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Tristan Carter, François-Xavier Le Bourdonnec, Metin Kartal, Gérard Poupeau, Thomas Calligaro, et al.. Marginal Perspectives: Sourcing Epi-Palaeolithic to Chalcolithic Obsidian from the Öküzini Cave (SW Turkey). Paléorient, CNRS, 2011, 37 (2), pp.123 - 149. 10.3406/paleo.2011.5427 . hal-01743167

HAL Id: hal-01743167
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MARGINAL PERSPECTIVES: SOURCING EPI-PALAEOLITHIC TO CHALCOLITHIC OBSIDIAN FROM THE ÖKÜZINI CAVE (SW TURKEY)

T. CARTER, F.-X. LE BOURDONNEC, M. KARTAL, G. POUPEAU, T. CALLIGARO and P. MORETTO

Abstract: *Fifty-six pieces of obsidian from the Öküzini Cave in SW Anatolia were elementally characterised using particle induced X-ray emission [PIXE], the artefacts coming from strata that span the early Epi-Palaeolithic to Late Chalcolithic. The obsidian comes from two sources in southern Cappadocia, East Göllü Dağ and Nenezi Dağ (380 km distant), representing the earliest evidence for these sources' use at distance. The cave's inhabitants perpetually existed on the margins of those socio-economic networks responsible for the circulation of these central Anatolian resources, obsidian only rarely crossing the cultural boundaries that separated the cave's populations from their contemporaries in the Konya Plain and Cilicia.*

Résumé : *La composition élémentaire de 56 pièces en obsidienne de la grotte d'Öküzini (sud-ouest de l'Anatolie), provenant des niveaux épipaléolithiques à chalcolithique, a été caractérisée par sonde nucléaire PIXE. Elle les rattache à deux sources cappadociennes, celles du Göllü Dağ Est et du Nenezi Dağ, distantes de 380 km ; ce serait l'utilisation la plus ancienne jamais observée à une telle distance. Les habitants de la grotte d'Öküzini ont toujours été à la marge des réseaux socio-économiques responsables de la circulation des ressources anatoliennes. Ainsi, l'obsidienne n'a que rarement franchi les limites culturelles qui séparaient les occupants de cette grotte de leurs contemporains dans la plaine de Konya, et de la Cilicie.*

Keywords: *Obsidian sourcing; Öküzini Cave; Epi-Palaeolithic - Chalcolithic Anatolia; Exchange; Socio-economic frontiers.*
Mots-clés : *Provenance ; Obsidienne ; Grotte d'Öküzini ; Anatolie épi-paléolithique et chalcolithique ; Échanges ; Frontières socio-économiques.*

INTRODUCTION

Located in the foothills of the Katran Mountains, Öküzini is a small cave overlooking the alluvial plain of the Göksu River in south-western Turkey, 32 km NW of modern Antalya and the current Mediterranean coastline (fig. 1). While first investigated between 1956-1965 and again in 1989,[1] the material discussed here comes from the 1989-1998 excavations undertaken by an international team directed by Professors Işin Yalçınkaya and Marcel Otte.[2] Most of the cave's occupation relates to the Epi-Palaeolithic, after which there is material relating to the Neolithic, Chalcolithic and Roman periods in the uppermost strata.[3] The Öküzini Cave thus provides a detailed sequence of Late Pleistocene and Early Holocene human activity in the region, with radiocarbon dates spanning the 19th–4th millennia cal. BC and into the historic period (table 1).[4]

1. Kökten, 1963; Albrecht, 1991; Albrecht *et al*., 1992.

2. Yalçınkaya *et al*., 2002.
3. López Bayón, Léotard et Kartal, 2002.
4. López Bayón *et al*., 2002.

 Manuscrit reçu le 28 avril 2010, accepté le 10 mai 2011

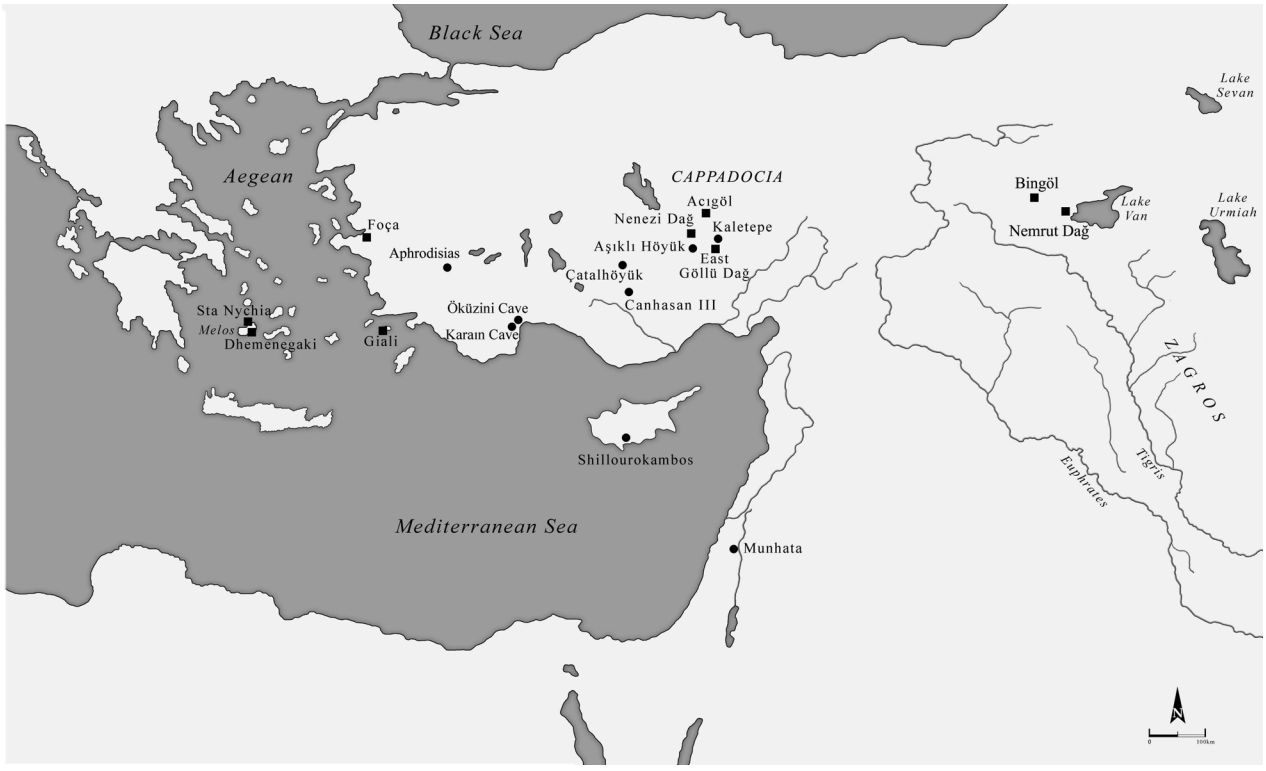


Fig. 1 – *The main sites and obsidian sources referenced in the text (M. Milić).*

Table 1 – *The main chronological schemes for the Öküzini Cave occupation sequence and the quantity of obsidian within each sub-phase.*

Geo. Horizon	Phase	Climate	Period	Approximate Dates	Obsidian
0	VI	Early – Middle Holocene	Early – Late Chalcolithic	5th – 4th millennia cal BC	29 (3.67g)
Ib1	VI	Early Holocene	Late Pottery Neolithic	7th millennium cal BC	23 (5.47g)
Ia1	V	Younger Dryas	late Epi-Palaeolithic	11th – 10th millennia cal BC	uncertain
Ia2	V	Younger Dryas	late Epi-Palaeolithic	12th millennium cal BC	3 (0.16g)
Hiatus					
II	IV	Older Dryas/ Bölling	late Epi-Palaeolithic	13th - 12th millennia cal BC	-
III	III	Bölling	late Epi-Palaeolithic	13th millennium cal BC	-
III-IV	III	Bölling	late Epi-Palaeolithic	no dates	-
IV	III	Bölling	late Epi-Palaeolithic	13th millennium cal BC	-
V	III	Bölling	late Epi-Palaeolithic	no dates	-
V-VI	III	Bölling	late Epi-Palaeolithic	no dates	-
VIa	III	Bölling	late Epi-Palaeolithic	no dates	-
VIa-VIb	III	Bölling	late Epi-Palaeolithic	14th - 13th millennia cal BC	-
VIb	III	Bölling	late Epi-Palaeolithic	15th - 13th millennia cal BC	-
VI-VII	III	Bölling	late Epi-Palaeolithic	16th - 15th millennia cal BC	-
Hiatus					
VII	II	Warm Phase	early Epi-Palaeolithic	16th millennium cal BC	-
VII-VIII	II	Warm Phase	early Epi-Palaeolithic	16th millennium cal BC	-
VIII	II	Warm Phase	early Epi-Palaeolithic	17th - 16th millennia cal BC	1 (0.28g)
IX	II	Late Glacial Maximum	early Epi-Palaeolithic	17th millennium cal BC	-
Hiatus					
X	I	Late Glacial Maximum	early Epi-Palaeolithic	19th - 18th millennia cal BC	-
XI	I	Late Glacial Maximum	early Epi-Palaeolithic	19th - 18th millennia cal BC	-
XII	I	Late Glacial Maximum	early Epi-Palaeolithic	19th - 18th millennia cal BC	-

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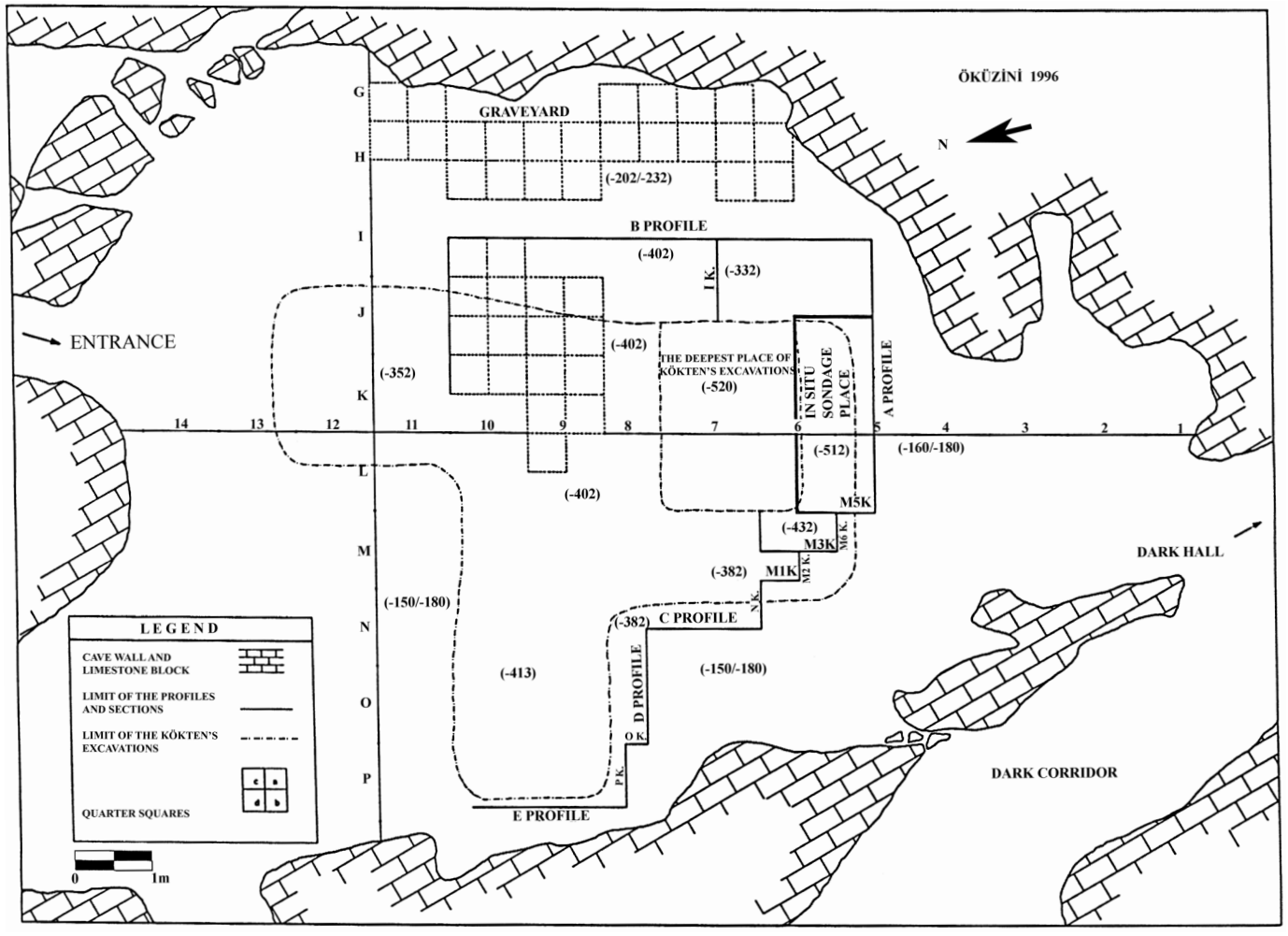


Fig. 2 – *Plan of the Öküzini Cave and excavation trenches (from* OTTE et al.*, 2003: fig. 2).*

The faunal data indicate that during the early Epi-Palaeolithic the cave acted as a late spring-early autumn base for hunting wild goat, sheep and fallow deer, most of which were likely procured within a 10 km radius.[5] Following a period of abandonment, the cave later experienced more frequent and lengthier uses over the summer months, a "trajectory of increasing sedentism" that continued into the later Epi-Palaeolithic.[6] Throughout these periods the cave's occupants supplemented their diets by foraging a wide range of wild fruits, nuts, roots, bulbs and tubers.[7]

The site also produced a small amount of parietal and mobiliary art, with aurochs incised on the cave wall and a series of limestone pebbles inscribed with complex geometric designs.[8] These symbols provide links to iconography from late Upper Palaeolithic Western Europe and the early Epi-Palaeolithic Levant.[9] More immediately, the Öküzini Cave material forms part of an Antalya-region artistic repertoire, with carved images from contemporary levels at nearby Karaın Cave (1.5 km away [fig. 1]).

The most recent strata contained mixed deposits of Late Ceramic Neolithic and Early Chalcolithic date (the latter including burials), followed by traces of Roman and more recent activity (fig. 2 and table 1).

