali 2000; Perlès 1990a; Torrence 1986). In the Early and Middle Neolithic of Greece (ca. 6600–5800 CAL B.C.), obsidian trade appears to have been in the hands of itinerant specialists who were both seafarers and skilled knappers; they were responsible for the exploitation of the Melian quarries and for the production and distribution of obsidian blades and bladelets (Perlès 1990a, 2004). Direct procurement at the sources as well as distribution by specialists can be inferred for the Late and Final Neolithic (Perlès 2004; Torrence 1986), while varied and sometimes complex systems of production and redistribution have been demonstrated for the Early Bronze Age (Carter 2007, 2008; Karabatsoli 1997; Runnels 2001). The presence of obsidian in the Final Palaeolithic and Mesolithic deposits at Franchthi Cave, four millennia earlier, shows, however, that knowledge of both navigation techniques and the island's resources was established well before the onset of the Neolithic (Perlès 1987, 1990b). A putative millennia-old interaction sphere around the Aegean Sea (Broodbank 1999, 2000, 2006; Runnels and van Andel 1988; Thissen 2005: 38) may thus have provided the necessary information about new lands for colonization on the Greek mainland at the onset of the Neolithic.

Melian obsidian artifacts have been identified at numerous Early Neolithic sites (ca. 6800–6000 CAL B.C.) on the Greek mainland and on some Aegean islands (Perlès 2001; Torrence 1986). More recently, several Early Neolithic sites in western Turkey have yielded obsidian from Melos and demonstrate that its distribution extended to the eastern side of the Aegean Sea (see below). The increasing number of archaeological excavations and surveys of Neolithic settlements in western Turkey have started to fill up what was, until a few years ago, almost an archaeological void for the Neolithic. New archaeological excavations conducted at Early Neolithic sites dated to ca. 6500 CAL B.C., such as Yeşilova, Ege Gübre, Ulucak, Araptepe, and Dedecik-Heybelitepe in the Izmir region (FIG. 1) shed new light on the Neolithization of west-central Turkey (Çilingiroğlu and Çilingiroğlu 2007; Derin 2007; Derin *et al.* 2009; Sağlamtimur 2007; Lichter 2002; Lichter and Meriç 2007). Several of these sites have yielded Melian

Correspondence to: Catherine Perlès, Préhistoire et technologie, MAE, 21 allée de l'Université, 92023 Nanterre Cedex, France. Email: catherine.perles@mae.u-paris10.fr

© Trustees of Boston University 2011
DOI 10.1179/009346910X12707321242313



Figure 1 Melos and Early Neolithic sites in western Turkey mentioned in the text. Central Anatolian obsidian sources are also shown as well as sources in the Carpathians.

obsidian, sometimes in large quantities (Lichter and Meriç 2007).

In northwestern Turkey, some 170 km north of the Izmir region, surface investigations undertaken at the Early Neolithic coastal site of Coşkuntepe (FIG. 1) yielded 118 obsidian blades and flakes, many of which are macroscopically similar to Melian obsidian. The presence of Melian obsidian tools at Coşkuntepe is intriguing because intensive production of tools made of local flint was also seen in the surface material. In addition, central Anatolian obsidian was also reaching the Troad during the Neolithic (Pernicka *et al.* 1996). One goal of the present study was to investigate whether or not obsidian tools at Coşkuntepe were derived from Melos by using both X-Ray Fluorescence (XRF) and Laser Ablation High Resolution Inductively Coupled Plasma Mass Spectrometry (LA-HR-ICP-MS). The results indicate that Melian obsidian actually made its way to the site. Because of export permit restrictions, only three samples were sent for analysis, but our long experience in analyzing Melian obsidian makes us confident that most of the assemblage is Melian. Thus, the second aim of the present study is to explore how these obsidian artifacts reached a site that is, so far, the northernmost point where Melian obsidian is found during the Early Neolithic, more than 330 km away from the source. None of the obsidian from the Early Neolithic site of Hoca Çeşme (FIG. 1), on the mouth of the Meriç River in Turkish Thrace, has been analyzed so far, and it is difficult to know whether the Melian trade network extended even further to the north.

A minority ($n = 8$) of the artifacts from Coşkuntepe displayed macroscopic Anatolian characters, which suggests that Melos was not the only source of obsidian for the settlers of the site. This highly transparent gray obsidian with a very fine and vitreous texture is strongly reminiscent of the obsidian from central Anatolian sources such as Göllüdağ (FIG. 1).

Given the small number of samples that could be chemically analyzed, we focused on samples that presented macroscopic Melian characteristics and not Anatolian ones.

