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Archaeology

Archaeology and Formation Processes in the M6 Block at Dmanisi, Georgia

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Excavations at the M6 Block of the Dmanisi Paleolithic site reveal a unique record of occupation patterns and activities. Geoarchaeological investigations and faunal analyses show that the materials in M6 most probably accumulated as an in situ deposit. Lithic assemblages reveal a very low intensity of reduction, with very few flakes per core. This may correlate with an emphasis on bone breakage, based on bone fragment data. The geological and archaeological data from these excavations indicate a high degree of variability in occupation patterns. The very high ratio of bones to lithic artifacts in M6 (1156/72) is possibly unique at Dmanisi, indicating a locus of substantial bone accumulation by carnivores and humans. The record from M6 is unlike that from any of the other areas of the site excavated thus far, showing that Dmanisi was a location of diverse activities during the many repeated occupations that are shown by spatial and stratigraphic distribution of in situ deposits. This is one of the few opportunities in any Paleolithic setting; most of the sites in globe present single occupation events in same localities. *© 2020 Bull. Georg. Natl. Acad. Sci.*

Dmanisi, Homo erectus, paleolithic industry, site formation

The Site of Dmanisi has provided evidence of the earliest exodus from Africa by early Homo erectus and their colonization of Eurasia [1]. In addition to thousands of artifacts [2] and animal fossils, Dmanisi has yielded almost 70 fossils of early Homo erectus [3-5]. Dmanisi preserves a rich record of human activities. Test excavations over the Dmanisi promontory have documented over 40,000 m^2 of artifact and fauna bearing deposits that are up to 7 m thick [6]. The records of repeated occupations are contained in a complex and extensive series of geologic sections.

In this paper we present the archaeology and geology of the M6 Block (Figure). M6 area is part of a unique and critical setting that has been a key component of the geoarchaeological development of the site. M6 has yielded three hominin fossils, hundreds of animal bones and artifacts.

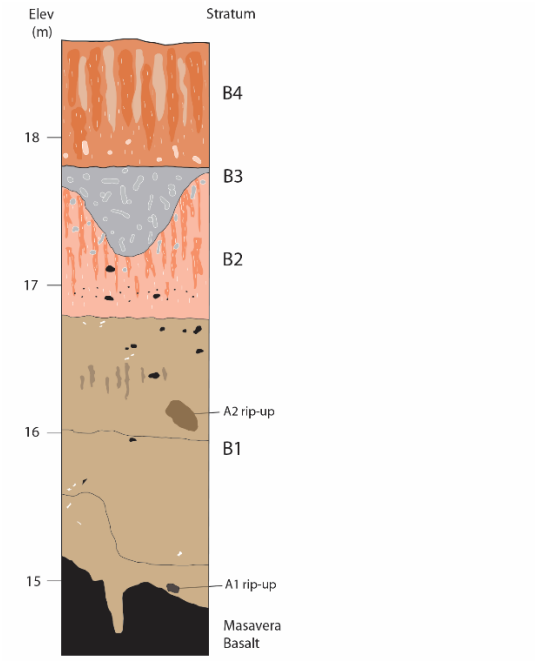

Fig. M6 profile.

Geology

About 1.85 MYA lavas flowed down the Mashavera valley, filling it and crossing over the rivers' confluence. Immediately after the lavas cooled, volcanic ashes began to accumulate, containing stone artifacts and fossils. At the Dmanisi site Stratum B1 records very different geologic processes [6]. During B1 time the underground tunnels called "pipes" formed in Stratum A deposits by the infiltration and then lateral flow of meteoric waters. A gully system had to have crossed the promontory before pipes could form. One of those early gullies was exposed in the M6 excavations.

The geology of the M6 Block is different than any other section at the site. Most immediately apparent is the lack of any Stratum A deposits. The basalt surface shows no erosion, and there is no lag of gravels to indicate a river channel. The basalt is overlain by two meters of Stratum B1. This is divided into lower (B1.1) and upper (B1.2) units, based on weak soil features near the top of B1.1. M6 has exposed a large gully flowing down slope to the east. This gully probably formed the necessary outlet for pipes in Block I. The primary gully of M6, was quickly filled by B1 ashes. Excavations at M6 provide the opportunity to investigate formation processes in a primary gully sedimentary environment.