5. Atici and Stutz, 2002; Martinoli, 2004: 76-77.
6. Atici and Stutz, 2002: 105.
7. Martinoli, 2004.
8. Marshack, 2002; Otte *et al*., 1995: 941-943.
9. Marshack, 2002: 285.

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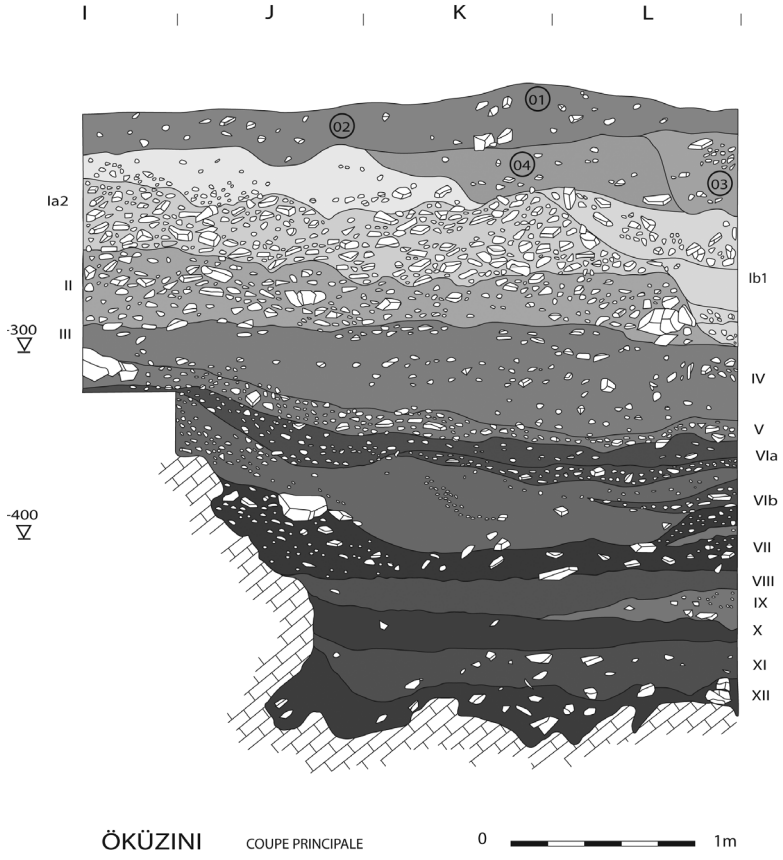


Fig. 3 – *Öküzini Cave South or Main Profile (from LÓPEZ BAYÓN* et al.*, 2002: fig. 3a).*

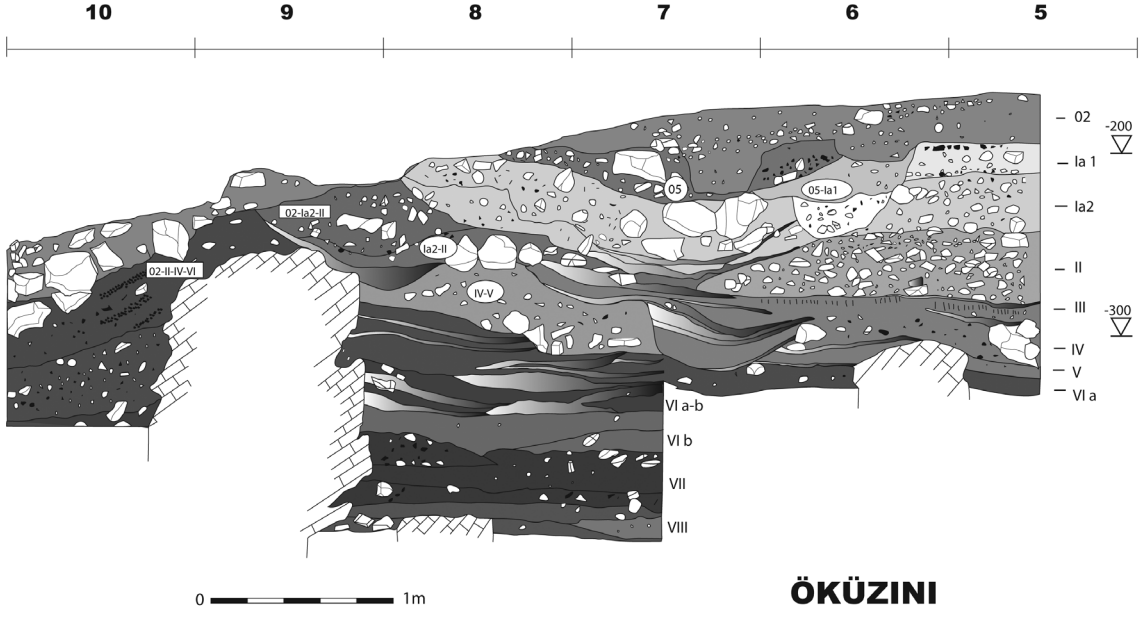


Fig. 4 – *Öküzini Cave East or Secondary Profile (from LÓPEZ BAYÓN* et al.*, 2002: fig. 3b).*

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Table 2 – *Radiocarbon dates for Geological Horizons with obsidian. Labs: ETH = Zurich; GX = Krueger Enterprises, Cambridge, USA; HD = Heidelberg, Germany; Lv = Louvain, Belgium; OxA = Oxford, UK; RT = Weizmann Institute, Israel (data from* GOLDBERG *and* BAR-YOSEF, *2002: Table 3;* KARTAL *and* EREK, *2002: table 2;* LÓPEZ BAYÓN et al., *2002: table 1;* OTTE et al., *2003).*

Square / AH	GH	Sample	Lab No.	Date uncal BP	Date cal BC (confidence)
G11b-d/5 – Grave V	0	bone	RT-3897 (AA43929)	5,965 ± 125	4838-4807
G7b-d/5 – Grave III	0	bone	RT-3896 (AA43928)	4,890 ± 45	3657
H7b/4 – Grave III	0	charcoal	RT-3891	4,745 ± 55	3,624–3,524
H7b/3 – Grave II	0	charcoal	RT-3892	4,465 ± 55	3,257–3,098
I5c/3 – Grave I	0	charcoal	RT-3899	5,430 ± 40	4,326–4,256
L5/2	O3-O4-Ia1-Ib1	charcoal	HD-13363-13884	8595 ± 90	7740-7540 (1σ 68.2%)
L5/6	Ia2-Ib1-II	charcoal	ETH-8026	12,020 ± 90	12,400-11,850 (1σ 68.2%)
K5c/5	Ia2	charcoal	RT-1441	10,440 ± 115	10,550-10,255 (1σ 68.2%)
K5c/6-7	Ia2	bone	GX-16283	11,880 ± 530	12,500-11,200 (1σ 58.7%)
L5/4	Ia2-Ib1	charcoal	ETH-8032	11,730 ± 90	11,770-11,530 (1σ 52.4%)
K5c/6	Ia2	bone	Lv-1895 (b)	11,440 ± 110	11,540-11,230 (1σ 68.2%)
K5c/5	Ia1-Ia2	charcoal	RT-1441	10,440 ± 115	10,700-10,150 (1σ 63.1%)
L5/5	Ia2-Ib1	charcoal	HD-13364-13887	9,650 ± 50	9,220-9,110 (1σ 38.4%)
I8b/8	Ia1-Ia2-II	charcoal	OxA-5213	10,150 ± 90	10,150-9,400 (1σ 68.2%)
L5/3	Ia2-Ib1	charcoal	ETH-8031	8,800 ± 80	8,200-7,650 (1σ 68.2%)
L5c/25	VIII	bone	Lv-1999 (b)	13,620 ± 280	14,750-14,050 (1σ 68.2%)
K5d/25	VIII	charcoal	OxA-5176	14,820 ± 150	16,100-15,450 (1σ 68.2%)
I8b/22	VIII	charcoal	OxA-5225	14,940 ± 140	16,250-15,600 (1σ 68.2%)
I8d/21	VIII	bone	Lv-2081 (b)	13,910 ± 120	15,050-14,450 (1σ 68.2%)
I7d/21	VIII	bone	Lv-2077 (b)	14,380 ± 190	15,650-14,950 (1σ 68.2%)
I8	VIII	charcoal	RT-2334	13,670 ± 175	14,800-14,150 (1σ 68.2%)

RELATIVE AND ABSOLUTE DATING

Stratigraphically, the Öküzini Cave deposits were excavated as a number of arbitrary 'archaeological horizons' [AH], from AH 1 at the top, to AH 33 at the base of the sequence. Given that many of the anthropomorphic deposits were sloping, these horizons ultimately incorporated more than one stratigraphic level and materials of differing dates.[10] Subsequent sedimentary and climatic studies allowed the excavators to rework these arbitrary strata into six geo-climatic phases spanning the Glacial Maximum to the Holocene. These six phases were in turn sub-divided into 13 geological horizons [GH], with the cave's uppermost level labelled 0 and the basal deposits labelled XII (fig. 3-4).[11] This relative sequence, in conjunction with material culture studies and 67 radiocarbon determinations, was then employed to create a six-phase cultural phasing for the cave, with Phase I the earliest and Phase VI the latest.[12] A summary of these various schemes is presented in table 1, while the absolute dates for those horizons containing obsidian are discussed in more detail below (see also table 2).

THE ÖKÜZINI CAVE OBSIDIAN

Throughout the occupation the chipped stone assemblages were dominated by local flint and radiolarites procured from the banks of the Göksu and Burhan rivers 20 km to the south-west.[13] The material also includes small quantities of quartz and obsidian, the latter recovered primarily from Neolithic/Chalcolithic strata though a handful are recorded from Epi-Palaeolithic deposits (table 1). Given that the closest sources are located over 300 km away (fig. 1), the Öküzini Cave obsidian provides a small but important data-set with which to investigate the early long-distance movement of this resource. The material further allows us to comment on the mobility and

10. López Bayón *et al*., 2002: 50.
11. López Bayón, Léotard et Kartal, 2002.
12. Goldberg and Bar-Yosef, 2002; Kartal and Erek, 2002: table 3; López Bayón *et al*., 2002: table 1; Otte *et al*., 2003.
13. Léotard et López Bayón, 2002: 189-190, fig. 27-28; Pawlikowski, 2002.

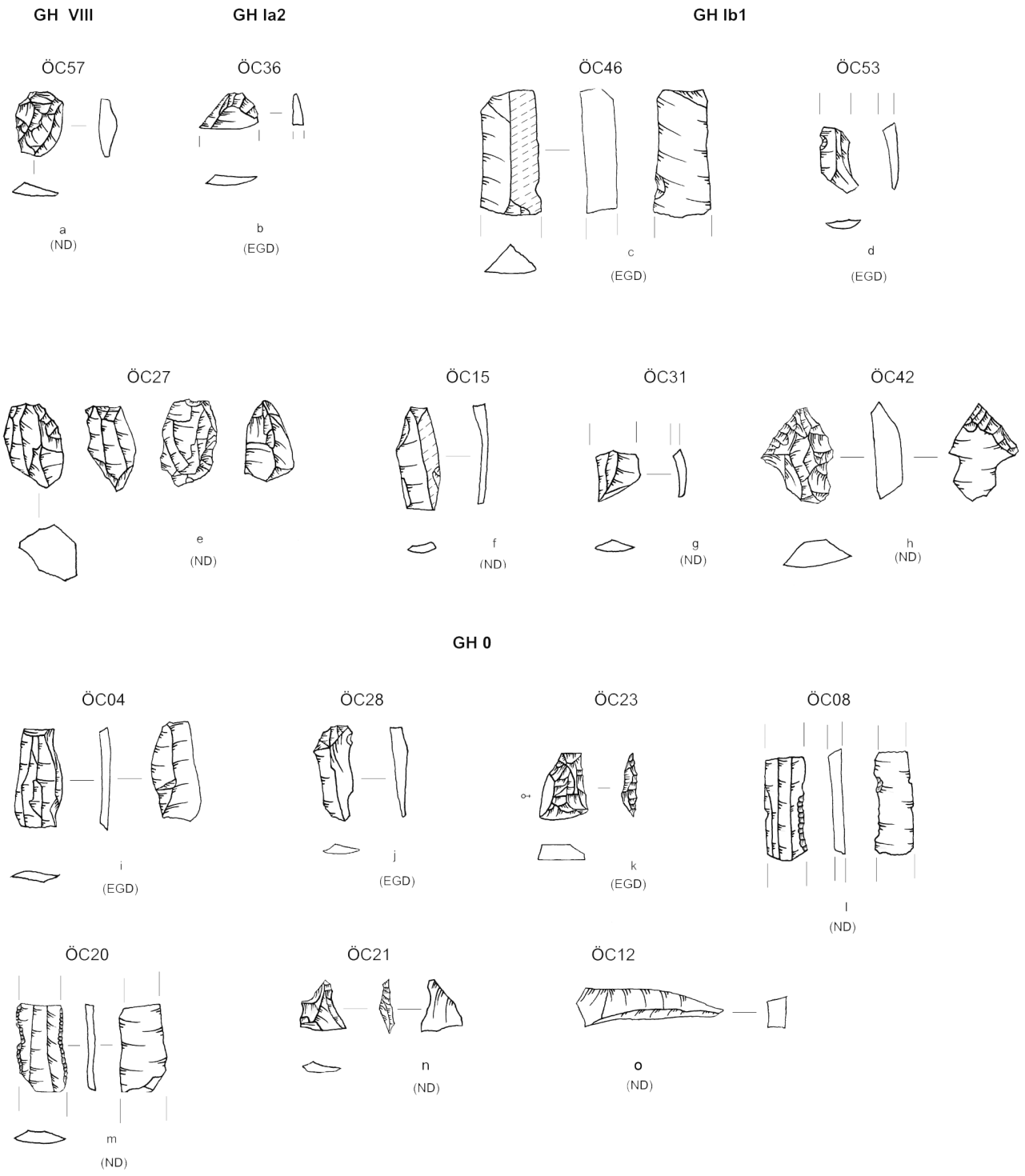


Fig. 5 – *Diagnostic obsidian artefacts from the Öküzini Cave by Geological Horizon and source (D. Mihailović).*

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contacts of the cave's inhabitants through time and helps us to fill something of a regional gap in obsidian sourcing studies, with precious little work having been previously undertaken in this part of Anatolia.[14]

This paper represents the first detailed study of the Öküzini Cave obsidian, as most of the artefacts come from assemblages other than those sampled for detailed analyses by the excavators (their "*unités d'étude*").[15] The material comprises a mere 56 pieces (10.52 g in total) mainly in the form of tiny non-cortical flakes recovered from the heavy residue sample of the water-sieving process (fig. 5-6 and table 3). Obsidian thus represents a *tiny* proportion of the Öküzini Cave chipped stone, less than 0.1% of the raw materials in any one period. This fact has to be borne in mind when we come to consider the material's socio-economic significance, as such a small assemblage cannot bear too much interpretative weight.