The Site of Coşkuntepe

Coşkuntepe has often been regarded as the westernmost Early Neolithic site in Turkey (Seeher 1990; Takaoğlu 2005). Overlooking the island of Lesbos (FIG. 1), the site is located at 230 masl at the end of a high promontory, roughly 1 km from the shoreline. This promontory with steep slopes on three sides is accessible only from the north. No archaeological excavation has been undertaken at the site so far. Surface surveys were conducted at the site and its vicinity in 2004 and 2005 to determine the cultural affiliation of Coşkuntepe and to reconstruct in part the subsistence strategies adopted by the Neolithic settlers of the site (Takaoğlu 2005). The site of Coşkuntepe is dated to ca. 6200 B.C. based on stylistic comparisons of Coşkuntepe pottery with the pottery from sites which have radiocarbon dates from good stratified contexts, including Hoca Çeşme and Ulucak (Takaoğlu 2005: 421). New radiocarbon dates and comparisons with the finds from Yeşilova in the İzmir region (Derin *et al.* 2009: 13) also support this dating. The surface survey helped us to understand why the Neolithic inhabitants of Coşkuntepe chose to settle in rather rugged terrain near the coast, despite the fact that there was no shortage of fertile land either in the Troad or around the shallow bays along the Aegean coast. Archaeological evidence from Coşkuntepe and its immediate vicinity indicates that some Aegean Neolithic coastal societies could have supplemented their economic base with non-agricultural production strategies. Millstone production was documented at Coşkuntepe and the site environs are rich in outcrops of andesite and basalt (Takaoğlu 2005). The question of whether millstone production was intended for regional exchange is difficult to evaluate in light of the small number of Neolithic settlements with millstones in the Troad and neighboring areas.

Surveys at Coşkuntepe also yielded a high density of flakes derived from on-site flint artifact production. Nearly 2400 chipped stone artifacts, predominantly made of flint of varied texture and color, were recorded in 2004 and 2005. Among these, 45 specimens are unworked nodules and partially tested cores, while blades, bladelets, awls, and waste flakes constituted most of the assemblage. The number of obsidian artifacts (118) appears very low when compared to the flints (only about 0.5%). As mentioned above, 8 of the 118 specimens are highly transparent and gray. These blades and flakes have the very fine and vitreous texture characteristic of the obsidian of central Anatolian origin. The remaining 110 are gray and have a rougher texture (FIG. 2); only a few of these Melian obsidian artifacts are flakes,

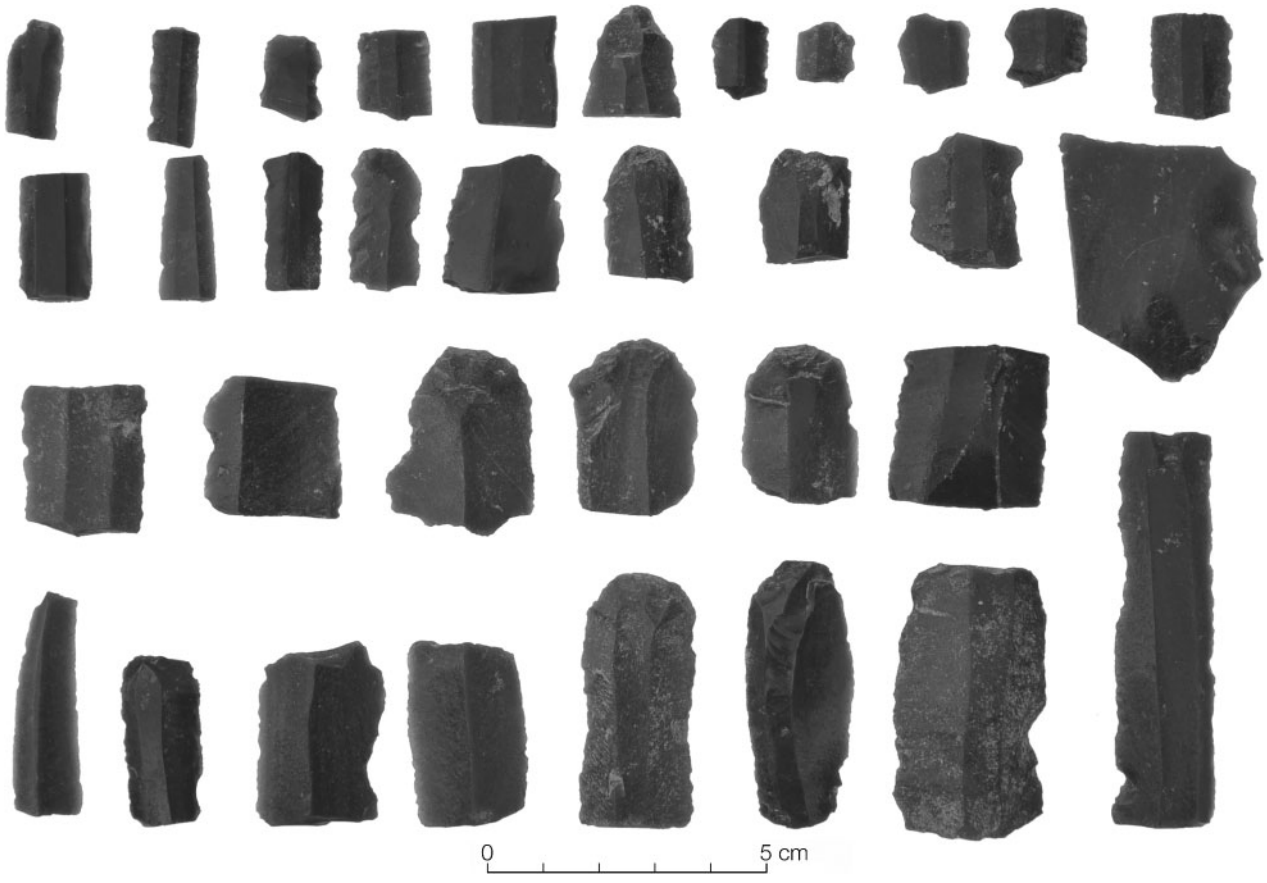


Figure 2 Melian obsidian artifacts found on the surface at Coşkuntepe.

while the majority are small blades and bladelets, at least partly produced by pressure flaking. This seems to indicate that obsidian arrived at Coşkuntepe through exchange as preformed cores or already-flaked artifacts.