Lithic Materials from M6

A total of 574 lithic specimens were recovered in the M6 excavations (Table 1). The discussion will focus on Stratum B1. The lithic materials from B1 are dominated by alluvial cobbles and cobble fragments which show no modification. The artifacts are dominated by flakes and flake fragments, and these are mostly tuff or vitreous tuff increasing from B1.2 to B1.1 (Table 2). Although the samples are small, the differences in raw materials between strata are significant. Further differences are evident in the intensity of reduction, measured by the number of flakes per core (Table 3). In Stratum B 1.1 and B1.2 this ratio is low. The data indicates a very low level of core reduction in M6. Do the artifacts in M6 represent in situ occupation debris or did all the artifacts accumulate

Table 1. Lithic materials from M6

Strata	Flakes	Flake fragment	Denticulate/ notch	Scraper	Retouched	Core	Battered cobble	Spalled cobble	Cobble fragment	Cobble	Blocky	Mashavera basalt	Total
	19.4	0	2.8	0	2.8	2.8	0	2.8	19.4	19.4	13.9	16.7	36
B1.2	16.5	3.3	0.5	0.5	0.5	3.3	0.5	2.7	14.3	25.8	11	20.9	182
B1.1	6.2	1.1	0	0.3	0	7.6	1.1	3.7	14.3	35.1	10.7	19.9	356

by erosion from areas surrounding the gully? These questions lead to examination of formation processes.

Table 2. Debitage. Raw material frequencies from M6 and M5

	Tuff	Vitr. Tuff	Rhyolite	Andesite	Rhyodacite	Basalt	Plutonic	Quartz	Total
M5 B1	41.7	13.9	11.1	5.6	0	19.4	5.6	2.8	36
M6 B1.2	26.7	36.7	6.7	0	3.3	16.7	0	0	30
M6 B1.1	18.2	27.3	4.5	0	0	32.2	3.4	0	22

Both alluvial cobbles and Mashavera Basalt clasts are common in Stratum B1. The basalt clasts were eroded from exposed basalt on the promontory. Given their very rough and porous properties we assume they were of no functional value to the occupants, and are probable indicators of natural deposition in the gully. The source of alluvial cobbles could reflect natural deposition or transport by hominins for use as raw material for knapping or pounding implements. The Mashavera Basalt densities (#/m^3) are clearly highest in Stratum B1.1, dropping significantly in Stratum B1.2 (Table 3). Overall, cobble and artifact densities follow this same pattern. In a totally natural setting, the cobbles and basalt clasts would be indicative of quite high energy water flow. But the associated flakes have much less mass, and are difficult to ascribe to those processes. The many bones recovered can provide crucial evidence of depositional mechanisms here.

M6 Taphonomy

A total of 1,157 bones representing 22 large mammal species were recovered in the M6 Block (7 m^2). The large mammal species include: Homininae: Homo erectus; Leporidae: Hypolagus cf. brachygnathus; Canidae: Canus etruscus; Ursidae: Ursus etruscus; Felidae: Lynx issiodorensis, Megantereon megantereon, Homotherium crenatidens; Hyaenidae: Pachycrocuta brevriostis; Elephantidae: Mammuthus meridionalis; Equidae: Equus stenonis; Rhinoceratidae: Stephanorhinus etruscus; Cervidae: Arvernoceros insolitus, Praemegaceros obscurus, Pseudodama nesti, Cervalces gallicus; Giraffidae: Paleotragus priasovicus; Bovidae: Bovinae: Bison (Eobison) georgicus; Caprinae: Gallogoral meneghinii sickenbergii, Praeovibos sp., Pontoceros surprine, Spiroceros sp., Aves indet.

The M6 B1 assemblage is like the rest of Stratum B1 faunas at the site; in that 95.6% of the bones are in Weathering Stages O or 1, so the vast majority of the animals they represent were buried within a few years after death [7]. 10% of the M6 assemblage has clear carnivore tooth marking. There are also seven specimens with possible cut marks made by tools. These marks will be fully vetted, but along with the co-occurrence of stone tools, they suggest the hominins may have been consuming animal products here. Overall, bone densities follow those of lithic materials (Table 3). In terms of depositional patterns in M6 the very large number of small bones and small bone fragments (>4 cm in maximum length) are indicative of low energy regimes.