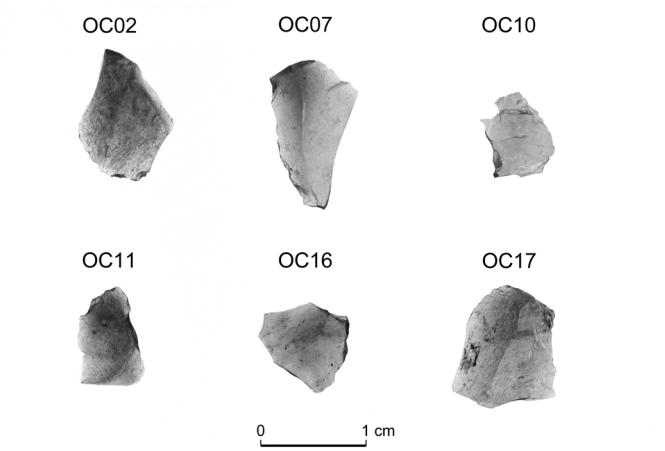


Fig. 6 – *A representative sample of small obsidian blanks from the Öküzini Cave (F.-X. Le Bourdonnec).*

DESIGNING THE ÖKÜZINI CAVE SOURCING STUDY

Sourcing the Öküzini Cave obsidian involves two stages. The first is to elementally characterize the objects; the second is to match the artefacts chemical signature with that of known geological sources. First we consider the sources that are most likely to have been exploited by the inhabitants of the Öküzini Cave, based on the following factors: 1) which archaeologically significant obsidian sources are closest to the site; 2) the results of previous obsidian characterisation studies on nearby (ideally contemporary) assemblages; 3) the artefacts date; 4) other lines of evidence that shed light on the cave occupants' geographical spheres of interaction / contact (via faunal, archaeobotanical, or material culture studies *inter alia*).

SITE LOCATION

In terms of linear distance, the Aegean / western Anatolian sources of Giali and Foça are the nearest to the Öküzini Cave at 310 and 370 km respectively (fig. 1). Neither case seems a likely candidate, with precious little evidence for the use of the former,[16] while most of the Giali products are spherulitic (and thus visually distinctive), their use seemingly restricted to populations on the nearby Aegean islands and western Anatolia.[17] The next closest sources are located in southern Cappadocia (*ca* 380 km distant), with East Göllü Dağ and Nenezi Dağ the most likely candidates, being the main obsidians procured by Epi-Palaeolithic - Neolithic communities in central Anatolia, Cyprus and the Levant.[18] Returning to the Aegean, we have the well-known sources of Sta Nychia and Dhemenegaki on the Cycladic island of Melos, *ca* 540 km from the Öküzini Cave,[19] whose products are known to have been exploited from at least the early 11th millennium cal. BC (Aegean Upper Palaeolithic).[20] Moreover, small quantities of these raw materials are attested in Anatolia,[21] albeit no furthest east than Early Chalcolithic Aphrodisias (Caria), 175 km north-west of the Öküzini Cave (fig. 1).[22]

PREVIOUS ANALYSES

This is the second characterisation study involving obsidian from the Öküzini Cave, as one artefact from the 1950's excavations was included in the first sourcing project to be undertaken

14. *Cf.* Chataigner, 1998; Cauvin et Chataigner, 1998.
15. Kartal, 2002; Kösem, 2002; Léotard et López Bayón, 2002: 111.
16. Poidevin, 1998 : 110.
17. Georgiadis, 2008.
18. Chataigner, 1998; Poidevin, 1998.
19. Renfrew *et al*., 1966; Torrence, 1986.
20. Perlès, 1987 : 142-145.
21. Carter, 2009: 207.
22. Blackman, 1986. The alleged piece from Late Neolithic Hacılar in the Lake District (only 70 km away [Gale, 1981: 49]), has since been assigned a Cappadocian source (Renfrew and Aspinall, 1990: 270).

Table 3 – *Contextual details, techno-typological attributes and raw material source for the 56 obsidian artefacts from the Öküzini Cave. (measurements in cm, weight in g; state: P (proximal), M (medial), D (distal), W (whole)).*

Sample	Trench	AH	GH	Date	Source	Artefact	State	Cortex	L	W	Th	Use	Wgt
OC 01	I5d	0	GH 0	Chalco / mix	EGD	Bladelet	P	0	0,93	0,98	0,21	Yes	0,26
OC 02	G8d	0-1	GH 0	Chalco / mix	EGD	Flake	D	0	0,59	0,41	0,22	No	0,05
OC 03	J5d	1	GH 0	Chalco / mix	EGD	Flake	P	0	0,26	0,41	0,03	No	0,01
OC 04	I6b	1	GH 0	Chalco / mix	EGD	Bladelet	D	0	1,93	0,91	0,19	Yes	0,43
OC 05	J5c	1	GH 0	Chalco / mix	ND	Flake	M	0	0,34	0,38	0,13	No	0,04
OC 06	I8c	1-2	GH 0	Chalco / mix	ND	Bladelet	M	0	0,87	0,46	0,09	No	0,04
OC 07	H8d	1-2	GH 0	Chalco / mix	ND	Flake	D	0	0,74	0,4	0,03	No	0,03
OC 08	H7b	2	GH 0	Chalco / mix	ND	Bladelet (retouch)	M	0	2	0,74	0,17	Yes	0,38
OC 10	I7a	2	GH 0	Chalco / mix	EGD	Flake	W	0	0,42	0,29	0,06	No	0,01
OC 11	I7a	2	GH 0	Chalco / mix	ND	Flake	M	0	0,52	0,24	0,08	No	0,01
OC 12	I7a	2	GH 0	Chalco / mix	ND	Sliver / flake	M	0	0,69	2,76	0,41	No	0,74
OC 13	I7a	2	GH 0	Chalco / mix	ND	Trapeze on blade	M	0	0,67	0,8	0,16	Yes	0,09
OC 14	I8a	2	GH 0	Chalco / mix	EGD	Flake	P	0	0,87	0,56	0,12	No	0,06
OC 16	H7d	3	GH 0	LCh (Grave II)	ND	Flake	M	0	0,36	0,44	0,07	No	0,01
OC 17	H8a	3	GH 0	Chalco / mix	EGD	Bladelet	P	0	0,63	0,46	0,16	No	0,04
OC 18	H8b	3	GH 0	Chalco / mix	EGD	Flake	P	0	0,76	0,66	0,08	No	0,03
OC 19	H8b	3	GH 0	Chalco / mix	ND	Flake (dull)	P	0	0,85	0,86	0,26	No	0,14
OC 20	H8c	3	GH 0	Chalco / mix	ND	Bladelet (notch / retouch)	M	0	1,74	0,89	0,18	Yes	0,42
OC 21	H9b	3	GH 0	Chalco / mix	ND	Bladelet	M	0	1,06	0,79	0,25	Yes	0,14
OC 22	H9b	3	GH 0	Chalco / mix	ND	Flake	P	0	0,66	0,41	0,09	No	0,03
OC 23	H9b	3	GH 0	Chalco / mix	EGD	Trapeze on blade	M	0	0,88	1,29	0,3	No	0,30
OC 24	H10b	3	GH 0	Chalco / mix	ND	Flake	D	0	0,65	0,37	0,08	No	0,02
OC 25	H12c	3	GH 0	Chalco / mix	EGD	Flake	D	0	0,57	0,46	0,14	No	0,03
OC 28	I7c	3	GH 0	Chalco / mix	EGD	Bladelet	PW	0	1,86	0,69	0,21	Yes	0,24
OC 29	G7d	4	GH 0	Chalco / mix	ND	Flake	M	0	0,67	0,62	0,19	Yes	0,09
OC 34	H13a	4	GH 0	Chalco / mix	ND	Flake	D	0	0,61	0,51	0,08	No	0,03
OC 32	H12a	4	GH 0-I	LN / ECh	ND	Flake	M	0	0,27	0,49	0,06	No	0,01
OC 33	H12d	4	GH 0-I	LN / ECh	ND	Flake	D	0	0,33	0,41	0,1	No	0,01
OC 56	I12a	5	GH 0-I	LN / ECh	EGD	Flake	D	0	0,7	0,36	0,09	No	0,02
OC 09	I6c	2	GH Ib1	LN / Ech (pit)	ND	Flake	D	0	0,81	0,41	0,22	Yes	0,05
OC 30	H8a	4	GH Ib1+D64	LN / Ech (pit)	EGD	Bladelet	M	0	0,91	0,62	0,13	Yes	0,11
OC 41	H10b	5	GH Ib1	LN / Ech (pit)	ND	Flake	D	0	0,4	0,37	0,12	No	0,02
OC 42	H10d	5	GH Ib1	LN / Ech (pit)	ND	Barb/tang point on blade	M?	0	1,88	1,33	0,45	Yes	0,98
OC 43	H11b	5	GH Ib1	LN / Ech (pit)	ND	Flake	D	0	0,28	0,51	0,05	No	0,01
OC 44	H11c	5	GH Ib1	LN / Ech (pit)	EGD	Bladelet	M	0	0,19	0,49	0,12	No	0,02
OC 45	H11c	5	GH Ib1	LN / Ech (pit)	ND	Flake	D	0	0,27	0,22	0,04	No	0,00
OC 46	H11d	5	GH Ib1	LN / Ech (pit)	EGD	Bipolar blade	M	50	2,41	1,13	0,53	Yes	1,63
OC 47	H12b	5	GH Ib1	LN / Ech (pit)	EGD	Flake	D	0	0,76	0,44	0,09	No	0,04
OC 48	H12b	5	GH Ib1	LN / Ech (pit)	ND	Flake	W	0	0,29	0,65	0,03	No	0,02
OC 50	H12b	5	GH Ib1	LN / Ech (pit)	ND	Flake	D	0	0,2	0,19	0,02	No	0,00
OC 51	H12b	5	GH Ib1	LN / Ech (pit)	EGD	Flake	D	0	0,09	0,62	0,12	No	0,02
OC 52	H12b	5	GH Ib1	LN / Ech (pit)	EGD	Flake	W	0	0,31	0,29	0,01	No	0,01
OC 53	H13a	5	GH Ib1	LN / Ech (pit)	EGD	Bladelet	D	0	1,31	0,51	0,19	Yes	0,14
OC 15	K5d	2	GH Ia1-1b1	Epi-Pal / Neo / Chalco	ND	Bladelet	P	0	2,02	0,76	0,19	Yes	0,32
OC 26	I6b	3	GH Ia1-1b1	Epi-Pal / Neo / Chalco	EGD	Flake	W	0	0,38	0,57	0,1	No	0,02
OC 27	I6c	3	GH Ia1-1b1	Epi-Pal / Neo / Chalco	ND	Bladelet core	W	0	1,71	1,15	0,82	No	1,69
OC 31	H9b	4	GH Ia1-Ia2-Ib1-II	Epi-Pal / Neo / Chalco	ND	Bladelet	D	0	0,97	0,82	0,22	No	0,16
OC 38	H9b	5	GH Ia1-Ia2-Ib1-II	Epi-Pal / Neo / Chalco	ND	Flake	D	0	0,41	0,36	0,03	No	0,01
OC 39	H9b	5	GH Ia1-Ia2-Ib1-II	Epi-Pal / Neo / Chalco	EGD	Flake	W	0	0,72	0,39	0,06	No	0,02
OC 40	H9b	5	GH Ia1-Ia2-Ib1-II	Epi-Pal / Neo / Chalco	ND	Flake	W	0	1,53	0,78	0,17	No	0,16
OC 54	I9a	5	GH Ia1-Ia2-Ib1-II	Epi-Pal / Neo / Chalco	ND	Flake	W	0	0,6	0,31	0,1	No	0,02
OC 55	I9a	5	GH Ia1-Ia2-Ib1-II	Epi-Pal / Neo / Chalco	ND	Distal bladelet	D	0	0,56	0,26	0,03	No	0,02
OC 35	I7c	4	GH Ia2	late Epi-Pal	ND	Flake	W	0	0,61	0,52	0,09	No	0,02
OC 36	I8a	4	GH Ia2	late Epi-Pal	EGD	Bladelet	P	P	0,69	1,02	0,19	Yes	0,14
OC 37	I8c	4	GH Ia2	late Epi-Pal	EGD	Flake / bladelet	D	0	0,12	0,34	0,02	No	0,01
OC 57	I8d	22	GH VIII	early Epi-Pal	ND	Rejuv off bladelet core	W	0	1,25	0,9	0,27	Yes	0,28

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in the 'Near East', a piece described variously as a "small flake" or "blade", coming from "the top of the Aurignacian IV level".[23] The same study also included a blade from the nearby Karaın Cave that came "from the travertine below the Aurignacian IV level".[24] Using Optical Emission Spectroscopy these two pieces of obsidian were sourced to the southern Cappadocian region of Çiftlik (the analysts' 'Group 2b'), a series of outcrops now generally equated with the East Göllü Dağ source group.[25] There is no other characterisation data from this region with which to contextualize our project.

DATE OF THE ARCHAEOLOGICAL CONTEXT

The date of the artefacts also needs to be considered, as certain sources have distinct histories of use. For example, during the Epi-Palaeolithic we only have evidence for the exploitation of East Göllü Dağ by central Anatolian and Levantine populations, and Bingöl and/or Nemrut Dağ by those living in south-eastern Anatolia.[26] Over time we witness an increased number of sources coming into play. The Aceramic / Pre-Pottery Neolithic sees the first use of Nenezi Dağ products,[27] while the exchange of obsidian during the Pottery Neolithic and Chalcolithic is notable for its "more cosmopolitan and widespread" nature,[28] with a range of northern Cappadocian (various Acıgöl types), Lake Van and north-eastern sources being exploited,[29] and the reconfiguration of long-standing exchange networks.[30]

OTHER LINES OF EVIDENCE FOR LONG-DISTANCE INTERACTION

Given the tiny quantities of obsidian recovered from the Öküzini Cave, it seems most likely that this exotic raw material was procured either through interaction with others in a form of exchange, or was collected in the process of undertaking more socio-economically significant activities, *i.e.* a form of 'embedded procurement'.[31] It would thus be beneficial to have a clearer idea as to the geographic extent and orientation of these people's 'territory' during the Epi-Palaeolithic as a means of elucidating which possible sources they were visiting and / or the potential intermediaries through which they gained access to their obsidian. For the Neolithic and Chalcolithic periods we would similarly like to examine other forms of evidence to reconstruct the exchange routes through which obsidian may have been disseminated.