Methods of Analysis

The analyses of these obsidian artifacts (FIG. 3) were conducted at the Ernest-Babelon Center at the Institut de Recherches sur les Archéomatériaux (Université d'Orléans). Two non-destructive methods were used to determine the origins of the obsidian (Gratuze 1999; Astruc *et al.* 2007), X-Ray Fluorescence (XRF) and Laser Ablation High Resolution Inductively Coupled Plasma Mass Spectrometry (LA-HR-ICP-MS).

XRF is a semi-quantitative technique. To differentiate the obsidian sources we measured nine minor and trace elements: calcium, titanium, manganese, iron, rubidium, strontium, yttrium, zirconium, and niobium. Geological and archaeological samples were jointly analyzed and data were compared using simple binary diagrams. X-rays were generated with a tungsten tube operating at 45 kV and 0.8 mA. Analytical parameters were as follows: acquisition time of 1200 seconds, no metallic beam filter, beam collimator diameter 1.5 mm, and the energy domain for elemental analysis was 0–25 keV. The net signal measured for each element was normalized by the Lα-tungsten X-ray.

LA-HR-ICP-MS is nearly non-destructive, as it leaves a crater in the obsidian artifact which is invisible to the naked eye. We measured the concentrations of 32 elements in each selected sample. Elements such as zirconium, yttrium, niobium, barium, strontium, cerium, lanthanum, and titanium were the most powerful for distinguishing obsidian outcrops. The attribution to an obsidian source was established by comparing the compositions of the archaeological samples to the compositions of samples in the obsidian source dataset. LA-HR-ICP-MS operated as follows. The object placed in the ablation cell was sampled by an Nd YAG pulsed laser whose frequency was quadrupled allowing it to operate in the ultraviolet region at 266 nm. The diameters of the ablation craters ranged from 60 to 100 μm, and their depth was around 250 μm. An argon gas flow carried the ablated aerosol to the injector inlet of the plasma torch, where the matter was dissociated, atomized, and ionized. The ions were then injected into the vacuum chamber of a quadrupole system, which filtered them by their mass-to-charge ratio. The ions were then collected by a channel electron multiplier. The isotope ^{29}Si was used as an internal standard and the Standard Reference Materials 610 from the National Institute for Standards and Technology were used for external standardization.

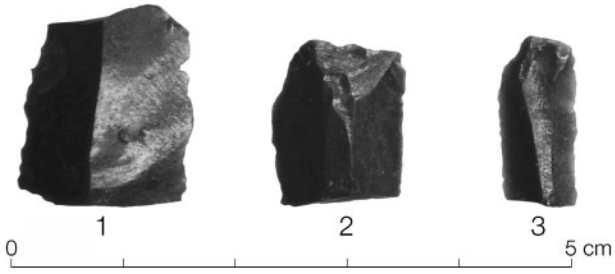


Figure 3 Three Melian obsidian samples used in sourcing analyses.

Studied Samples and Results

As stated above, three obsidian blades recovered at the Neolithic site of Coşkuntepe were analyzed (FIG. 3). For XRF analysis, some geological obsidian from Carpathian, central Anatolian, and Melian obsidian sources were analyzed together with the artifacts. These geological samples come from Acıgöl, Korudağ, and East Göllüdağ in Turkey; Melos (the two different outcrops of Demenegaki and Sta Nychia) and Giali in Greece; and the outcrops located near Tolcsva, Mad, Cejkov, and Kasov in the Carpathians. Results obtained by XRF analysis shows that the artifacts from Coşkuntepe are closely related to the Melian sources (FIGS. 4, 5), and are unrelated to any other sources (see analytical data in Biagi *et al.* 2007; Gratuze 1998, 1999; Poidevin 1998; Ròzsa *et al.* 2006). However, XRF analysis did not allow attribution to one of the two Melian obsidian outcrops of Demenegaki or Sta Nychia. More precise characterization using LA-HR-ICP-MS was then carried out to determine the precise origin of the artifacts. For these measurements, only samples from Melos (Demenegaki and Sta Nychia outcrops) were analyzed together with the artifacts because no overlap with the other obsidian sources was observed using XRF. The measured compositions showed that one of the artifacts (number 1) comes from the Demenegaki outcrop while the two others (numbers 2 and 3) come from the Sta Nychia outcrop (FIG. 6). The two Melian outcrops were thus represented in this small sample. Unless the complete obsidian assemblage at Coşkuntepe had been analyzed to assess relative frequencies, the analysis of a few more pieces would have added little or no information.

