Dzudzuana: an Upper Palaeolithic cave site in the Caucasus foothills (Georgia) Supplementary information.

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The report announces the important radiocarbon-dated sequence recently obtained at Dzudzuana Cave in the southern Caucasus foothills. The first occupants here were modern humans, in c. *34.5–32.2 ka cal BP, and comparison with dated sequences on the northern slope of the Caucasus suggests that their arrival was rapid and widespread. The rich, well-dated assemblages of lithics, bone tools and a few art objects, coloured fibres,*

pollen and animal remains deposited at Dzudzuana through 20 millennia provide an invaluable point of reference for numerous other sites previously excavated in western Georgia. Detailed information has been placed in a supplementary excavation report online. The data support the significance of these excavations for a better understanding of modern human dispersals.

Keywords: Georgia, Caucasus, Middle Palaeolithic, Upper Palaeolithic, lithics, modern humans

1. Summary

The sequence established at the site of Dzudzuana Cave in the southern Caucasus (Georgia) is instrumental for reconstructing the Upper Palaeolithic cultural succession and variability and its spatial interrelationship between the various areas of the Caucasus region at large. The lowermost deposit (Unit D) is dated to the early stages of the Upper Palaeolithic and by reference, to the first appearance of modern humans in the region (*c*. 34.5–32.2 ka cal BP). The great similarity between the assemblages of the Early Upper Palaeolithic from both sides of the Caucasus reflects the rapid movement of humans across a major geographic boundary. Unit C (*c*. 27–24 ka cal BP) contained an industry which was mistakenly referred to in the past as a variant of the west European 'Aurignacian'. Detailed lithic studies, as well as the absolute dating, preclude this association but find comparisons in the Near East as well as in the Caucasus region itself. The youngest Palaeolithic entity on site, Unit B (*c*. 16.5–13.2 ka cal BP) is one of the easternmost occurrences of the Epi-Gravettian techno-complex.

2. Sediments

In general, the deposits comprise large blocks of roof fall (>0.5m in size), which occur at the entrance; flat, platy and generally weathered pieces of limestone that appear particularly in the western part of the front profile; and poorly sorted fine gravelly clay with ~3mm-size rounded pebbles of quartz. Many lateral facies changes occur, with clays

exhibiting lenticular changes in colour, or grading into pebbly clays and localised stringers of pebbles.

Units D and C deposits comprise millimetre-sized, typically rounded clasts of limestone, iron/manganese concretions and pisolites, quartz and radiolarite chert within a silty clay matrix. Associated with this material are extensive infillings, coatings and intercalations (Stoops 2003) of reddish clay, as well as orientation of the clay matrix (b-fabric of Stoops 2003). Such micromorphological features suggest that these are mudflow deposits, which would foster the orientation of the clay during transport. Some of the void infillings of clay are likely to be due to the percolation of drip water from the ceiling which contains suspended clay, and possibly from groundwater — a small channel can be seen today draining the interior of the cave toward the cave mouth. The combination of these processes was responsible for the destruction of hearths, some local movement of the lithics, as well as for the weathering of long bones (see below).

Unit B on the other hand tends to be somewhat finer grained, although these same types of rounded clasts occur but in noticeably lower abundance. In addition, the b-fabrics are less distinct and secondary clay accumulation is associated with mostly dripping water, and possibly some groundwater.

The bulk of the cave fill was graded to a surface that continued outward to the stream valley in front of the cave, which would be in line with the dips of the sediments outward towards the entrance; at present the stream has downcut some 5m below the entrance of the cave. The association of the cave deposits with allochthonous deposits would also explain the presence of some lithoclast types (e.g. radiolarian chert), which do not occur within the cave limestone, although such material can be found in the region.

3. Assemblages

The assemblages comprised lithics, obsidian, bone objects, animal bones, pollen and flax. The relative quantities of: tool types in each major stratigraphic unit (D to B) are given in Table 3; of debitage in Table 4; of cores in Table 5; of obsidian in Table 6; of bone tools and ornament in Table 7 and of animal bones in Table 8.

4. Lithic assemblages

Unit D (formerly II7)

Unit D was excavated in two separate areas (Figure 2), in the frontal section (G–I 9–7) ('lower area') and in the rear section (G–H 19–18) ('upper area'). The industry of Unit D differs from that of Unit C in having blade cores reduced by uni-directional flaking, and no carinated cores to speak of (Tables 3–4; Figure 4). While the sample sizes are much smaller then those obtained for Unit C, in both areas, and especially in the upper area, one can observe a marked difference in the proportions of backed *versus* retouched bladelets. Moreover, the percentage of narrow retouched bladelets (i.e. less than 3mm wide) is lower by far than that in the samples from Unit C. Though obsidian tools account for 3.3% and 3.2% of the tool assemblages of the lower and upper areas respectively, the absolute numbers are quite small, and the same is true for the obsidian debitage items and cores (Table 6).