During the Epi-Palaeolithic most of the basic food and raw material requirements seem to have been procured within a territory of 20 km radius. From further afield, there are quantities of marine shell such as *Dentalium* and *Columbella rustica* that would have been procured from the Mediterranean *ca* 30 km to the south-east,[32] while each of the Geological Horizons with obsidian also contained a few large flint blades that appear to have been procured ready-made from non-local sources (unfortunately, albeit from sites / sources currently unknown.[33] Arguably it is the cave's iconography that provides us with the best evidence for community interaction over distance, with the abstract and figurative symbolism forming part of a shared repertoire with those living both in the Levant and Western Europe.[34]

Having taken the above factors into consideration, it was decided that a relatively wide range of archaeologically significant source materials should be included in the study, both Aegean and central Anatolian, the most archaeologically significant of which are East Göllü Dağ (as represented by products of the Kömürcü, East-Kayırlı and Sırça Deresi flows)[35] and Nenezi Dağ in southern Cappadocia, plus Dhemenegaki and Sta Nychia on Melos (fig. 1). We also considered geological samples from Giali (Dodecanese), Foça (west Anatolian coast), plus various outcrops of the Acıgöl massif in northern Cappadocia, specifically the 'East Acıgöl *ante-caldera*' geo-chemical compositional group (Kartaltepe, Tulucetepe and Boğazköy flows), the 'East Acıgöl *post-caldera*' type (Kocadağ), plus 'West Acıgöl' (Körüdağ, Acıgöl crater and Güneydağ flows).[36] This is not to suggest that we ruled out the possibility of other Eastern Mediterranean sources (particularly given the above reference to the wider range being exploited in the Chalcolithic), but merely that one can construct an initial frame of reference through a detailed geo-temporal consideration of the material under consideration.

As detailed below, these source materials were characterised using the same technique as that employed to analyse the

23. Renfrew *et al*., 1966: 42-43, 65 and 71.
24. *Ibid.*: 43, 65 and 71.
25. Chataigner, 1998 : 285-292; Poidevin, 1998 : 115-121.
26. Cauvin et Chataigner, 1998 : 328-331.
27. Chataigner, 1998 : 285-287.
28. Renfrew *et al*., 1966: 48.
29. *Cf.* Bressy *et al*., 2005; Chataigner, 1998 : 280-285.
30. Carter, Dubernet, King *et al*., 2008.
31. *Cf.* Binford, 1979.
32. Yalçınkaya, Otte et Kösem, 2002.
33. Léotard et López Bayón, 2002.
34. Marshack, 2002.
35. Poidevin, 1998 : 119-121.
36. *Ibid.* : 113-114.

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Öküzini Cave artefacts; full details of these analyses are published elsewhere.[37]

THE ELEMENTAL CHARACTERISATION OF THE ÖKÜZINI CAVE OBSIDIAN

All 56 artefacts were analysed using particle induced X-ray emission [PIXE]. This technique is strictly non-destructive, relatively fast, involves minimal sample preparation and provides high-quality trace elemental data.[38] Moreover, PIXE has already been employed successfully by our research group as a means of elementally discriminating the major obsidian sources of archaeological significance in Anatolia.[39] The analyses and subsequent data manipulation were undertaken by Le Bourdonnec and Poupeau, the study developing out of three of the present authors' collaborative analyses of obsidian from Çatalhöyük.[40]

Fifty-three of the artefacts were analysed by the vacuum microbeam line of the AIFIRA facility at the Centre d'Études Nucléaires de Bordeaux-Gradignan [CENBG],[41] the other three through the extracted beam of the AGLAE analytical system at the Laboratoire du Centre de Recherche et de Restauration des Musées de France [C2RMF].[42] In both cases the samples were excited by a proton beam of nominal energy 3 MeV, their induced X-ray emission recorded by two Si(Li) detectors that allow the simultaneous detection of light and heavy elements, with 15 elemental contents recorded in total (Na, Al, Si, K, Ca, Ti, Mn, Fe and Zn, Ga, Rb, Sr, Y, Zr, Nb respectively).[43] Data treatments were performed using the 2000 version of the GUPIX software.[44] It has been demonstrated elsewhere that the data obtained by the two PIXE instrumental facilities at AIFIRA and AGLAE are equivalent.[45]

Two compositional groups were identified amongst the 56 artefacts analysed, characterized by a "low" and a "high" content of major elements Ca, Fe and trace elements Sr, Zr. These groups also differ with regard to their contents in Al, Si, Ti, and Zn (table 4). Four artefacts, ÖC 23 and ÖC 28 in the low-Ca group, ÖC 19 and ÖC 48 in the high Ca group, exhibit anomalously low Na and correspondingly high K contents. Such behaviour, accompanied for the three of them with the lowest Na content, by a small depression in their Si content, was shown to result from post-depositional surface alteration.[46] It may not be coincidental that three of these artefacts came from the uppermost stratum GH 0, whereby the different elemental contents might be viewed as the result of greater exposure to air and water, while ÖC 48 came from the pit from GH Ib1, whose fill would likely have been looser than surrounding deposits facilitating water percolation. That said, there was a number of other artefacts from the same strata that displayed no such distinctions in their Na and K composition, indicating that a number of variables are likely to be of influence in these matters, not just exposure to water/air, but also soil conditions, geometry and size of artefact, plus other environmental / contextual specificities (table 3).

Assigning the low- and high-Ca groups a specific volcanic source was achieved diagrammatically, by comparing the elemental compositions of the artefacts with those from the various Anatolian and Aegean source samples discussed above. According a geological source to these two groups was achieved through a principal component analysis (fig. 7) which demonstrates that our two compositional groups are compatible with the southern Cappadocian sources of East Göllü Dağ and Nenezi Dağ. Eastern Mediterranean obsidians and Eastern Anatolian peralkaline obsidians, whose elemental compositions are clearly different of those of the Öküzini artefacts,[47] were not included in figure 7.

One final methodological point, we would argue that PIXE represents the best possible technique to use in this situation given that most of the Öküzini Cave artefacts are extremely small (fig. 6), with almost three-quarters of them being <1 cm in length/width (n=41). INAA and ICP techniques would not have been suitable as the entire assemblage had to be analysed non-destructively, while EDXRF would potentially have run into analytical problems due to the artefacts' thinness and small diameter.[48] In contrast, with PIXE the beam usually penetrates no further than 50 µm (microns), with the gamma-ray

37. Poupeau *et al*., 2010.
38. The use of non-destructive techniques for obsidian characterisation studies in the larger region is becoming more commonplace for a variety of reasons pertaining to issues of laboratory facilities and cultural sensitivity, see Briois *et al*., 1997; Carter and Shackley, 2007; Gratuze, 1999; Khalidi *et al*., 2009; Poupeau *et al*., 2010, *inter alia*.
39. Le Bourdonnec *et al*., 2005; Lugliè *et al*., 2007 and 2008; Poupeau *et al*., 1998, 2005 and 2010, *inter alia*.
40. Carter *et al*., 2005 and 2006; Carter, Dubernet, King *et al*., 2008; Poupeau *et al*., 2005 and 2010.
41. A facility jointly run by the *CNRS* and *Université Bordeaux* 1.
42. A *CNRS-Ministère de la Culture* facility based in Paris (Calligaro *et al*., 1996 and 2002).
43. Le Bourdonnec *et al*., 2005; Lugliè *et al*., 2007.
44. Campbell *et al*., 2000; Maxwell *et al*., 1989.
45. Le Bourdonnec *et al*., 2005; Poupeau *et al*., 2010.
46. Poupeau *et al*., 2010.
47. *Cf.* Shelford *et al*., 1982; Carter and Kilikoglou, 2007; Poidevin, 1998.
48. *Cf.* Davis *et al*., 1998.

Table 4 – *Element contents for the 56 obsidian artefacts from the Öküzini Cave and their source attribution (NNZD = Nenezi Dağ, EGD = East Göllü Dağ).*

Sample	Lab.*	Na_2O	Al_2O_3	SiO_2	K_2O	CaO	TiO_2	MnO	Fe_2O_3	Zn	Ga	Rb	Sr	Y	Zr	Nb	Type
ÖC 001	1	3,7	12,7	77,4	4,5	0,46	0,064	0,070	0,88	—	17	227	19	23	89	26	EGD
ÖC 002	1	3,7	12,8	77,2	4,5	0,49	0,063	0,077	0,93	24	22	257	21	27	93	56	EGD
ÖC 003	1	3,6	12,8	78,0	4,4	0,40	0,062	0,064	0,76	19	15	210	15	22	71	47	EGD
ÖC 004	1	3,5	12,6	77,6	4,5	0,56	0,058	0,062	0,84	—	19	250	22	—	—	34	EGD
ÖC 010	1	3,1	12,8	78,3	4,5	0,48	0,062	0,054	0,66	19	11	169	7	—	71	21	EGD
ÖC 014	1	3,0	12,8	78,1	4,6	0,46	0,058	0,064	0,77	22	16	153	10	30	77	13	EGD
ÖC 017	1	3,6	13,0	77,7	4,4	0,42	0,057	0,070	0,85	23	23	250	27	—	97	65	EGD
ÖC 018	1	3,2	12,7	78,1	4,6	0,48	0,072	0,064	0,80	20	15	216	19	—	73	29	EGD
ÖC 023	1	1,9	12,6	76,4	7,1	0,48	0,063	0,059	0,78	27	14	270	13	—	85	32	EGD
ÖC 025	1	3,4	13,3	77,0	4,4	0,61	0,073	0,077	0,90	32	20	217	10	—	97	24	EGD
ÖC 026	1	3,1	13,0	77,3	5,0	0,52	0,063	0,068	0,87	27	15	287	24	—	77	—	EGD
ÖC 028	1	2,8	12,4	77,4	5,3	0,47	0,059	0,071	0,89	—	18	218	15	—	87	38	EGD
ÖC 030	1	3,3	12,7	78,5	4,6	0,50	0,061	0,057	0,74	31	17	242	10	—	76	19	EGD
ÖC 036	1	3,2	12,7	77,9	5,0	0,45	0,076	0,064	0,89	26	18	234	22	30	73	—	EGD
ÖC 037	1	3,1	12,8	78,4	4,5	0,47	0,056	0,051	0,63	22	10	189	16	35	58	26	EGD
ÖC 039	1	3,6	12,6	78,1	4,4	0,42	0,054	0,077	0,89	24	15	230	17	49	69	47	EGD
ÖC 044	1	3,5	12,8	78,2	4,4	0,49	0,051	0,053	0,70	22	11	174	11	—	68	31	EGD
ÖC 046	1	3,7	12,7	78,2	4,3	0,39	0,062	0,053	0,67	19	15	165	16	—	64	32	EGD
ÖC 047	1	3,3	12,7	78,5	4,5	0,44	0,051	0,055	0,66	24	14	183	16	—	70	26	EGD
ÖC 051	1	3,3	12,6	78,5	4,5	0,45	0,055	0,056	0,64	17	14	186	14	22	78	21	EGD
ÖC 052	1	3,5	12,6	78,1	4,4	0,47	0,058	0,072	0,84	25	17	224	6	23	85	35	EGD
ÖC 053	1	3,7	12,7	77,4	4,3	0,57	0,075	0,076	0,97	—	16	223	10	30	83	36	EGD
ÖC 056	1	3,6	12,7	78,2	4,3	0,46	0,054	0,058	0,67	18	14	176	12	24	60	15	EGD
ÖC 005	1	3,8	13,9	74,9	4,2	1,20	0,121	0,077	1,26	57	19	185	161	23	177	34	NNZD
ÖC 006	1	3,8	13,7	75,4	4,3	0,95	0,128	0,069	1,17	49	12	189	166	—	172	—	NNZD
ÖC 007	1	3,9	13,7	75,5	4,2	1,00	0,105	0,066	1,10	39	16	163	141	—	139	22	NNZD
ÖC 008	2	3,8	13,7	75,3	4,1	1,10	0,120	0,070	1,23	47	18	175	139	22	116	17	NNZD
ÖC 009	1	3,7	14,0	75,3	4,1	1,11	0,102	0,062	1,07	38	14	162	108	—	122	27	NNZD
ÖC 011	1	3,7	13,8	75,5	4,3	1,10	0,114	0,063	1,04	32	12	168	104	—	127	26	NNZD
ÖC 012	1	4,1	13,8	75,1	4,2	1,02	0,121	0,079	1,28	47	22	183	116	31	144	31	NNZD
ÖC 013	1	3,8	13,8	75,5	4,1	1,24	0,108	0,052	0,94	40	16	146	95	—	133	20	NNZD
ÖC 015	1	3,4	13,7	76,3	4,3	0,92	0,116	0,053	0,97	38	14	153	95	15	110	14	NNZD
ÖC 016	1	3,8	13,8	75,1	4,3	1,01	0,117	0,082	1,36	44	19	219	152	—	183	44	NNZD
ÖC 019	1	1,3	13,6	73,1	8,2	1,17	0,128	0,069	1,18	49	17	254	139	—	199	40	NNZD
ÖC 020	1	4,0	13,7	75,3	4,3	0,96	0,112	0,070	1,22	44	16	217	132	—	175	39	NNZD
ÖC 021	1	3,9	13,7	75,5	4,2	0,98	0,123	0,066	1,14	44	14	173	130	—	142	37	NNZD
ÖC 022	1	3,9	13,8	74,9	4,2	1,09	0,127	0,083	1,41	52	22	224	165	—	149	52	NNZD
ÖC 024	1	3,9	14,1	74,8	4,2	0,99	0,128	0,080	1,34	44	18	186	136	—	168	45	NNZD
ÖC 027	2	4,0	13,8	75,2	4,1	1,03	0,127	0,063	1,08	36	13	143	117	14	115	15	NNZD
ÖC 029	1	3,7	13,6	73,9	4,5	1,22	0,153	0,085	1,52	51	23	209	131	31	150	18	NNZD
ÖC 031	1	3,6	13,6	75,0	4,3	1,00	0,131	0,070	1,31	49	15	204	147	—	135	31	NNZD
ÖC 032	1	3,8	13,8	74,9	4,2	1,25	0,136	0,079	1,31	44	15	192	117	47	179	24	NNZD
ÖC 033	1	3,8	13,9	74,8	4,1	1,33	0,139	0,076	1,21	44	13	196	130	48	120	—	NNZD
ÖC 034	1	3,9	13,9	75,0	4,2	1,16	0,107	0,071	1,20	43	16	211	120	—	156	31	NNZD
ÖC 035	1	3,5	13,7	75,6	4,3	1,05	0,122	0,072	1,14	38	17	174	118	—	194	21	NNZD
ÖC 038	1	4,1	13,8	75,0	4,2	1,04	0,116	0,082	1,33	46	20	198	180	37	143	28	NNZD
ÖC 040	1	3,6	13,7	75,6	4,2	0,97	0,118	0,073	1,28	45	19	191	151	—	157	36	NNZD
ÖC 041	1	3,7	14,2	74,7	4,1	1,29	0,133	0,064	1,17	38	18	148	145	27	126	45	NNZD
ÖC 042	2	3,6	14,0	74,7	4,2	1,23	0,144	0,070	1,30	54	18	157	140	15	130	13	NNZD
ÖC 043	1	3,8	13,9	75,3	4,1	1,15	0,130	0,062	1,11	38	17	172	148	34	138	—	NNZD
ÖC 045	1	3,9	13,7	75,8	4,1	0,99	0,096	0,065	1,09	37	14	160	126	—	101	31	NNZD
ÖC 048	1	1,8	13,6	74,4	6,9	1,14	0,121	0,065	1,04	40	15	188	134	—	146	34	NNZD
ÖC 050	1	4,0	13,7	75,7	4,1	1,01	0,117	0,061	1,06	40	15	170	126	21	120	—	NNZD
ÖC 054	1	4,0	13,6	75,4	4,2	0,98	0,119	0,069	1,19	47	18	170	165	28	147	23	NNZD
ÖC 055	1	3,9	13,8	76,0	4,1	0,88	0,103	0,056	0,93	34	15	141	118	19	100	26	NNZD
ÖC 057	1	4,0	13,8	75,4	4,1	1,00	0,118	0,066	1,14	60	18	171	137	—	114	33	NNZD