Discussion

The geologic and archaeological data from these excavations are very significant for the study of occupation patterns and formation processes at Dmanisi. First, documentation of a large gully is critical to understanding the piping processes documented in several nearby areas. Pipes could not have formed there without a deep gully to enable removal of sediment from the pipes. Second, the gully itself appears to be a locus of primary deposition of artifacts and faunas. Third, the very high ratio of bones to lithic artifacts in M6 (1156/72) is possibly unique at Dmanisi, indicating a locus of substantial bone accumulation by carnivores and possibly humans. This contrasts dramatically with setting such as Stratum A in

Table 3. Lithic and bone densities from the M6 Block

				Lithic densities (#/m^3)					Bone densities (#/m^3), size classes in mm					
Strata	Arbitrary level	Elevation	m^3	Artifacts	Cobbles	Basalt	Flks/Core	Bone #	40	80	120	160	>160	0-30
B4	17	18.5	0.1											
B4	18	18.4	0.1											
B4	19	18.3	0.1											
B4	20	18.2	0.1											
B4	21	18.1	0.1					3	2.1	13.3				
B4	22	18.0	0.1					1	2.1					
B4	23	17.9	0.1						0.1					
B4	24	17.8	0.1						0.1					
B4	25	17.7	0.1						1.1					
B3	26	17.6	0.1						0.1					
B2	27	17.5	0.1	10.0	0.0	0.0			11.1					
B2	28	17.4	0.2	0.0	0.0	0.0		1	1.2					
B2	29	17.3	0.2	0.0	0.0	0.0			0.2					
B2	30	17.2	0.2	8.9	8.9	4.4	1.00		30.4					
B2	31	17.1	0.2	0.0	0.0	0.0			0.2					
B2	32	17.0	0.2	8.9	8.9	4.4			28.4					
B2	33	16.9	0.2	8.9	13.3	4.4		3	32.9	4.4	4.4	4.4		
B2	34	16.8	0.2	8.9	22.2	0.0		8	42.3	26.7	4.4			
B2	35	16.7	0.3	6.2	6.2	6.2		11	33.8	6.2	3.1			
B1.2	36	16.6	0.3	6.2	18.5	12.3		27	63.2	40.0	6.2			
B1.2	37	16.5	0.7	9.2	12.3	6.2	1.00	40	67.3	24.6	7.7	4.6		
B1.2	38	16.4	0.7	12.3	16.9	15.4	5.00	41	96.3	32.3	9.2	3.1		3
B1.2	39	16.3	0.7	12.3	20.0	4.6		67	101.6	33.8	6.2	4.6	1.5	13.8
B1.2	40	16.2	0.5	6.7	15.6	13.3	2.00	36	76.0	28.9	6.7	2.2		
B1.2	41	16.1	0.4	**22.5**	20.0	12.5	1.67	26	89.1	32.5	12.5	7.5		
B1.1	42	16.0	0.4	**25.0**	55.0	12.5	8.00	33	158.9	27.5	10.0		2.5	
B1.1	43	15.9	0.4	**22.5**	**65.0**	**32.5**	1.67	58	**198.1**	62.5	20.0	7.5	**25.0**	
B1.1	44	15.8	0.4	**27.5**	**77.5**	22.5	0.57	112	**239.5**	70.0	**37.5**	**17.5**	**20.0**	47.5
B1.1	45	15.7	0.4	15.0	55.0	**27.5**	1.00	113	208.9	77.5	27.5	5.0	7.5	97.5
B1.1	46	15.6	0.4	**30.0**	**77.5**	17.5	0.50	116	**227.9**	**107.5**	**45.0**	7.5	**20.0**	
B1.1	47	15.5	0.3	16.7	**63.3**	**36.7**	1.00	121	**256.0**	70.0	20.0	3.3		**156.6**
B1.1	48	15.4	0.2	**20.0**	55.0	**30.0**	2.00	123	219.2	**145.0**	5.0	**10.0**	5.0	**215**
B1.1	49	15.3	0.2	11.4	57.1	17.1	0.00	56	133.9	**120.0**	17.1	5.7	11.4	
B1.1	50	15.2	0.2	11.4	57.1	22.9	1.00	51	139.6	74.3	28.6	0.0	11.4	11.4
B1.1	51	15.1	0.2	6.7	40.0	13.3		33	94.2	66.7	6.7	6.7		33.4
B1.1	52	15.0	0.1	0.0	**60.0**	**30.0**		77	157.1	**150.0**		**20.0**	**30.0**	**340**
			9.3	**16.9**	**60.2**	**23.9**		**1157**	**184.8**	**88.3**	**21.7**	**8.3**	**14.8**	

Block M5, which has hundreds of stone artifacts and almost no bones [6]. Other settings of significant bone accumulation (including hominin fossils) are pipes and the secondary gullies that formed on collapsed pipes, as in Blocks I and II.