Interpretation of the Evidence

The first archaeological evidence for the presence of Melian obsidian in western Anatolia goes back to the 1960s, when two obsidian artifacts from the site of Moralı were shown to originate from Melos on the basis of trace elements analyses (Renfrew *et al.* 1965: 238). These specimens were apparently selected from the materials collected by David French during his surveys of the region, also conducted in the 1960s

	Coşkuntepe			Geological obsidian from Melos: Demenegaki		Sta Nychia	
Element	*No. 1*	*No. 2*	*No. 3*	*1*	*2*	*1*	*2*
Li	35	38	49	41	49	43	53
B	23	25	23	25	28	26	31
Ca	13412	11328	9058	13042	1284	10739	11140
Sc	6.2	5.8	5.1	6.8	7.9	6	7.3
Ti	1224	1011	905	1231	1202	974	976
Mn	465	457	430	462	449	454	483
Fe	11835	9818	9414	13192	12933	9916	10210
Rb	98	112	97	108	110	115	115
Sr	87.3	75.9	60.7	82.4	84.9	68.8	79.5
Y	11.3	12.9	9.6	11.2	9.8	10.2	10.5
Zr	94	94	73	95	82	76	77
Nb	7	7.6	6.8	6.9	6.7	7.1	7.2
Cs	2.6	3	2.7	2.9	3.1	3.1	3.4
Ba	440	487	375	444	429	433	455
La	19	21	17	19	18	18	18
Ce	38	40	35	38	37	38	38
Pr	3.3	3.6	2.7	3.2	3	3.1	3.3
Nd	11.9	13.5	9.6	11.9	11	11.1	12
Sm	2.1	2.3	1.6	2	1.9	2	2.2
Eu	0.48	0.41	0.29	0.41	0.53	0.37	0.61
Gd	1.8	2	1.3	1.8	1.6	1.6	1.9
Tb	0.27	0.3	0.21	0.26	0.24	0.23	0.39
Dy	1.8	2	1.4	1.8	1.6	1.6	1.9
Ho	0.39	0.41	0.29	0.36	0.32	0.32	0.44
Er	1.2	1.4	0.9	1.2	1.1	1.1	1.3
Tm	0.2	0.23	0.14	0.18	0.17	0.17	0.27
Yb	1.6	1.9	1.2	1.6	1.4	1.5	1.9
Lu	0.25	0.27	0.18	0.23	0.22	0.22	0.36
Hf	2.7	2.8	2	2.6	2.4	2.2	2.5
Ta	0.6	0.7	0.5	0.6	0.5	0.6	0.7
Th	9.4	10.9	8.1	9.2	8.6	9.2	10.1
U	2.9	3.2	2.7	3.1	3.2	3.3	3.8

Figure 4 Analytical results obtained from LA-HR-ICP-MS. Results in part per million (ppm): 1 ppm = 0.0001 weight percent.

(French 1965, 1969). It is reasonable to date these two obsidian specimens to the late 7th and early 6th millennia B.C. since most of the surface pottery from Moralı displays the characteristics of this period (Takaoğlu 2004).

Archaeological excavations at the Early Neolithic site of Dedecik-Heybelitepe in 2003 and 2004 provided data concerning the introduction of Melian obsidian into western Turkey (Lichter and Meriç 2007: 386; Herling *et al.* 2008: 51, table 2). Dedecik-Heybelitepe is located near the mouth of the Gediz River to the north of Izmir Province (FIG. 1) and is dated to the late 7th/early 6th millennium CAL B.C. More than 350 obsidian artifacts were recovered. Of the 10 obsidian tools analyzed by neutron activation from Dedecik-Heybelitepe, five were attributed to Demenegaki, four to Sta Nychia, both on Melos, and only one to the Nenezi Dağ deposits (FIG. 1) in central Anatolia. According to the excavators, obsidian was acquired

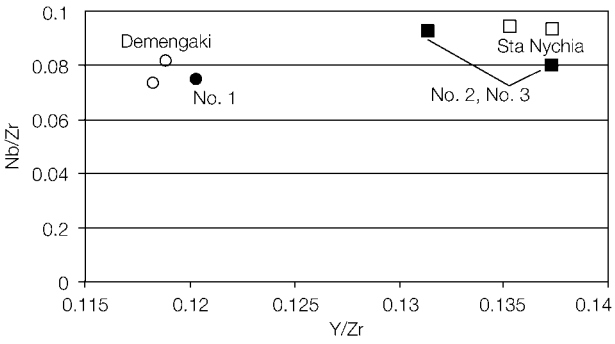


Figure 5 Y/Zr-Nb/Zr binary diagram of the obsidian analyzed with LA-HR-ICP-MS. Binary diagram reporting the ratio of concentrations of Yttrium/Zirconium (Y/Zr on the X axis) versus Nilobium/Zirconium (Nb/Zr on the y axis) for the obsidian analyzed with LA-HR-ICP-MS.

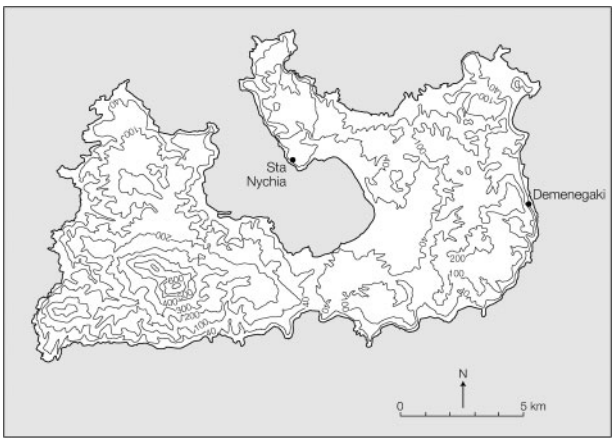


Figure 6 Map of Melos and the two obsidian sources, Demenegaki and Sta Nychia.