Contents in oxides are in wt % and contents in elements in ppm (µg/g). / * Measures performed respectively at CENBG (1) and C2RMF (2). (see text).

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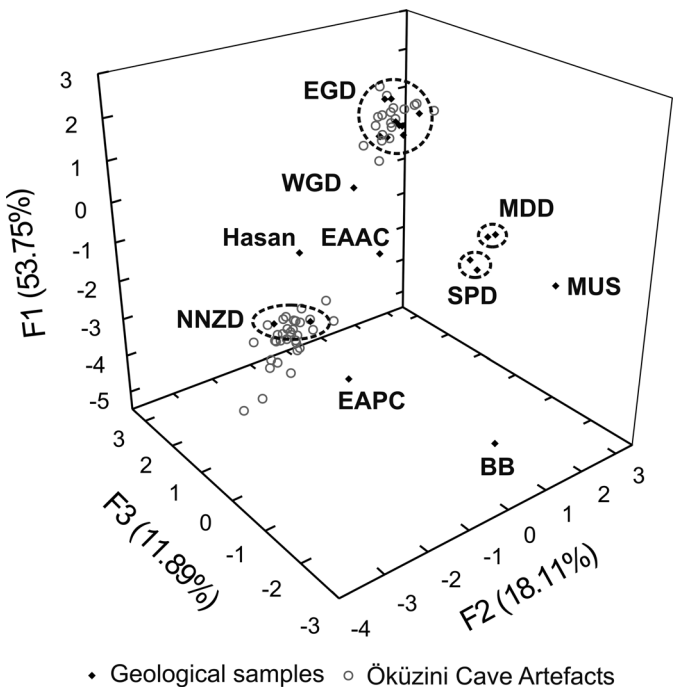


Fig. 7 – *A principal component analysis of the trace elemental data from the PIXE analysis of the 56 Öküzini Cave obsidian artefacts and major Aegean and Anatolian sources (F.-X. Le Bourdonnec).*

and X-ray emission mainly taking place within 10-20 µm, whereby the thinness of the Öküzini Cave artefacts had no undue effect on the analytical process and results.[49]

RESULTS

The results of the obsidian analyses are presented here by geo-chronological horizon starting with the earliest finds, their full contextual details presented in table 3. The sourcing data is accompanied by discussion of not only the artefacts techno-typological specifics, but also a more general overview of the archaeology of that period in the cave and its climatic and broader Anatolian / Near Eastern context, the latter derived from the chrono-cultural system of the *Maison de l'Orient*.[50]

Regarding absolute dates, there is a number of radiocarbon determinations from the Geological Horizons containing obsidian, though they are not without issue. A critical evaluation of the entire sequence of dates (considering lab, method, sample type and context), led the excavators to view those generated from bone to be highly problematic,[51] with López Bayón *et al.* arguing that those produced by the Oxford accelerator from carbon should be used as the basis for the absolute chronology of the Öküzini Cave sequence.[52] In this section we follow their lead, while at the same time reproducing all radiocarbon dates from the pertinent strata in table 2 (the majority of which were derived from charcoal).

GH VIII – EARLY EPI-PALAEOLITHIC (WARM PHASE) / PERIOD 0

Described as the Öküzini Cave's richest archaeological stratum, GH VIII forms part of the early Epi-Palaeolithic occupation sequence, dated to the late 17th - first half of the 16th millennia cal. BC (tables 1-2). This horizon is equated with the excavators' cultural Phase II, and climatically is located within the Warm Phase,[53] during which time the cave's occupants overwhelmingly favoured the hunting of ovicaprines, primarily wild goat (fig. 3-4).[54]

GH VIII contained evidence for a significant level of stone tool production, with various radiolarites used to make both blades and bladelets flaked by percussion techniques, primarily from unipolar cores. Various microlith types are documented, with retouched bladelets, micropoints, microgravettes, lunates, trapezes and isoscele triangles, while other tool forms include endscrapers on blades.[55] Amongst this rich chipped stone assemblage was a single piece of obsidian ÖC 57, that appears to be a small rejuvenation flake struck from the face of a bladelet core made of Nenezi Dağ obsidian (fig. 5: a).

If we can be certain that ÖC 57 belongs to this stratum, it would represent the earliest evidence for the long-distance movement of Cappadocian obsidian. To substantiate such a claim we need to critically consider the artefact's archaeological integrity. The first question that needs to be asked, is why should there be such a major chronological gap between this piece and the next obsidian finds in GH Ia2, a hiatus of perhaps as long as 7000 years. Might it make more sense to argue that ÖC 57 is in fact intrusive, having fallen out of a more recent stratum higher-up the stratigraphic profile? The hypothesis seems tempting given that the piece came from a square that

49. Summerhayes *et al.*, 1998: 134-135.
50. Aurenche *et al.*, 2001; Hours *et al.*, 1994.
51. Goldberg and Bar-Yosef, 2002: 42; López Bayón *et al.*, 2002 : 49-51.
52. López Bayón *et al.*, 2002: 49-51, fig. 3-5.
53. *Ibid.*: 52-54, table 1, fig. 6a and 7b; López Bayón, Léotard et Kartal, 2002 : 27-31; Otte *et al.*, 2003: 329.
54. Otte *et al.*, 2003: 333.
55. Léotard et López Bayón, 2002 : 131, fig. 10-11; Kartal, 2002: 236.

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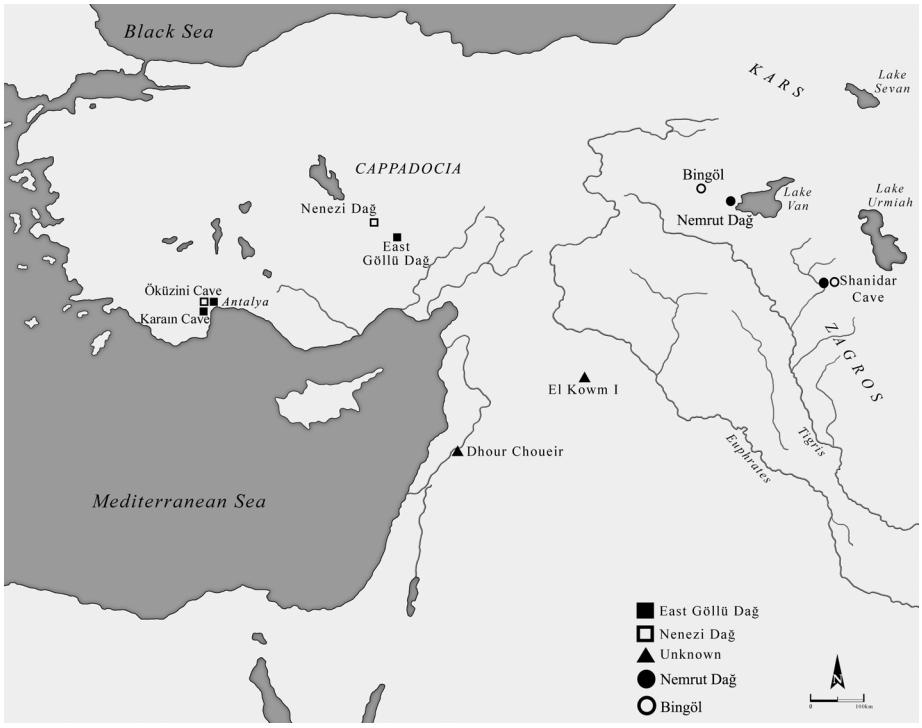


Fig. 8 – *Distribution of Anatolian obsidian in Period 0 (Epi-Palaeolithic) and earlier Palaeolithic periods (M. Milić).*

immediately abutted the East / Secondary profile (locus I8d/22 [fig. 4]). That said, the piece came from 'quadrant d' (the SW part of the square), which places it at least 50 cm away from the actual section (fig. 2).[56] While one would have preferred ÖC 57 to have come from a square further away from the profile, it should be noted that there is no record of any intrusive ceramics or other diagnostic later material recovered from this context. Moreover, ÖC 57 came from the same trench and layer as one of the three Oxford lab radiocarbon samples (I8b/22 [table 2]), further suggesting its uncontaminated nature.[57] Finally, one should not forget that this is not the first time obsidian has been recovered from a later Palaeolithic context at this site. An obsidian flake is reported from the top of the "Aurignacian IV level" from the 1950's excavation, while another came from "the travertine below the Aurignacian IV level" at neighbouring Karaın B (fig. 8); both of these artefacts were subsequently shown to be made of obsidian from the Çiftlik source (East Göllü Dağ).[58] More recently, Albrecht has reported a single cortical flake from one of the lowest Upper Palaeolithic levels at Karaın B, from a stratum that appears to be broadly contemporary with GH VIII;[59] this piece has yet to be sourced.

If ÖC 57 did indeed belong to GH VIII, then chronologically this places the find earlier than the *Maison de l'Orient*'s Period 0 [15,500–14,200 cal. BP], broadly contemporary with the Epi-Palaeolithic cultures of the Geometric Kebaran in the Levant, and Zarzian further to the east.[60] Hitherto, Period 0 represented the first phase during which we had evidence for the movement of Cappadocian obsidians beyond their source areas; ÖC 57 now represents one of the best documented pieces from conceivably an even earlier date. Furthermore, this artefact pushes back the earliest date for the long distance exploitation of Nenezi Dağ products by some 8000 years, with

56. See Yalçınkaya et Otte, 2002 : fig. 2.
57. It should be noted that there is some contradiction in the publication as to this context's Geological Horizon, as it is also listed as GH V in Yalçınkaya *et al*. (2002: table 7, 344), however the unit is described as belonging to GH VIII in Goldberg and Bar-Yosef (2002: 47, table 3), while GH VIII was also clearly written on the bag of chipped stone from which ÖC 57 was sampled (T. Carter, personal observation).
58. Both pieces having come from the 1950's excavations by Prof. Kökten (Renfrew *et al*., 1966: 42-43).
59. The piece comes from Archaeological Horizon 29, from which a single radiocarbon determination produced on a bone gave a date of 14,200 ± 500 BP, a determination that was considered possibly too young due to diagenesis (Albrecht, 1988: 213-214, fig. 2: 6).
60. Cauvin, 2000: 13-14; Hours *et al*., 1994.

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the material's first use previously dated to the 9th millennium cal. BC at the early Pre-Pottery Neolithic B [PPNB] sites of Munhata in Israel and Shillourokambos on Cyprus (fig. 1).[61] During Period 0 we are dealing with only tiny quantities of obsidian from a handful of sites over a relatively wide area. Aside from the Öküzini and Karaın B material, there is a tiny quantity of obsidian from roughly contemporary sites of the Kebaran culture (14,000-12,000 BP) in the Levant. From the same broad period there are also two bladelets from El Kowm I (Syria) plus a bladelet from Dhour Choueir (Lebanon) unfortunately, this material has yet to be sourced (fig. 8).[62]

While ÖC 57 may indeed represent the earliest evidence we have for the *distant* use of Cappadocian obsidian (at source exploitation of Göllü Dag materials goes back to the Lower Palaeolithic),[63] we should not forget that the SE Anatolian sources have an even earlier history of long-distance procurement, with two pieces of obsidian found in an Upper Palaeolithic stratum of the Shanidar Cave in northern Iraq (dated *ca* 30,000 BP). One of these pieces when analysed was shown to be a peralkaline product of Bingöl and / or Nemrut Dağ, sources that lay some 300-400 km north-west of the site (fig. 8).[64]

As-the-crow-flies, the distance from the Öküzini Cave to Nenezi Dağ is approximately 380 km; however, a more realistic circuitous route either around the southern edge of Konya Plain, or via Cilicia would be in the region of 400-600 km.[65] Given that the inhabitants of the cave are known to have exploited a relatively small ecological niche of no more than 30 km radius for their foodstuffs and lithic resources,[66] it seems extremely unlikely that they would have procured the obsidian from Cappadocia themselves. Of course, the catchment area of the seasonal cave residence would have been significantly smaller than that exploited by these people during an annual / longer-term cycle of movement, though even this territory is unlikely to encompass the mountain of Nenezi Dağ which is some 400-600 km distant.[67] When one takes all of these points into consideration, it seems most likely that the inhabitants of the Öküzini Cave gained access to the obsidian through intermediary populations.[68] Unfortunately we have precious little idea as to who these peoples were, as the early Epi-Palaeolithic occupation of the area between Antalya and Cappadocia remains *terra incognita*.[69]

GH IA1 AND IA2 – LATE EPI-PALAEOLITHIC (YOUNGER DRYAS) / PERIOD 1

Geological Horizons Ia1 and Ia2 constitute Öküzini's uppermost late Epi-Palaeolithic deposits (with Ia1 overlaying Ia2), a re-occupation of the cave that represents the excavators' cultural Phase V, climatically relating to the Younger Dryas (table 1, fig. 3-4).[70] In one area, these strata were cut by a Neolithic pit (GH Ib1), while GH Ia2 was disturbed by a series of Neolithic and Chalcolithic features (GH 03, 04 and 05);[71] none of the obsidian from these strata came from these disturbed areas. The four radiocarbon determinations associated with GH Ia2, two of which were generated from the preferred charcoal samples, give dates of the early 12th – mid 11th millennia cal. BC (table 2), Period 1 in the *Maison de l'Orient*'s chronological scheme.[72]

Radiolarites were once again the dominant raw material, employed to make blades from unipolar prismatic and pyramidal nuclei using a pressure-flaking technique.[73] The tools of GH Ia2 include new types such as large blades with lateral retouch, scrapers on large flakes, and small flakes with multiple notches. The microlithic component included geometric forms such as trapezes, plus isosceles and scalene triangles, while the GH Ia1 material had microburins of the Krukowski type.[74] GH Ia1 also produced a series of long blades up to 8 cm long that were imported ready-made, together with truncated and splintered blades, notched blades and micro-scrapers. The three pieces of obsidian from these strata came from GH Ia2, comprising two bladelet segments of East Göllü Dağ obsidian (ÖC 36 [fig. 5b] and ÖC 37) and a tiny non-cortical flake sourced to Nenezi Dağ (ÖC 35).