However, M6 adds important evidence that Dmanisi preserves records of many serial occupations. Moreover, the artifact and faunal associations among those areas indicate a high degree of variability in occupation patterns. As in

other parts of the site, the M6 data present challenges to understanding the roles of carnivores as bone accumulators. Similarly, our opportunity to study the roles of human as bone accumulators, or as having either primary or secondary access to carcasses brought by carnivores is greatly enhanced by the M6 data.

Table 4. Dorsal cortex of debitage from M5 and M6

	Platform only	0%	1-25%	26-50%	51-75%	76-99%	100%	Total
M5 B1	9.8	9.8	18	9.8	16.4	24.6	11.5	61
M6 B1.2		16.7	6.7	13.3	6.7	16.7	40	30
M6 B1.1		13.6	18.2	13.6	4.5	22.7	27.3	22

In addition to the faunal analyses, the M6 artifacts permit valuable comparisons of lithic technology among different areas of the promontory. For example, despite small samples, it is clear that the M6 artifacts exhibit differences of Stratum B1 assemblages from M5 (Table 3). Recall that the Stratum B1 assemblages at M5 were deposited on a flat aggrading surface with no evidence of either pipes or gullies [6]. For example, the debitage from M6 has significantly more vitreous tuff than at M5, possibly indicating a need for better quality cutting edges at M6. Complimenting the very low flake/core ratios at M6 mentioned above, more than 50% of the flakes from Strata B1.1 and B1.2 M6 have >75% dorsal cortex (Table 4). In contrast, only 36% of the flakes from Stratum B1 at M5 have the same amount of dorsal cortex. These contrasts are examples of the variability in reduction patterns among different occupations and different occupation settings.

Conclusions

Together the data from the M6 Block reveal that this part of the very large Dmanisi site preserves evidence of intense processing of large animal carcasses, with little production and discard of lithic artifacts. Other parts of the site, notably M5, have evidence of intense lithic reduction but little or no fauna processing. The debitage from M6 has significantly more vitreous tuff than at M5, possibly indicating a need for better quality cutting edges at M6. Thus, different occupations of the Dmanisi promontory were characterized by different activities. In this sense, Dmanisi really preserves a multi-site character of occupations with great significance for reconstructing the adaptive ecology of Dmanisi's early Homo erectus population.

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არქეოლოგია

დმანისის ძეგლის არქეოლოგია და ფორმირების პროცესი M6 უბნის მონაცემების მიხედვით

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დმანისის პალეოლითური ძეგლის გათხრების M6 უბნის შესწავლის შედეგად გამოვლინდა მნიშვნელოვანი მონაცემები ძეგლზე ჰომინინების განსახლების ხასიათსა და ქცევის თავისებურებაზე. გეოარქეოლოგიურმა კვლევამ და ნამარხი ფაუნის ანალიზმა აჩვენა, რომ M6 იყო ადგილი, სადაც მასალა დიდი ალბათობით in situ მდგომარეობაში განამარხდა. ინდუსტრიის ანალიზის შედეგად ქვის იარაღების დამუშავების დაბალი მაჩვენებელი დაფიქსირდა, თითო ნუკლეუსზე მცირე რაოდენობის ანატკეცით, რაც კორელაციაშია ფაუნის ანალიზის შედეგებთან. ძვლების ფრაგმენტების რაოდენობა მეტია მთელ ძვლებთან შედარებით. მკვეთრი განსხვავება ძვლების და ქვების თანაფარდობაშიც (1156/72) ადასტურებს, რომ აქ მტაცებლების და ადამიანების მიერ ძვლების დაგროვების ადგილი იყო. M6-ის კვლევის შედეგად დასტურდება, რომ დმანისი ქვედა პალეოლითში მრავალჯერადი განსახლების და განსხვავებული ქცევის ამსახველი არეალებისგან შემდგარი კომპლექსური ძეგლია, რაც ქვედა პალეოლითში მსოფლიოს მასშტაბით, ძალზედ იშვიათია.

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