as cores and flaked at the site to produce blades and bladelets (Herling *et al.* 2008: 55). The conspicuously small number of flakes (Herling *et al.* 2008: 29), the presence of only two fragmentary cores, and the overwhelming predominance of blades and bladelets, however, lead us to believe that at least some of the blades and bladelets may have been introduced as finished products. It is noteworthy that at Dedecik-Heybelitepe the number of flint artifacts roughly equals the number of obsidian artifacts. Contrary to the situation at Coşkuntepe, raw materials for producing flaked lithic tools seem to have been rare. Recent analyses, which are soon to be published, reveal that Melian obsidian was also imported to the site of Ulucak, in the Izmir region (Çilingiroğlu *et al.* 2004: 52; Çilingiroğlu and Çilingiroğlu 2007: 366; Çiler Çilingiroğlu, personal communication 2010).

Although Melian obsidian was very common at Dedecik-Heybelitepe, recent archaeological excavations conducted at the Early Neolithic sites of Yeşilova, Ege Gübre, and Araplı in west-central Turkey, not far from Dedecik-Heybelitepe, have not yet yielded definite evidence that these sites also had access to Melian obsidian. The obsidian tools from the Early Neolithic levels at Yeşilova and Ege Gübre have not yet been analyzed (Sağlamtimur 2007: 375; Derin 2007: 382, fig. 15; Derin *et al.* 2009: 19).

The mechanisms and routes by which this obsidian was obtained by the inhabitants of west-central Anatolia and of Coşkuntepe to the north remain unclear. Until more samples are available and more detailed technological analyses have been conducted, several hypotheses can be put forward. Direct procurement of obsidian nodules at Melos is the least likely hypothesis, considering the distance involved and the very scarce evidence for the initial stages of the reduction process at the well-documented sites. It might be relevant to note that in Greece direct procurement of obsidian at Melos by mainland villagers cannot be identified before the Late

Neolithic (ca. 5600 CAL B.C.) (Perlès 1990a). Down-the-line trade through the Cycladic and eastern Aegean islands is also unlikely, since no Early Neolithic settlements have been reported from the southeastern Aegean islands (Broodbank 1999). A more northern route, via the Sporades, would considerably increase the distance between the source and the recipient sites, and again raises the problem of the absence of Early Neolithic sites on many of the presumed intermediary points of exchange.

On the other hand, the evidence that led us to suggest indirect procurement of obsidian in Early and Middle Neolithic Greek mainland settlements, through specialized seafaring knappers, would also apply to western Anatolia: presence of obsidian in inland farming settlements where knowledge of boat-building and seafaring is unlikely; absence of the initial steps of roughing out and shaping of the cores at sites; small quantities at each settlement; massive dominance of "plein temps de debitage" (i.e. blades and bladelets); absence or extreme scarcity of cores; and use of pressure flaking which is characteristic of specialized production intended for widespread distribution (Perlès 1990a, 2004). At Coşkuntepe, the use of pressure flaking on flint blades presumed to be of local origin shows that the local artisans could have flaked the obsidian blades themselves. But the scarcity of obsidian flakes and the absence of cores do not support this hypothesis.

The distances involved between Melos and western Anatolia are also compatible with this hypothesis: the maritime trip between Melos and the coast near Dedecik-Heybelitepe is smaller than the distance between Melos and the Peneios River mouth in Thessaly, Greece. On mainland Greece, quantities of obsidian do not appear to decrease with distances and do not suggest an inland down-the-line diffusion. Assuming, therefore, that seafarers following the coast provisioned Thessaly, the distance is roughly 400 km to the Peneios River mouth and 260 km to the coast near Dedecik-Heybelitepe. The distance from Melos to the Peneios River mouth is also greater than the distance from Melos to Coşkuntepe (ca. 330 km). Melian obsidian was also reaching Crete during the Early Neolithic, some 110 km to the south with no intermediary island (Evans 1964); therefore crossing stretches of open sea was not a problem. Anatolian coastal sites may thus have acquired their obsidian directly from specialist knappers arriving by boat with their load of obsidian and may, in turn, have exchanged it with inland sites for agricultural products (Erdoğu 2003).

The possibility that similar production/distribution systems operated in Greece and in western Anatolia raises a fascinating question: were the same specialists provisioning mainland Greece, Crete, and western Anatolia? In the case of Greece and Crete, the answer is "no." There is actually no indication that the working of obsidian in Crete was in the hand of specialists. In addition, the flaking methods and techniques, as well as the products, are entirely different than those found on mainland Greece, as observed by the authors (Conolly 2008). In mainland Greece and west-central Anatolia, the methods and the products are much more alike. In both areas, pressure-flaking was applied using small flat platforms, with preparation on their flaking surfaces, in order to produce prismatic blades and bladelets. However, detailed technological analyses would be required to ascertain whether the technical traditions are exactly the same. What the differences between Crete and mainland Greece do demonstrate is that the Melian sources were not controlled by a single group. In addition, as noted above both Coşkuntepe and Dedecik-Heybelitepe yielded samples deriving from the two Melian sources, Sta Nychia and Demenegaki. This is intriguing, since it hard to envision reasons that would lead a group of obsidian knappers to provision themselves at both sources at the same time, either by circumnavigating half of the island or by crossing over the island's rough terrain. Obsidian nodules are easily accessible and plentiful at both sources and the quality is similar. Although Torrence (1986: 96) considers Melos as a *single source* (emphasis in the original), the presence of artifacts from the two outcrops suggests either different groups provisioning the Anatolian sites, or, at least, different trips to and from Melos, with the successive exploitation of the two outcrops (Carter 2008; Perlès 2004).