The procurement of obsidian by the dwellers of the Öküzini Cave during GH Ia2 occurred at a time when we view the first major expansion in the long-distance circulation of Cappadocian products. Small quantities of central Anatolian

61. Briois *et al*., 1997 ; Cauvin et Chataigner, 1998 : 286-287, fig. 5: a-b.
62. Cauvin, 1991 : 166; Cauvin et Chataigner, 1998 : 328-329.
63. Slimak, 2004; Slimak *et al*., 2008.
64. Renfrew *et al*., 1966: 40-41.
65. *Ibid*. 1966: fig. 4b.
66. Atici and Stutz, 2002; Martinoli, 2004; Pawlikowski, 2002.
67. For example, roughly contemporary Epi-Palaeolithic foragers from the Levantine coast were estimated to have had a territory of 'only' 250-350 km (Bar-Yosef and Belfer-Cohen, 1989).
68. One can further point out that the one season when the cave's inhabitants moved elsewhere is winter, *i.e*. the time when the quarries would have been snow covered and inaccessible.
69. Baird, 2005; Binder, 2002: 81.
70. López Bayón, Léotard et Kartal, 2002 : 32-33 and 37-38, fig. 4a.
71. Otte *et al*. 2003: 331.
72. Aurenche *et al*., 2001: 1194-1196; Cauvin, 2000: 34-50, 75-95.
73. Léotard et López Bayón, 2002 : 133-134, fig. 22-24.
74. Kartal, 2002: 236; Léotard et López Bayón, 2002: 133-134, fig. 22-24.

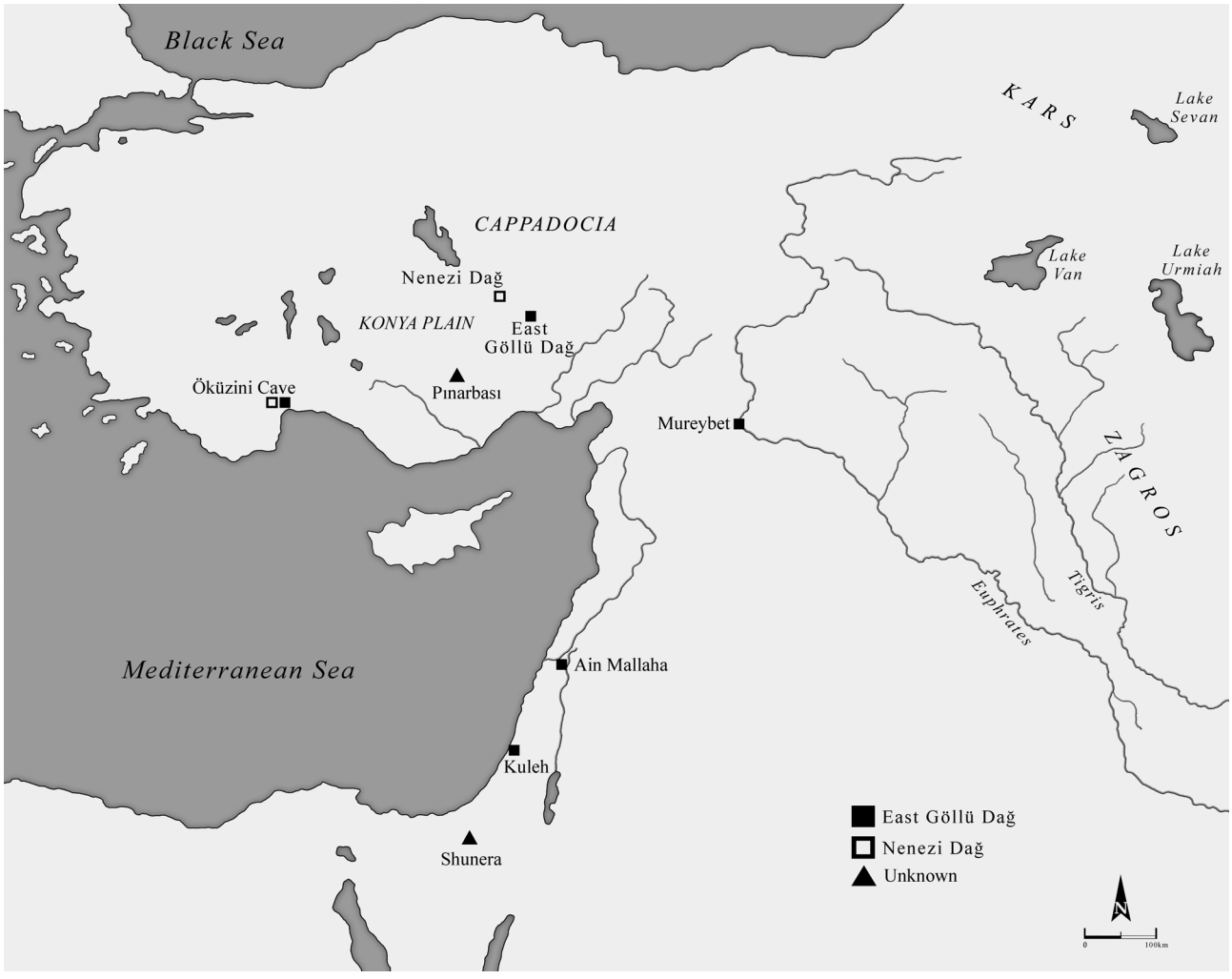


Fig. 9 – *Distribution of Cappadocian obsidian in Period 1 (Late Epi-Palaeolithic) (M. Milić).*

obsidian are now recorded from a number of Natufian sites throughout the Levant (fig. 9), including Mureybet, Abu Hureyra, Shunera, Ain Mallhala (Eynan) and Kuleh, communities that appear to have primarily procured the material in the form of ready-made blades and bladelets; where analysed, the material has all been sourced to East Göllü Dağ.[75] While the two Öküzini Cave bladelets would seem to fit this pattern, the tiny Nenezi Dağ flake is an interesting anomaly given that—as noted above—the first evidence for this raw material being consumed at distance had until now been placed much later during the early/middle PPNB (Period 3 / 9th-8th millennia cal. BC [fig. 1]).[76] This small but complete flake might further suggest the on-site working of Nenezi Dağ obsidian. Ultimately, given that the Öküzini Cave lies on the other side of Cappadocia to the Levant, it seems safe to assume that there were a number of different exchange networks in operation during the 12th-11th millennia cal. BC, with differences in both which sources were being exploited and the form(s) in which their products circulated.

As to the identity of those responsible for providing the cave's inhabitants with obsidian during this time, recent survey in the Konya Plain has found a number of sites with a

75. Cauvin et Chataigner, 1998 : 330-331; Delerue, 2007 : 217; Delerue et Poupeau, 2007; Moore, 2000: 182.

76. Briois *et al*., 1997; Cauvin et Chataigner, 1998 : 332-337; Chataigner, 1998 : 286-287.

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'microlithic' component (not least Pinarbaşı and Boncuklu), some of which are potentially Epi-Palaeolithic contemporaries of GH Ia2 Öküzini (fig. 9).[77] All of these sites assemblages were dominated by obsidian—presumably of Cappadocian origin—the material having potentially been directly procured by members of these small communities, the sources lying within the aforementioned 250-350 km range / territory of Levantine hunter-gatherers. Yet precious little of this obsidian seems to have trickled 'down-the-line' to the inhabitants of the Öküzini Cave or their neighbours, suggesting only limited interactions between the Epi-Palaeolithic populations of the Antalya region and the Konya Plain;[78] this is an issue that we return to below.

GH IB1– LATE NEOLITHIC (EARLY HOLOCENE) – PERIOD 6

GH Ib1 comprises the fill of a Neolithic pit that had been cut into strata GH Ia1, Ia2 and II at the western end of the South / Main profile (fig. 2-3), part of the excavators' cultural Phase VI and relating climatically to the Early Holocene.[79] Four of the five associated radiocarbon determinations (all charcoal) are problematic as they span the 9th to the mid 8th millennium cal. BC (table 2), which, given that the Ceramic Neolithic in Anatolia does not start until *ca* 7000 cal. BC,[80] suggests that these samples were residual. The fifth determination of 6558-6994 cal. BC (1σ=49.2%) seems a much more likely date for this feature, *i.e.* Early-Late Pottery Neolithic in a central / southwestern Anatolian context.[81]

Unfortunately little detail is provided on the chipped stone from the cave's uppermost levels, with the contents of GH Ib1 discussed together with those from the above GH 0 of Early-Late Chalcolithic date. The material is described as fragmentary, poor and primarily made of radiolarite; unipolar blade technologies dominate, with modified end-products including piercers, dihedral burins, and *pièces esquillées*, while others were glossed, conceivably from use as sickles.[82] The microburin technique is again represented, as were irregular geometric microliths, though as with much of the pit's contents, they are thought to be residual Epi-Palaeolithic material.[83]

Fourteen pieces of obsidian came from units associated exclusively with the contents of GH Ib1. In turn, we also discuss here a further nine artefacts that came from mixed deposits that may have partly formed a part of this pit, being labelled as 'GH Ia1-Ib1 mixture' and 'GH Ia1-Ia2-Ib1-II mixture' (tables 2-3). Of the aforementioned 14 pieces, half were sourced to East Göllü Dağ and half to Nenezi Dağ. While seven of these were in the form of undiagnostic tiny non-cortical flakes, there were also three bladelets of East Göllü Dağ obsidian (ÖC 30, ÖC 44 and ÖC 53 [fig. 5: d]) and two of Nenezi Dağ (ÖC 09, ÖC 45), pieces that we consider residual Epi-Palaeolithic material given their typo-technological characteristics. There are however two pieces that are much more likely to be genuine Neolithic products. The first is the medial section of a primary series blade (as attested by the remnant natural surface) from an opposed platform technology made of East Göllü Dağ obsidian (ÖC 46 [fig. 5: c]). The production of blades from opposed platform cores using this specific raw material is something that we almost exclusively associate with the Aceramic Neolithic in Central Anatolia (9th-8th millennia cal. BC), as attested at the quarry-based *atelier* of Kaletepe-Kömürcü,[84] at 'Aşıklı culture' sites of western Cappadocia[85] and at Canhasan III and Çatalhöyük (Level Pre-XII) in the Konya Plain.[86] Bipolar blade technologies are also known from Early and Late Neolithic contexts (7th millennium cal. BC), as at Çatalhöyük for example, but at this site at least, such products are *almost* always made from Nenezi Dağ obsidian.[87]

The second piece from GH Ib1 that should date to the Holocene is a small tanged point made on a prismatic blade of Nenezi Dağ obsidian modified with unifacial retouch (ÖC 42 [fig. 5: h]). While we struggle to find an exact parallel for this arrowhead, short projectiles such as these tend to be a diagnostic feature of Late Neolithic and Early Chalcolithic assemblages, as at Çatalhöyük in the Konya Plain (late 7th / 6th millennia cal. BC),[88] though they can continue much later, as evidenced by a not dissimilar projectile from Middle Chalcolithic Yumuktepe/Mersin (6th-5th millennia cal. BC).[89]

Of the nine remaining pieces from mixed deposits (table 3), seven were sourced to Nenezi Dağ and two to East Göllü Dağ; just under half of this material can be categorised as tiny non-cortical flakes (n=4). The other five pieces comprise an

77. Baird, 2005, 2007a and 2008.
78. Baird, 2007b: 293.
79. López Bayón, Léotard et Kartal, 2002: 32-33, 37, fig. 4a.
80. Which starts *ca* 7000 cal. BC (*cf.* Last, 2005: 127; Moore, 1995).
81. See papers in Gérard and Thissen, 2002.
82. Léotard et López Bayón, 2002: 134.
83. Kartal, 2002: 236.
84. Binder and Balkan-Atlı, 2001, *inter alia*.
85. Abbès *et al*., 1999; Balkan-Atlı, 1998; Kayacan, 2003.
86. Ataman, 1988: 70 and fig. 29.A and 34; Carter, Conolly and Spasojević, 2005: 472, fig. 11.5b-c.
87. T. Carter, personal observation.
88. Bialor, 1962: 97, fig. 10,6; Carter *et al*., 2006: fig. 162.
89. Garstang 1953: 106, fig. 66.