Unit C (formerly II5b, II6): the use of carinated cores

This type of core reduction strategy was previously described in the Near East by one of us (O. B-Y.) under the term 'narrow cores' (Bar-Yosef 1970, 1991), but would be better called 'carinated cores' (Belfer-Cohen & Grosman 2007). In brief, during the process of preparing the nodule for the detachment of the blanks, the knapper first shaped it into a quasi-biface and then removed one of the thinner (or narrow) sides to make it a striking platform. From the narrow end of this platform, which has a 'nose' shape, a series of primary and secondary ridge blades were removed. In order to keep a standard length (and thus to avoid maximising the curvature of the bladelet), the edge opposite the platform (or the 'keel' of the core), was continuously shaped into a 'notched-form', either by retouch or by bifacial removal of small flakes (Figure 5.20–22). The chosen bladelets were modified into tools mostly by fine retouch, reminiscent of the Ouchtata bladelets (Tixier 1963).

The largest category in both lower (37.1%) and upper (48.3%) areas is that of *retouched bladelets* (Figure 5.9–17). It is of interest to note that up to 32% (N=493) of those from

the upper area are of the narrow variety — less than 3 mm in width — and *c.* 18% (N=278) are 3–5 mm wide.

Unit B (formerly II2–4, II5a upper)

Unit B was identified as a concrete entity only in the lower area (Figure 3). Its lithics were described in detail in the preliminary report of the recent excavations (Mesheveliani *et al.* 1999). The backed bladelets represent the second largest tool category (after the endscraper varieties) and *c.* 37% bear a distinctive bi-polar retouch which, as a rule, appears in the later part of the Upper Palaeolithic sequence. The blade cores are generally bi-directional and often trimmed at the back, with tilted opposed platforms (Table 5; Figure 7.12–13). It is of interest to know that the local character of these assemblages is marked by the consistently high percentages of endscrapers which always outnumber the burins, through all the archaeological occupations on site (Table 2). There are elongated blades, *c.* 80mm long, but most of the debitage comprises flakes, small blades, bladelets and debris (Tables 4 & 5). Obsidian tools comprise 1.2% (N=11) of the total tool count; there are no obsidian cores and only *c.* 50 debitage artefacts (Table 6). The worked bone items retrieved during current excavations consist of only eight items, of which one is a decorated, incised rib fragment (Table 7). Previous excavations yielded 18 items, all of which are either awls or points.

Unit A (Layer I of the previous excavations).

Since no wet-sieving was practised we do not possess the smaller elements indicating that the bifacial modification was indeed practised on location. Also we do not know which part of the debitage may actually derive from the Epi-Gravettian levels (Unit B) underlying the Eneolithic occupation (Unit B, rich in flint artefacts including various types of blades and bladelets from uni-and bi-directional cores). Admixture with these levels is quite apparent through the presence in Unit A of backed bladelets and especially microgravettes, the major tool components of Unit B.

Bone samples from Unit A were originally dated by the radiocarbon laboratory of Tbilisi (Apakidze & Burchuladze 1987) and had provided several dates, supported by a single

recently obtained date (Table 2). As this unit was poorly represented in the second series of excavations, a detailed discussion is precluded until the publication of the much larger sample recovered previously.

5. Faunal assemblage

Detailed taphonomic and zooarchaeological analyses of the faunal assemblages of Dzudzuana Cave provided important information on the depositional history of the site and the foraging behaviours and landscape use of its Upper Palaeolithic dwellers. A full taphonomic consideration of the faunal assemblage, which includes data on assemblage completeness, bone fragmentation, bone surface modifications and skeletal element abundance, is provided in Bar-Oz *et al*. 2008. Here we summarise some of this data and compare the Upper Palaeolithic samples that originated from Units D, C and B.

The total of the three samples, grouped from both the upper and lower areas amounts to 26 629 complete and fragmentary skeletal elements larger than 20mm in maximum dimension, of which 2214 (7%) were identified to taxon (including elements that were identified only to body-size group). The relative abundance of the taxa represented and the main values of taphonomic variables in each of the units are detailed in Table 8.

The sample size of the different units of Dzudzuana Cave is not sufficient to conduct detailed analyses of mortality profiles. Yet Units C and B show a similar tendency towards harvesting prime-adult bison/aurochs and tur specimens (Table 8; based on the eruption and wear of dP4 and M3). The absence of ageable bison/aurochs and tur teeth from Unit D does not permit a similar analysis. In addition, the presence of neonatal tur (two complete medial-shaft humeri) in Unit B and bison/aurochs (unworn dP4) in Unit C further reinforces the impression that some of the hunting encounters took place in summer.