Finally, it is necessary to consider the possibility that the settlers of Coşkuntepe did not obtain their obsidian directly from itinerant specialists, but through redistribution. Since some kind of specialized production is probable at the site (for millstones and possibly for flint tools), the obsidian could have been acquired through exchange with another west-central Anatolian community. If the presumed contemporaneity of these settlements is verified, down-the-line trade from the Izmir region, *sensu stricto*, might have to be ruled out by the scarcity or absence of Melian obsidian at several settlements between the Izmir region and Coşkuntepe. No site other than Moralı provided definite evidence about the presence of Melian obsidian between the Izmir region and Coşkuntepe in the Early Neolithic period, but future analyses of obsidian from excavated sites such as Araplı and Ege Gübre will probably enhance our understanding of trade involving Melian obsidian. On the other hand, since long-distance trade is demonstrated with obsidian, it cannot be ruled out

for other products as well, such as millstones. The inhabitants of Coşkuntepe may thus have been trading directly with obsidian specialists, or they may have exchanged their products for obsidian at settlements located some distance away.

Conclusions

The presence of obsidian at Çoskuntepe, deriving from the two sources on the island of Melos, Demenagaki and Sta Nychia, adds new data to a growing body of evidence showing that the western Anatolian coast was fully integrated into the Melian obsidian diffusion network. Examination of the distances involved reveals that this should not be considered as altogether surprising, since even the Troad, the most northeasterly point where Melian obsidian is presently recorded, is nearer to the sources than is Thessaly.

Whereas in several regions of Greece local raw materials were of poor quality and may have created a need for obsidian, it is doubtful that the presence of Melian obsidian at Coşkuntepe can be strictly explained by technical requirements. Contrary to the situation at Dedecik-Heybelitepe where suitable raw materials appear to have been scarce, the abundance and quality of local flints at Coşkuntepe should have answered the needs of these early farmers, or farmer-fishermen. Obsidian was probably valued for its physical appearance and also because of its exotic status, even more than for its functional properties (Helms 1988). But exchange with other communities may, by itself, have been the most important factor. Trade includes not only the transfer of material goods, but also of non-material goods and services "which furnish information or confer status, rank, prestige or power" (Runnels and van Andel 1988: 93).

In this respect, it is worth considering again the presence of central Anatolian obsidian at Coşkuntepe. How can we explain the presence of central Anatolian obsidian artifacts on the Aegean coast of Anatolia, when the sources are, respectively, some 650 to 740 km away from Dedecik-Heybelitepe and Coşkuntepe, and when Melos is, by comparison, 300–380 km from the same settlements? As mentioned above, a few obsidian blades of presumed (at Coşkuntepe) or demonstrated (at Dedecik-Heybelitepe) central Anatolian origin have been found alongside the Melian ones. At both sites, Anatolian specimens appear to constitute a small portion of the obsidian assemblage. Unless they correspond to different chronological episodes, which does not seem to be the case at the latter site, it is even less plausible to envision that their procurement answered specific functional needs, which the Melian obsidian would have already addressed. The presence of central Anatolian obsidian in western Anatolia seems to have aroused less excitement amongst scholars than the presence of Melian obsidian, perhaps because the diffusion takes place within what is nowadays a single political state, or because it only involves inland routes and no navigation. Similarly, the presence of Melian obsidian in Thessaly is deemed "normal." Yet, considering the distances and quantities involved, the diffusion of central Anatolian obsidian up the western Anatolian coast perfectly fits the model of diffusion of "prestige goods" (Renfrew 1984), and may be a better illustration of the special status of obsidian and the social importance of trade than the obsidian from Melos.

Catherine Perlès (Ph.D. 1973, University of Paris X; Doctorat d'État 1986) is Professor at the University of Paris Ouest Nanterre. She has worked on Greek Palaeolithic, Mesolithic, and Neolithic chipped stone assemblages and on the origins of the Greek Neolithic. Her research interests also include the prehistory of fire use, the organization of Neolithic societies, and technological approaches in prehistoric research. She is currently working on ornaments from Franchthi Cave in Greece.

Turan Takaoğlu (Ph.D. 2000, Boston University) is Associate Professor at Çanakkale Onsekiz Mart University in Turkey. He is currently excavating the early 5th millennium B.C. settlement at the Sanctuary of Apollo Smintheus near the modern village of Gülpinar in northwestern Turkey. He has also been conducting archaeological and ethnoarchaeological surveys in the southwestern part of the Troad. His research interests include prehistoric interactions in the eastern Aegean, craft production, and ethnoarchaeology.

Bernard Gratuze (Ph.D. 1988, Orléans University; HDR 1998) is a senior researcher at CNRS and the director of the Institut de Recherches sur les Archéomatériaux at the Ernest Babelon Center in Orléans. He is in charge of the development of the analytical protocol to characterize archaeological material. He is mainly involved with the analysis of glass, stone, and precious metals. Among his research interests there are obsidian sourcing in the Mediterranean area and the Near East and glass ornament trade during proto-historical periods.