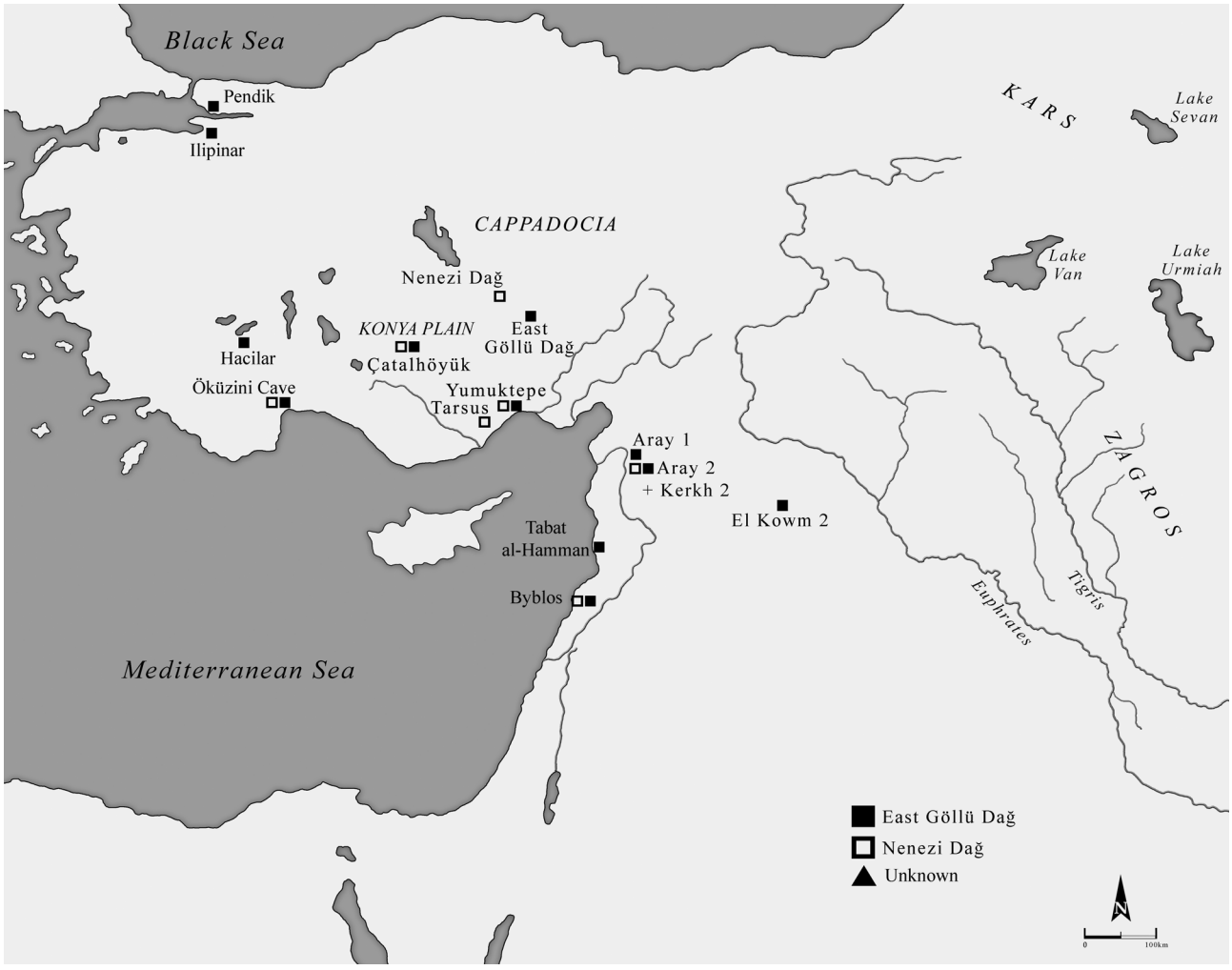


Fig. 10 – *Distribution of Cappadocian obsidian in Period 6 (Late Neolithic) (M. Milić).*

exhausted bladelet core (ÖC 27 [fig. 5: e]), plus four bladelet fragments (ÖC 15, ÖC 31, ÖC 38 and ÖC 55 [fig. 5: f-g]), all of which were made of Nenezi Dağ obsidian. Technologically there is no reason why this material could not be residual material from Epi-Palaeolithic strata, though one notes that the raw material is different to that of the bladelets from GH Ia2.

Primarily on the basis of the one radiocarbon date and the tanged point we are tempted to date GH Ib1 to the Late Neolithic in central / south-western Anatolian terms, equating broadly with the *Maison de l'Orient*'s Period 6, *i.e.* the second half of the 7th / first half of the 6th millennia cal. BC.[90] During this period obsidians from East Göllü Dağ and Nenezi Dağ are known to have circulated amongst communities throughout Anatolia and the Levant (fig. 10). In central Anatolia these Cappadocian obsidians represented the primary chipped stone raw material for such Late Neolithic communities as Çatalhöyük East in the Konya Plain and Yumuktepe/Mersin on the Cilician coast (*ca* 97% and 86% respectively).[91] Once again, as one moves south/south-west of the Konya Plain the amount of obsidian in circulation appears to fall off rapidly. That said, it represents 42% of the chipped stone raw materials at Late Neolithic / Early Chalcolithic Hacılar, with ample evidence for its on-site reduction,[92] yet this Lake District site

90. Aurenche *et al*., 2001: 1197-1198.

91. Carter *et al*., 2006; Renfrew *et al*., 1966: 60 (Yümüktepe/Mersin – Level XXIV).

92. Mortensen, 1970.

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is further on from the sources than the Öküzini Cave, where obsidian once more comprises only a tiny proportion of the assemblage (<1%). Farther afield, East Göllü Dağ obsidian has also been documented at Late Neolithic Ilıpınar and Pendik in northwest Anatolia, El Kowm (Syria), Byblos and Tabat-el-Hammam on the Levantine littoral, plus Aray 1, Aray 2 and Kerkh 2 in the Rouj Valley (NE Syria), while Nenezi Dağ products are documented from a few of the same sites, specifically Çatalhöyük East, Yumuktepe/Mersin Byblos, Aray 2 and Kerkh 2.[93]

GH 0 – EARLY-LATE CHALCOLITHIC (EARLY-MIDDLE HOLOCENE) – PERIODS 9-10

GH 0 represents the Öküzini Cave's uppermost deposits, containing material culture of later prehistoric, Roman and modern date. The earliest material relates to a small Early-Late Chalcolithic burial ground (fig. 2), with five graves radiocarbon dated to the 5th-4th millennia cal. BC (tables 2-3).[94] GH 0 constitutes the excavators' cultural Phase VI (fig. 3-4), spans the Early-Middle Holocene and can be equated with the *Maison de l'Orient*'s Periods 9-10.[95]

The nature of the GH 0 chipped stone assemblage is described above. Half of the Öküzini Cave obsidian came from these latest strata (n=29, 23.43 grams),[96] 17 of which were sourced to Nenezi Da and 12 to East Göllü Da (table 3). All but one came from the eastern part of the cave where the graves were located. One tiny flake (ÖC 16) actually came from the fill of a Late Chalcolithic burial (Grave II),[97] but is not considered an actual grave good. As before, most of the artefacts are small and fragmentary, with many chronologically undiagnostic. While almost a third of this material is described as 'non-cortical flakes' (n=9), many of these pieces are probably highly fragmented bladelets (only one of these 'flakes' was complete). Indeed the rest of the assemblage is almost entirely made up of blades and bladelets (n=13), nine of Nenezi Dağ obsidian and four of East Göllü Dağ (fig. 5: i-o). The longest – near complete – example was made of East Göllü Dağ obsidian and measured 1.86 cm long (ÖC 28 [fig 5: j]); two of the Nenezi Dağ pieces were retouched, one having simple linear modification (ÖC 08 [fig. 5: l]), while the other was notched (ÖC 20 [fig. 5: m]). Given that Anatolian Chalcolithic assemblages tend to comprise true unipolar prismatic blade products,[98] it is not inconceivable that these are Epi-Palaeolithic bladelets re-deposited from earlier strata when the graves were dug. Alongside the bladelets were four blades that we consider genuine Chalcolithic (or Late Neolithic) products, not least ÖC 13 and ÖC 23, medial blade segments that had been retouched into trapezoidal transverse projectiles, the former's raw material sourced to Nenezi Dağ, the latter to East Göllü Dağ (fig. 5: k). A handful of these distinctive implements made of radiolarite are recorded from the upper layers at the Öküzini Cave, Type 43 in Kartal's microlith typology (albeit made on flakes), while examples made on blades are known from Holocene layers at the nearby Karaın B[99] and Suluin caves.[100] Trapezes made on blades seem to be a relatively common later Neolithic / Chalcolithic tool type, with examples known from Early Chalcolithic Yumuktepe/Mersin in Cilicia and Çatalhöyük West in the Konya Plain (6th millennium cal. BC),[101] from Fikirtepe Culture sites of NW Anatolia (later 7th-6th millennia cal. BC),[102] while in the Near East they are most popular during the late 5th and 4th millennia cal. BC.[103]

The fact that the inhabitants of the Öküzini Cave continued to use East Göllü Dağ and Nenezi Dağ products during the Chalcolithic comes as no surprise, for while an expanded range of obsidians are known to have come into play at this time,[104] these clearly remained the primary sources in central Anatolia, with a major quarry-based *atelier* at Kaletepe-Kömürcü at this time (fig. 1).[105] For central Anatolian communities of the period obsidian remained the primary raw material for chipped stone tool production, dominating the assemblages at Tepecik/Çiftlik Höyük and Köşk Höyük in western Cappadocia,[106] plus Canhasan I and Çatalhöyük West in the Konya Plain (fig. 11).[107] At the latter site some of us have been responsible for analysing over 200 artefacts

93. Bigazzi *et al*., 1998: 82-86; Carter *et al*., 2006; Gale, 1981; Maeda, 2003; Renfrew *et al*., 1966.
94. Seven radiocarbon dates were generated in total, but one from the 10th millennium cal. BC was obviously residual while another of AD 1297 was patently intrusive (Kartal and Erek, 2002).
95. López Bayón, Léotard et Kartal, 2002: 33, 37, fig. 3a-b, 4a-b.
96. This figure includes three pieces labelled as 'GH 0-I': ÖC 32, ÖC 33 and ÖC 56.
97. Dated to the late 4th millennium cal. BC by radiocarbon sample RT-3892 (Kartal and Erek, 2002: 347-349).
98. *Cf.* Carter, Milić, Kayacan *et al*., 2008; Garstang, 1953: 50-52; Léon Leurquin, 1986; Mortensen, 1970.
99. Kartal, 2002: 240, fig. 20,13.
100. Prof. Dr. Harun Taşkıran, Personal communication.
101. Carter *et al*., 2007; Conolly, 1999 : 36-37; Garstang, 1953: 50, fig. 29.
102. Özdoğan, 1999: 211-215, fig. 4.
103. Rosen, 1997: 39-44, fig. 3.2.
104. *Cf.* Bressy *et al*., 2005; Fornaseri *et al*., 1975-1977; Khalidi *et al*., 2009; Renfrew *et al*., 1966: 48; Yellin *et al*., 1996.
105. Balkan-Atlı et Binder, 2000: 205.
106. Bıçakçı, 2001: 29-30; Öztan, 2002: 59.
107. Though these sites are admittedly earlier in date: French, 1962: 32; Raszick, 2002 and 2003.

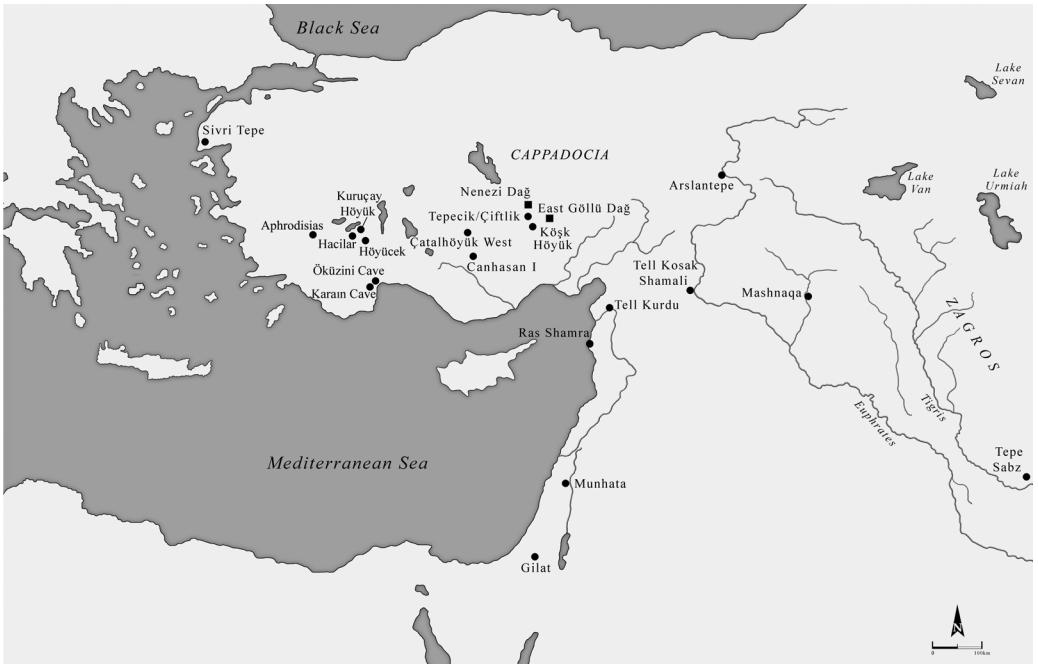


Fig. 11 – *Distribution of Cappadocian obsidian in Periods 9-10 (Early-Late Chalcolithic) (M. Milić).*

from Early Chalcolithic I-II contexts, virtually all of which were shown to have been made of obsidian from East Göllü Dağ and Nenezi Dağ.[108] As before, the amount of obsidian in circulation seems to diminish fairly rapidly as one leaves central Anatolia, as for example at Höyücek and Kurucay Höyük in the Lake District, *ca* 350-390 km west of the Cappadocian sources, where obsidian represents only 10% and 12-16% respectively of their Early–Late Chalcolithic chipped stone assemblages.[109] That said, obsidian comprised 42% of the late Neolithic–Chalcolithic assemblage at nearby Hacılar, which is located slightly further from the sources (*ca* 400 km), indicating that access to these Cappadocian raw materials was based on more complex factors than proximity to the quarries.[110] Indeed, in terms of linear distance the Öküzini Cave is somewhat closer to the sources (*ca* 380 km), yet its Chalcolithic assemblage contains a far smaller proportion of obsidian, indicating the inhabitants' existence on the margins of those socio-economic networks through which these Cappadocian raw materials circulated. One might view these data as contributing further to the recent view that the Antalya region communities were located in a somewhat marginal position *vis-à-vis* the major 'cultural zones' of the period,[111] and further evidence for the lack of strong links between the inhabitants of the Antalya region and those living in the Lake District / Konya Plain.[112]

Returning to the wider evidence for the use of the two main southern Cappadocian sources during the Early-Late Chalcolithic (fig. 11), archaeometric analyses have recorded East Göllü Dağ from such broadly contemporary sites as the South-Eastern Turkish settlements of Tell Kurdu (Halaf-Ubaid) and Arslantepe (Halaf),[113] Ras Shamra and Tell Kosak Shamali in Syria, Gilat and Munhata in Israel, plus Mashnaqa and Tepe Sabz in Mesopotamia, the latter over 1200 km from the source.[114] In the other direction, the same obsidian is

108. Carter *et al*., 2006: 907. The sourcing data from a further 200 artefacts are being prepared for publication.
109. This is still considerably more than that we have at the Öküzini Cave, despite being located at much the same distance(s) from the Cappadocian sources (Balkan-Atlı, 2005: 131; Baykal-Seeher, 1994: 106-108, and 1996: 126-127).
110. Mortensen, 1970: 153-154. One notes a similar situation in the Konya Plain, for while 95% of the chipped stone at Çatalhöyük West is obsidian, it comprises a far smaller proportion of the assemblages from its neighbouring contemporaries (Baird, 2005: 71-73).
111. Schoop, 2005: 17-20, fig. 1.1.
112. *Cf.* Kayan *et al*., 1987.
113. Bressy *et al*., 2005; Fornaseri *et al*., 1975-1977.
114. Bellot-Gurlet *et al*., 2003; Chataigner, 1998 : 290-291; Renfrew *et al*., 1966: 48; Wright and Gordus, 1969; Yellin *et al*., 1996.

