First archaeobotanical data from the basin of Lake Sevan

Հնաբուսաբանական առաջին տվյալները Սևանա լճի ավազանից

Erste archäobotanische Untersuchungen in der Ebene des Sevan-Sees

Roman Hovsepyan

Ռոման Հովսեփյան

Summary

The results of archaeobotanical studies in the years 2011 and 2012 in Sotk 2 at the south-eastern part of the Lake Sevan basin in addition to preliminary data from the neighbouring sites Norabak 1 und Geghakar sites certify that people have practiced agriculture in this region in Early, Middle, and Late Bronze Ages, Early Iron Age, and medieval period. The main focus of agriculture was the cultivation of cereals: bread wheat (*Triticum aestivum*), barley (*Hordeum vulgare*; including hulled six-rowed barley, *H. vulgare* ssp. *vulgare* convar. *vulgare*) and emmer (*Triticum dicoccum*). The mentioned assemblage of cultivated plants is characteristic for the Early Bronze Age to Early Iron Age period of the South Caucasus. The recorded diversity of wild and weedy plants suggests the presence of humid steppes with some bushes of rose-hip in the territory under study during the prehistoric period.

Ամփոփում

Սևանա լճի ավազանի հարավ-արևելքում գտնվող Սոթք-2, Նորաբակ-1 և Գեղաքար հնավայրերում կատարված երկամյա հնաբուսաբանական հետազոտությունների նախնական արդյունքները վկայում են տարածաշրջանում ակտիվ երկրագործության առկայության մասին բրոնզի և վաղ երկաթի դարաշրջանում, ինչպես նաև միջնադարում: Երկրագործության հիմնական ուղղությունը եղել է հացազգի մշակաբույսերի մշակությունը: Մշակվել են փափուկ ցորեն (*Triticum aestivum*), գարի (*Hordeum vulgare*; այդ թվում թեփուկավոր վեցաշարք մշակովի գարի՝ *H. vulgare* ssp. *vulgare* convar. *vulgare*) և հաճար (*Triticum dicoccum*): Մշակաբույսերի վերոհիշյալ կազմը բնութագրական է Հարավային Կովկասի վաղ բրոնզի դարից մինչ վաղ երկաթի դար ընկած ժամանակաշրջանի համար: Վայրաճ բույսերի արձանագրված կազմը վկայում է վերոհիշյալ հետազոտված տարածքներում նախապատմական դարաշրջաններում խոնավ տափաստանների և մասրենու թփուտների առկայության մասին:

Zusammenfassung

Die archäobotanischen Untersuchungen in den Jahren 2011 und 2012 im Bereich der Siedlung Sotk 2 am Südostufer des Sevan-Sees zeigen zusammen mit vorläufigen Angaben von den benachbarten Fundstellen Norabak 1 und Geghakar, dass im untersuchten Gebiet während der Früh-, Mittel- und Spätbronzezeit, Früheisenzeit und im Mittelalter Ackerbau betrieben wurde. Vor Ort wurde vorrangig Getreide kultiviert. Nachgewiesen sind Saat-Weizen (*Triticum aestivum*), Saat-Gerste (*Hordeum vulgare*; darunter auch Sechszeilgerste [Spelzgerste *H. vulgare* ssp. *vulgare* convar. *vulgare*]) und Emmer (*Triticum dicoccum*). Die genannten Kulturpflanzen sind für den Südkaukasus charakteristisch von der Frühbronze- bis zur Frühen Eisenzeit. Die erfassten Wild- und Unkrautpflanzen deuten für die vorgeschichtlichen Epochen auf das Vorkommen von humiden Steppen mit einigen Rosensträuchern hin.

Fig. 1. Location of the sites Sotk 2, Norabak 1, and Geghakar.