References

Astruc, L., B. Gratuze, J. Pelegrin, and P. Akkermans. 2007. "From Production to Use: A Parcel of Obsidian Bladelets at Sabi Abyad II," in L. Astruc, D. Binder, and F. Briois, eds., *La diversité des systèmes techniques des communautés du Néolithique pré-céramique vers la caractérisation des comportements sociaux, 5e colloque international sur les industries lithiques du Néolithique pré-céramique*. Antibes: APDCA Editions, 327–341.

Biagi, P., B. Gratuze, and S. Boucetta. 2007. "New Data on the Archaeological Obsidians from Banat and Transylvania (Romania)," in M. Spataro and P. Biagi, eds., *A Short Walk Through the Balkans: The First Farmers of the Carpathian Basin and Adjacent Regions. Quaderno* 12. Trieste: Socieda per la preistoria e protohistoria della regione Friuli-Venezia 129–139.

Broodbank, C. 1999. "Colonization and Configuration in the Insular Neolithic of the Aegean," in P. Halstead, ed., *Neolithic Society in Greece*. Sheffield: Sheffield University, 15–41.

Broodbank, C. 2000. *An Island Archaeology of the Early Cyclades*. Cambridge: Cambridge University Press.

Broodbank, C. 2006. "The Origins and Early Development of Mediterranean Maritime Activity," *Journal of Mediterranean Archaeology* 19: 199–230.

Carter, T. 2007. "The Theatrics of Technology: Consuming Obsidian in the Early Cycladic Burial Arena," *Archaeological Papers of the American Anthropological Association* 17. Arlington, VA: American Anthropological Association, 107.

Carter, T. 2008. "The Consumption of Obsidian in the Early Bronze Age Cyclades," in N. Brodie, J. Doole, G. Gavalas, and C. Renfrew, eds., *Horizons: A Colloquium on the Prehistory of the Cyclades*. Cambridge: Macdonald Institute, 225–235.

Carter, T. 2009. "Obsidienne égéenne: caractérisation, utilisation et culture," in M.-H. Moncel and F. Frölich, eds., *L'Homme et le précieux. Matières minerales précieuses de la préhistoire à aujourd'hui. BAR International Series* S1934. Oxford: Archaeopress, 199–212.

Çilingiroğlu, A., Z. Derin, E. Abay, H. Sağlamtimur, and İ.Kayan. 2004. *Ulucak Höyük: Excavations Conducted between 1995–2002. Ancient Eastern Studies Supplement* 15. Louvain: Peeters.

Çilingiroğlu, A., and Ç. Çilingiroğlu. 2007. "Ulucak," in M. Özdoğan and N. Başgelen, eds., *Turkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*. Istanbul: Arkeoloji ve Sanat Yayınları, 361–372.

Conolly, J. 2008. "The Knapped Stone Technology of the First Occupants at Knossos," in V. Isaakidou and P. Tomkins, eds., *Escaping the Labyrinth: The Cretan Neolithic in Context. Sheffield Studies in Aegean Archaeology*. Oxford: Oxbow Books, 73–89.

Derin, Z. 2007. "Yeşilova Höyüğü," in M. Özdoğan and N. Başgelen, eds., *Turkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*. Istanbul: Arkeoloji ve Sanat Yayınları, 377–384.

Derin, Z., F. Ay, and T. Caymaz. 2009. "Izmir'in prehistorik Yerleşimi-Yeşilova Höyüğü 2005–2006 yılı Çalışmaları," *Arkeoloji Dergisi* 13: 1–58.

Erdoğu, B. 2003. "Visualizing Neolithic Landscape: The Early Settled Communities in Western Anatolia and in the Eastern Aegean Islands," *European Journal of Archaeology* 6: 7–23.

Evans, J. 1964. "Excavations in the Neolithic Settlement of Knossos 1957–1960, Part I," *Annual of the British School at Athens* 59: 132–240.

French, D. 1965. "Early Pottery Sites from Western Anatolia," *Bulletin of the Institute of Archaeology* 5: 15–24.

French, D. 1969. "Prehistoric Sites in Northwest Anatolia II: the Balikesir and Akhisar/Manisa Areas," *Anatolian Studies* 19: 41–98.

Gratuze, B. 1998. "Les méthodes de caractérisation de l'obsidienne," in M.-C. Cauvin, A. Gourgaud, B. Gratuze, N. Arnaud, G. Poupeau, J.-L. Poidevin, and C. Chataigner, eds., *L'obsidienne au Proche et Moyen Orient. BAR International Series* S738. Oxford: Archaeopress, 31–48.

Gratuze, B. 1999. "Obsidian Characterization by Laser Ablation ICP-MS and Its Application to Prehistoric Trade in the Mediterranean and the Near East: Sources and Distribution of Obsidian with the Aegean and Anatolia," *Journal of Archaeological Science* 26: 869–881.

Helms, M. 1988. *Ulysses' Sail. An Ethnographic Odyssey of Power, Knowledge, and Geographical Distance*. Princeton, NJ: Princeton University Press.

Herling, L., K. Kasper, C. Lichter, and R. Meriç. 2008. "Im Westen nichts Neues? Ergebnisse der Grabungen 2003 und 2004 in Dedecik-Heybelitepe," *Istanbuler Mitteilungen* 58: 13–65.