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attested at both Late Chalcolithic Sivri Tepe in the Troad,[115] and Late Chalcolithic Aphrodisias in SW Turkey where products from Nenezi Dağ were also attested.[116]

DISCUSSION

In summary, all of the obsidian analysed from the Öküzini Cave comes from the southern Cappadocian sources of East Göllü Dag and Nenezi Dağ, with the latter's recovery from GH VIII and GH Ia2 serving to push back the earliest evidence of this raw material's long-distance use by some eight millennia. The Nenezi Dağ component of the Öküzini Cave material is important not only for its early date, but also because it dominates the overall assemblage. This is in marked contrast to what one has come to expect from Eastern Mediterranean prehistoric sites, where previous characterisation studies had showed that East Göllü Dağ obsidian was both the first and quantitatively most important of the Cappadocian sources.[117] So why does the Öküzini Cave data not conform to the existing pattern? We would argue that there are two issues of concern here. The first is perhaps the most significant, namely that our results have arguably shed light on a different set of socio-economic practices to those engaged in by contemporary hunter-gatherers groups to the east of Cappadocia. The idea that different peoples over such large areas were exploiting distinct obsidian sources should not perhaps be surprising; at the same time, this data might be an important reflection of how various populations employed common resources as a means of self-identification and association with and / or distinction from other groups. It is very much hoped that the planned characterisation of obsidian from the late Epi-Palaeolithic / Aceramic Neolithic sites of Pinarbaşı and Boncuklu in the Konya Plain will help us further clarify these matters.

The second point to make concerning the relative quantity of Nenezi Dağ obsidian at the Öküzini Cave, is that parts of the assemblage might in fact be quite typical for their period, namely that from the Late Neolithic and Chalcolithic strata. If one surveys the extant sourcing data one appreciates quite rapidly that there has been something of a research bias towards Epi-Palaeolithic and Aceramic Neolithic sites, with far less attention accorded to obsidian assemblages from Pottery Neolithic and later prehistoric sites. Thus the dominance of East Göllü Dağ obsidian in the Eastern Mediterranean might in fact relate to certain periods but not all. Indeed recent work at Çatalhöyük has demonstrated clearly that these two Cappadocian sources had a quite different history of use for this Konya Plain community. Here a combination of archaeometric analyses and visual discrimination studies indicate that East Göllü Dağ products are dominant (up to 95%) in the Aceramic Neolithic and earliest Early Ceramic Neolithic strata (Level Pre XII.D – VIB), after which there is a radical shift to a reliance upon Nenezi Dağ obsidian (Level VIA – I [again as much as 95%]), while Early Chalcolithic assemblages tend to be quite evenly balanced between the two.[118] When considered in this light, the Öküzini Cave data set finds itself far less anomalous, providing further evidence for a radical reconfiguration of Cappadocian source exploitation (for certain communities) somewhere around the middle of the 7th millennium cal. BC, if the Çatalhöyük data is ultimately to prove to be representative of a larger whole.

In trying to reconstruct the form(s) in which these obsidians were procured by the cave's inhabitants, we are hampered by the fact that most of the artefacts had been rendered technologically and typologically undiagnostic due to intensive reduction/curation processes, arguably a reflection of the material's rarity. With no cortical material we can at least say that the cave's occupants gained access to this material in an already worked state, conceivably as finished products, bladelets during the Epi-Palaeolithic, then blades and projectiles in later periods. Nor can we say a great deal about how these implements were used or valued, as they all came from general fill deposits. As such, our discussion of the Öküzini Cave material has had to focus on contextualising the material within the broader history of these Cappadocian obsidians use by prehistoric populations in Anatolia and the Near East. We here provide some further thoughts as to the socio-economic significance of this material to those who lived at the site.

Given that deposits spanning 11 millennia have produced a mere 56 pieces of obsidian, it is clear that obsidian would have represented a highly exotic material to the cave's inhabitants throughout its occupation history. Entire generations likely never experienced its procurement and use. So what was the significance of this material to these people and what can be said more generally about this handful of material? In trying to explain why only such small quantities of obsidian made their way to the Öküzini Cave we think most people would empha-

115. Pernicka *et al*., 1996
116. Blackman, 1986.
117. Chataigner, 1998; Cauvin et Chataigner, 1998.
118. Carter *et al*., 2006; Carter and Shackley, 2007; Poupeau *et al*., 2010; T. Carter, personal observation.

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sise two facts: 1) the great distances between the site and the obsidian sources, and 2) the site's rich local ecology with its plentiful supplies of good quality lithic raw materials.

Considering the first point, we would argue that concepts of distance are culturally constructed and as such are not constant.[119] In our study we are dealing with very different groups of people, from Epi-Palaeolithic hunter-gatherers via Neolithic farmers to a Late Chalcolithic populace who were on the margins of a world that was experiencing not only early metallurgy, but also the emergence of proto-urbanism.[120] Each of these societies was underpinned by a variety of socio-economic relations that involved resources, material culture and ideas moving over significantly different distances, whereby the Öküzini Cave data has to be considered within its particular chronological / cultural milieu.

The earliest material from the Öküzini Cave (GH VIII and GH Ia2) arguably fits the pattern of what one sees in later Palaeolithic Europe more generally; *i.e.* that while the chipped stone assemblage contains the occasional piece from over 300 km away, most of the tools were made of resources available within a 100 km radius.[121] Previous work in the Near East has seen no reason to invoke formal trade mechanisms at such an early date to explain the movement of such long-distance 'exotica'. The tiny quantities of obsidian recovered from these early sites are thought to reflect opportunistic procurement by hunter-gatherers who operated within large shifting territories.[122] While we do not rule out this model as a means of explaining the few pieces of obsidian from Epi-Palaeolithic strata, we do wonder if the distances involved in the case of the Öküzini Cave might not equally suggest the material's sporadic movement through simple forms of exchange. The data from the later Epi-Palaeolithic (Natufian) Levant, broadly contemporary with the GH Ia2 material, arguably supports this hypothesis, as here we have instances of East Göllü Dağ obsidian being found 500 km from source (at Ain Mallaha in central Israel),[123] the procurement of which must have involved a process of down-the-line movement via intermediary communities (fig. 9).

For later periods, the procurement and circulation of obsidian are viewed in more complex terms. The model that has underpinned our conceptualisation of exchange in Neolithic and Chalcolithic Anatolia / the Near East is that proposed by Colin Renfrew and colleagues over 40 years ago, based on the results of their groundbreaking, large-scale sourcing programme.[124] Their analysis of the distribution patterns associated with Cappadocian and south-eastern Anatolian obsidians led them to argue that two modes of exchange existed in parallel, the primary influence in both instances being distance-from-source. It was proposed that those who lived close to the obsidian quarries would have procured the raw materials themselves with no need for formal mechanisms of exchange, a notional region that was termed the 'supply zone'. At a distance of approximately 250-350 km from source it was noted that the amount of obsidian in circulation decreased exponentially, a change in distribution patterns that was interpreted as reflecting the shift from communities with 'direct access' to obsidian to those who were reliant upon intermediary exchange networks.[125] Given that the Öküzini Cave is located in this more distant 'contact zone', one could argue that it should come as no surprise that so little obsidian reached the site. However, we would argue that the quantities recovered from the cave do not fit this hypothetical pattern. For instance we have noted above the striking contrast between the Öküzini Cave and Hacılar data, the latter having 42% of its Late Neolithic/ Early Chalcolithic chipped stone consisting of obsidian despite the fact that this community is situated further from the sources than our cave site (fig. 10-11). This suggests strongly that access to these Cappadocian raw materials was not based on issues of distance alone; instead we would argue that it has more to do with the fact that these people were located on the *margins* of those socio-economic networks through which these obsidians circulated.

In thinking further about this notion of marginality we need to turn to the issue of the rich local ecology. It has to be admitted that a strong case can be made that a certain cultural insularity developed amongst the prehistoric people of the Antalya region due to the "plentiful possibilities of living" offered by their Mediterranean coastal environment,[126] not least their locally available artefact quality stone. Such plentiful resources may indeed have led to the development of a more restricted territory and worldview. Indeed, we have already noted the limited communication that existed between the later Epi-Palaeolithic hunter-gatherers of this region and their obsidian using contemporaries living to the north-east

119. *Cf.* Helms, 1988.
120. Algaze, 2005.
121. Gamble, 1999: 313-315. See also Demars, 1998; Geneste, 1988.
122. Renfrew *et al.*, 1966: 50.
123. Delerue et Poupeau, 2007. Obsidian has also been found at Natufian Shunera in southern Israel, though this material has yet to be analysed; if it came from central or eastern Anatolia it would represent a movement of over 800 km from source (Cauvin et Chataignier, 1998 : 330-331).
124. Renfrew *et al.,* 1966 and 1968.
125. Renfrew, 1968: 326-331.
126. Bostancı, 1962: 267.

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in the Konya Plain (during the period represented by strata GH Ia1 - Ia2).

In a situation perhaps analogous to the 'Mesolithic paradise' offered by the location of Serbia's famed Lepenski Vir, there is evidence to suggest that a hunter-gatherer lifestyle was retained by these Antalya region communities long after farming economies had been adopted by those living in the surrounding areas of Cilicia, the Konya Plain and Lake District.[127] At this point it is tempting to view the limited amounts of obsidian being procured by the cave's inhabitants in terms of a genuine hunter-gatherer / farmer frontier. Here we focus on the long-acknowledged fact that the trade and use of obsidian is a *quintessentially* Neolithic phenomenon.[128] This is not to reduce the material significance to a farming-related functionality, but instead to highlight the idea that its consumption formed an important part of the Neolithic *mentalité*, not least through its recurrent inclusion in the acts of exchange that bound these communities together and a variety of related symbolically charged practices.[129]

The late Epi-Palaeolithic occupants of the Öküzini Cave were contemporaries of these early agriculturalists, and we would suggest that it was these fundamental lifestyle differences that represented the greatest barrier to these people's procurement of obsidian, rather than distance from source. In evoking the hunter-gatherer / farmer frontier, we are careful to emphasise a temporal and geographical specificity, as opposed to a belief that this opposition is somehow inherently significant,[130] hence our previous distinction between central / south-western Anatolian Epi-Palaeolithic populations. In due course the peoples of the Antalya region *appear* to have adopted true agro-pastoral lifestyles,[131] yet we would suggest that the prehistoric inhabitants of this region never really shook off their earlier heritage in terms of their restricted access to the 'Neolithic' exchange networks of Central / South-central Anatolia; a regional difference remained.

We thus find it significant that amongst the few typologically distinctive obsidian artefacts from the later prehistoric levels at the Öküzini Cave are three arrowheads. We suggest that what we are primarily witnessing here is the movement of socially meaningful goods, *i.e.* the exchange of hunting equipment / weaponry, rather than the movement of raw materials alone. One could easily imagine that a projectile would represent an appropriate item for gifting, particularly if the hafting and fletching was indicative of a particular individual or social group,[132] these objects initially flowing—albeit rarely—across a regional-cultural boundary that seems to have continued in various forms from the early Epi-Palaeolithic to the Late Chalcolithic, with the Öküzini Cave' perpetual marginal location restricting its inhabitants' access to the black gold of Cappadocia.

ACKNOWLEDGEMENTS

This project would not have been possible without the permission of the excavation directors Işin Yalçınkaya and Marcel Otte for access to the material and the Turkish Ministry of Culture for the permit to export the obsidian for analyses. Ofer Bar-Yosef, Marcel Otte and Ignacio López Bayón provided invaluable advice and insight to the Öküzini Cave's occupation sequence and absolute dating. We are also grateful to Harun Taşkıran, and Catriona Gibson and Rebecca Williams for access to unpublished data, leads on literature and critical feedback, plus Danica Mihailović and Marina Milić for the map and line illustrations. Laurent Pichon and the late Joseph Salomon facilitated our analyses of the samples at AGLAE. Carter's time working on the Öküzini Cave material at Ankara University was undertaken while a Post-Doctoral Fellow of the British Institute at Ankara, while his contribution to the final stages of the paper were undertaken at CRP2A thanks to a grant from the Scientific Service, French Embassy in Canada (2008). Finally we gratefully acknowledge the critical reflections and aid of our two anonymous reviewers and the *Paléorient* editorship.

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127. Garasanin and Radovanovic, 2001.
128. Cauvin, 2000: 93-94.
129. *Cf.* Carter, 2007, and for the circulation of large projectile preforms see Balkan-Atlı et Der Aprahamian, 1998: 244, fig. 6.
130. C*f.* Baird, 2007b : 294-295.
131. An argument largely based on the presence of recognisable 'Neolithic' and 'Chalcolithic' material culture as opposed to a detailed report upon the archaeobotanical and faunal assemblages of the period.
132. *Cf.* Akerman *et al*., 2002; Ataman, 1998: 266-269; Bayman, 1995: 53-54; Wiessner, 1983: 260-261.

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