The taphonomic analysis of Dzudzuana Cave reveals that the bone assemblages from each of the units suffered from significant density mediated biases, caused by both human bone-processing behaviour and *in situ* post-burial bone attrition. A significant and positive relationship between bison/aurochs and tur bone survivorship and their structural density indicates pronounced density-mediated attrition. Many of the bones display

surface cracks and moderate signs of surface weathering (Table 8). Also, on average 20% of bones from all units appear to have been partially weathered. Thus, bones from all three units were buried under largely similar depositional conditions. The amount of bone completeness of both bison/aurochs and tur indicates both a similar rate of bone preservation and that the bones did not suffer considerably from post-depositional decay (Bar-Oz *et al*. 2008: fig. 5).

Although density-mediated bone weathering is partially caused by *in situ* attrition, it is clear that the main cause for the observed bone destruction is human subsistence behaviours, and in particular the processing of bone marrow. Such an activity produced large numbers of long bone shaft fragments of various sizes, most of which exhibit green bone fractures (i.e. oblique and V-shaped; Table 8; following Villa & Mahieu's 1991 typology). This observation is supported by the presence of several percussion marks close to fracture edges, which have been made during the marrow extraction process. The presence of butchery marks from all stages of butchery, coupled with the low rates of axial units and high representation of upper fore- and hind-limbs of both bison/aurochs and tur suggest that carcasses of both taxa occasionally underwent field butchery and dismemberment at kill sites before their transportation to the site.

6. References

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7. Tables

Table 3. Tool types of Units B, C and D.

	Lower area						Upper area, squares 18 &19			
UNIT	**B**		**C**		**D**		**C**		**D**	
Tool Group	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
endscrapers	239	26.2%	511	22.7%	58	21.4%	512	15.9%	72	23.3%
burins	42	4.6%	188	8.4%	40	14.8%	191	5.9%	21	6.8%
composites	5	0.5%	11	0.5%	5	1.8%	14	0.4%	4	1.3%
blades, backed	13	1.4%	12	0.5%	1	0.4%	41	1.3%	10	3.2%
blades, retouched	38	4.2%	126	5.6%	16	5.9%	200	6.2%	18	5.8%
bladelets, backed	119	13.1%	159	7.1%	18	6.6%	164	5.1%	39	12.6%
bladelets, retouched	62	6.8%	835	37.1%	82	30.3%	1551	48.3%	73	23.6%
flakes, backed	2	0.2%	3	0.1%	2	0.7%	26	0.8%	1	0.3%
flakes, retouched	52	5.7%	129	5.7%	14	5.2%	119	3.7%	18	5.8%
fragments	27	3.0%	12	0.5%	3	1.1%	51	1.6%	6	1.9%
Gravettes points	2	0.2%	1	0.0%	0	0.0%	4	0.1%	0	0.0%
microgravette points	84	9.2%	21	0.9%	0	0.0%	24	0.7%	3	1.0%
Sakajiya points	0	0.0%	0	0.0%	0	0.0%	20	0.6%	1	0.3%
á cran points	10	1.1%	1	0.0%	0	0.0%	0	0.0%	0	0.0%
geometrics	10	1.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
truncations	64	7.0%	34	1.5%	4	1.5%	80	2.5%	5	1.6%
notches and denticulates	58	6.4%	43	1.9%	3	1.1%	52	1.6%	1	0.3%
awls and borers	21	2.3%	22	1.0%	5	1.8%	43	1.3%	6	1.9%
p. esquillée	13	1.4%	75	3.3%	9	3.3%	73	2.3%	23	7.4%
other types	5	0.5%	3	0.1%	2	0.7%	16	0.5%	0	0.0%
varia	45	4.9%	64	2.8%	9	3.3%	31	1.0%	8	2.6%
TOTAL	911	100.0%	2250	100.0%	271	100.0%	3212	100.0%	309	100.0%

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Table 4. Debitage of Units B, C and D.