Karabatsoli, A. 1997. *La production de l'industrie lithique taillée en Grèce centrale pendant le Bronze ancien*. Thèse de Doctorat, Université Paris X.

Karimali, E. 2000. "Decoding Inferences in Models of Obsidian Exchange: Contexts of Value Transformation in Neolithic Aegean," in C. Gillis, C. Risberg, and B. Sjöberg, eds., *Trade and Production in Premonetary Greece*. Jonsezed: Paul Aströms Forlag, 9–27.

Lichter, C. 2002. "Central Western Anatolia—A Key Region in the Neolithization of Europe?" in F. Gérard and L. Thissen, eds., *The Neolithic of Central Anatolia. Internal Developments and External Relations During the 9th–6th Millennia B.C*. Istanbul: Ege Yayinevi, 161–169.

Lichter, C., and R. Meriç. 2007. "Dedecik-Heybelitepe," in M. Özdoğan and N. Başgelen, eds., *Turkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*. Istanbul: Arkeoloji ve Sanat Yayınları, 385–386.

Perlès, C. 1987. *Les industries lithiques taillées de Franchthi (Argolide, Grèce)*. Tome I: *Présentation générale et industries paléolithique. Excavations at Franchthi Cave, Fascicle* 3. Bloomington and Indianapolis: Indiana University Press.

Perlès, C. 1990a. "L'outillage de pierre taillée néolithique en Grèce: approvisionnement et exploitation des matières premières," *Bulletin de Correspondance Hellénique*, 14: 1–42.

Perlès, C. 1990b. *Les industries lithiques taillées de Franchthi (Argolide, Grèce)*. Tome II: *Les Industries du Mésolithique et du Néolithique initial. Excavations at Franchthi Cave, Fascicle* 5. Bloomington and Indianapolis: Indiana University Press.

Perlès, C. 2001. *The Early Neolithic in Greece. The First Farming Communities in Greece*. Cambridge: Cambridge University Press.

Perlès, C. 2004. *Les industries lithiques taillées de Franchthi (Argolide, Grèce)*. Tome III: *Du Néolithique ancien au Néolithique final. Excavations at Franchthi Cave, Fascicle 13*, Bloomington and Indianapolis: Indiana University Press.

Pernicka, E., J. Keller, G. Rapp, and T. Ercan. 1996. "Provenance of Late Neolithic and Early Bronze Age Obsidian Artifacts from the Troad," in S. Demirci, A. Ozer, and F. Summers, eds., *Proceedings of the 29th International Symposium on Archaeometry*. Ankara: Tubitak, 515–551.

Poidevin, J.-L. 1998. "Les gisements d'obsidienne de Turquie et Transcaucasie: géologie, géochimie et chronométrie," in M.-C. Cauvin, A. Gourgaud, B. Gratuze, N. Arnaud, G. Poupeau, J.-L. Poidevin, and C. Chataigner, eds., *L'obsidienne au Proche et Moyen Orient. BAR International Series* S738. Oxford: Archaeopress, 105–156.

Renfrew, C. 1984. "Trade as Action in Distance," in C. Renfrew, ed., *Approaches to Social Archaeology*. Cambridge, MA: Harvard University Press, 86–134.

Renfrew, C., J. E. Dixon, and J. R. Cann. 1965. "Obsidian in the Aegean," *Bulletin of the British School of Archaeology* 60: 225–247.

Ròzsa, P., S. Gyula, E. Zoltán, U. Imre, and K. Árpád. 2006. "Comparative Geochemical Studies of Obsidian Samples from Various Localities," *Acta Geologica Hungarica* 49: 129–139.

Runnels, C. 1983. "Trade and Communication in Prehistoric Greece," *Ekistics* 302: 417–420.

Runnels, C. 2001. "The Organization of Flaked Stone Production at Bronze Age Lerna," *Hesperia* 70: 255–283.

Runnels, C., and T. van Andel. 1988. "Trade and the Origins of Agriculture in the Eastern Mediterranean," *Journal of Mediterranean Archaeology* 1: 83–109.

Sağlamtimur, H. 2007. "Ege Gübre Neolitik Yerleşimi," in M. Özdoğan and N. Başgelen, eds., *Turkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*. Istanbul: Arkeoloji ve Sanat Yayınları, 373–384.

Seeher, J. 1990. "Coşkuntepe-Anatolische Neolithikum am nordostufer der Agais," *Istanbuler Mitteilungen* 40: 9–15.

Takaoğlu, T. 2004. "Moralı: A Neolithic Mound in Central-Western Anatolia," in T. Korkut, ed., *Anadolu'da Doğdu: 60. Yaşında Fahri Işık'a Armağan*. Istanbul: Ege Yayınevi, 743–751.

Takaoğlu, T. 2005. "Coşkuntepe: An Early Neolithic Quern Production Site in NW Turkey," *Journal of Field Archaeology* 30: 419–433.

Torrence, R. 1986. *Production and Exchange of Stone Tools. Prehistoric Obsidian in the Aegean*. Cambridge: Cambridge University Press.

Thissen, L. 2005. "Coming to Grips with the Aegean in Prehistory: An Outline of the Temporal Framework 10,000–5500 cal B.C.," in C. Lichter, ed., *How Did Farming Reach Europe? Anatolian-European Relations from the Second Half of the 7th through the First Half of the 6th Millennium Cal. B.C*. Istanbul: Ege Yayinlari, 29–40.