	Lower area						**Upper area squares 18 & 19**			
UNIT	**B**		**C**		**D**		**C**		**D**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
p. flake	886	10.5%	2079	14.0%	189	10.2%	3206	12.0%	245	10.7%
p. blade	207	2.4%	277	1.9%	48	2.6%	511	1.9%	51	2.2%
flake	3154	37.2%	5545	37.2%	768	41.2%	11670	43.6%	938	40.8%
blade	1653	19.5%	1551	10.4%	188	10.1%	2089	7.8%	279	12.1%
bladelet	1470	17.3%	3283	22.0%	379	20.4%	6211	23.2%	490	21.3%
CTE	764	9.0%	1285	8.6%	197	10.6%	2303	8.6%	209	9.1%
burin spall	25	0.3%	162	1.1%	38	2.0%	190	0.7%	34	1.5%
core	319	3.8%	716	4.8%	55	3.0%	599	2.2%	53	2.3%
Total	**8478**	**100.0%**	**14898**	**100.0%**	**1862**	**100.0%**	**26779**	**100.0%**	**2299**	**100.0%**
Debris										
chunks	731		1426		276		1528		77	
chips	5971		37528		3945		52122		2624	

Table 5. Cores of Units B, C and D.

	Lower area						**Upper area squares 18 &19**			
UNIT	**B**		**C**		**D**		**C**		**D**	
Core Type	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
unipolar	122	38.2%	215	29.8%	15	25.4%	174	28.8%	18	34.0%
bipolar	92	28.8%	108	15.0%	16	27.1%	74	12.2%	12	22.6%
carinated	8	2.5%	145	20.1%	4	6.8%	138	22.8%	2	3.8%
others	97	30.4%	254	35.2%	24	40.7%	219	36.2%	21	39.6%
Total	**319**	**100.0%**	**722**	**100.0%**	**59**	**100.0%**	**605**	**100.0%**	**53**	**100.0%**

Table 6. Obsidian of Units B, C and D.

Debitage	**Lower area**			**Upper area squares 18 &19**	
UNIT	**B**	**C**	**D**	**C**	**D**
Flake	18	40	12	36	**7**
Blade	9	7	1	15	4
Bladelet	9	53	31	41	10
CTE	3	11	4	14	0
BS	2	1	5	2	1
Total	**41**	**112**	**53**	**108**	**22**
Chunk	2	10	2	7	0
Chips	10	372	74	163	10
	Lower area			**Upper area squares 18 & 19**	
TOOLS	**B**	**C**	**D**	**C**	**D**
endscraper	1	10	2	3	2
burin		1	2	1	2
borer					1
spike				2	
awl		1			
bl. backed		1			
bl. retouched	1	2		3	
bld. backed	1	12		8	2
bld. retouched	1	47	5	11	2
fl. backed	1			1	
fl. retouched	4	2		2	
microgravette		1		1	
truncation	2	2		2	
p.esquillée		2		1	
varia		2		2	1
Total	**11**	**83**	**9**	**37**	**10**

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% of total tools	1.2%	3.7%	3.3%	1.2%	3.2%
CORES	**B**	**C**	**D**	**C**	**D**
carinated		1		2	
unipolar		1			
at 90 degrees				1	
fragment				2	
varia		3	2		
Total		**5**	**2**	**5**	
% of total cores		0.7%	3.4%	0.8%	

Table 7. Bone tools and ornaments of Units B, C and D.

	Lower area			**Upper area squares 18 & 19**	
UNIT	**B**	**C**	**D**	**C**	**D**
awl	4	5	1	14	2
bone point	1	2		17	6
antler point		4	1	4	
needle		1		0	
polished fragment	2	2	1	14	
retoucher		0		1	
polisher		1		0	
spatula		1		0	
decorated piece	1	3	1	2	
tooth pendant		0		2	
bone pendant		1		0	
varia		1		3	
TOTAL	**8**	**21**	**4**	**57**	**8**

Table 8. Measured values of taphonomic and zooarchaeological variables from Units D, C and B at Dzudzuana Cave.

	Unit B	**Unit C**	**Unit D**
Number of ungulate taxa	6	4	4
NISP	1312	788	113
MNI	63	20	9
Species abundance (%NISP)			
Bison/aurochs	42%	60%	35%
Capra caucasica	52%	34%	61%
% Other ungulate (mainly red deer)	6%	6%	4%
Demographic composition of main ungulate			
% prime-adult bison/aurochs (dental wear)	68%	78%	-
% prime-adult Caucasian tur (dental wear)	78%	73%	-
Bone surface modifications			
% Weathered (> stage 2)	15%	7%	19%
% Abraded long bone edges	23%	16%	-
% Carnivore marks (of total NISP, excluding teeth)	1%	1%	-
% Rodent marks (of total NISP, excluding teeth)	2%	1%	-
Bone preservation and fragmentation			
% Fresh (oblique) fracture angle	41%	47%	52%
% Fresh (V-shaped) fracture outline	49%	63%	52%
% Impact fracture on bone edges	3%	2%	-
% Butchery marks	3%	2%	-
% Identified burned bones	5%	3%	3%