Introduction

Lake Sevan is the largest lake in the Caucasus (Fig. 1). The presence of numerous archaeological sites in its basin suggests that – despite of its elevation, of ca. 1900 m a.s.l., and severe climatic conditions – the surrounding territory was continuously inhabited by humans since early prehistory (Biscione et al. 2002; Kunze et al. 2011). Unfortunately, data on the prehistoric plant economy of this region has been absent and this lack of knowledge has been compensated with speculations. Recent archaeological excavations carried on in the settlement of Sotk 2 in the years 2011 and 2012 (cf. Kunze et al. in this volume, as well as few data from the sites of Norabak 1 and Geghakar) which were accompanied by archaeobotanical investigations yielded first data on prehistoric plant economy for this region[1]. All three abovementioned sites are situated in the south-southeastern part of the Sevan basin (Fig. 1). The site Sotk 2 lies on the southwestern slopes of Sevan Mountain Range (N 40° 12' 12,0''; E 45° 53' 10,0''), 20 km away from the present southeastern shore of Lake Sevan, on an altitude of 2101 m a.s.l. Neighbouring sites to Sotk 2 include Geghakar which lies 2220 m a.s.l. (Harutyunyan/Badalyan 2008), and Norabak 1 which is 2140 m a.s.l. (N 40° 09' 15,5''; E 45° 52' 18.7'') (Fig. 1).

Materials and methods

As this was the first time that archaeobotanical investigations were undertaken in Sotk 2, our first task was to find archaeological contexts, which were most suitable for archaeobotanical investigations. Soil samples were collected from various archaeological layers and structures. Around thirty soil samples with a total volume of 688 litres were sampled and processed during the 2011 and 2012 excavation seasons at Sotk 2 (samples from the same archaeological context are merged in Tab. 1). The volumes of the samples ranged mostly from 20 to 40 litres, and averaged about 25 litres. Flotation technique using sieves with a mesh size of 0.25 mm was used to separate preserved plant remains. The state of preservation of plant remains is low at Sotk 2. Approximately 1360 units of carpological material preserved in carbonized or mineralized states were recovered (Tab. 1). In addition, around one hundred charred fragments of organic material were secured. They were thought to represent fragments of charred grains of cereals (Tab. 1, cf. *Triticeae gen.* sp.) and many (around 530) desiccated seeds, which are intrusions in archaeological deposits from later times, are registered in Tab. 1, but not included in any calculations and charts. The density of carpological material ranges from 0 to 10.8 units per one litre sediment, with the average result being two units per litre (Tab. 1; Fig. 4).

1 Therefore, we can not discuss observations on the archaeobotany of the entire Sevan basin during prehistory.

Three samples from two pits (Tab. 2) at the Geghakar site were taken by R. Badalyan and A. Karakhanyan and passed to us for archaeobotanical presence analysis. 26 units of archaeobotanical material, all in charred state, were recovered from those above-mentioned sediment samples, but only six of them belong to cultivated plants. In general, the preservation of the studied plant remains can not be considered as good, but the concentration of carpological material in samples (Tab. 2; two–six archaeocarpological finds per one litre sediment) is a base to consider future archaeobotanical investigations at the site of Geghakar as advisable.

Only one sample with one litre volume has been taken from Norabak 1 to do presence analysis of archaeobotanical material there. Quantity of carpological material found from this sample is essential (Tab. 3). Taking into account the preservation and the amount of plant remains recovered in this sample, we consider the site Norabak 1 as perspective for future archaeobotanical investigations.

Results and discussion

Sotk 2

The recovered carpological material has been grouped into ca. 100 categories, based on preserved organ, their preservation types and taxonomical traits. The recovered archaeocarpological materials could be assigned to different taxonomical levels ranging from species and even variety to family levels. The minimum number of identified taxa is forty (40) at the settlement of Sotk 2 (Tab. 1), where the preservation state is very low.

Although materials recovered from the settlement of Sotk 2 belong at least to four periods (Early Bronze Age [EBA, ca. 3500–2500 B.C.], transitional period from Middle Bronze Age to Late Bronze Age [MBA/LBA, ca. 1700–1500 B.C.][2], Late Bronze Age [LBA, ca. 1500–1200 B.C.] and Early Iron Age [EIA, ca. 1200–900 B.C.]; cf. Kunze et al. in this volume), we will present the taxonomical assemblage of the recorded plants comprehensively as they are similar for the above mentioned periods. Carpological remains of cultivated plants made up 33 % of all recovered herbaceous plants' seed material (Fig. 6). They are represented with dozens of fragmented and complete charred grains of cultivated cereals, of which 61 % could be identified as wheat (*Triticum*) and barley (*Hordeum*), the rest, 39 %, was unidentifiable up to genus level (*Triticeae gen.* sp.; category 'cf. *Triticeae gen.* sp.' was not included in these calculations). In addition, there were many fragments of silicified (biomineralized) awns of cultivated cereals' spikes (E7, room floor). The average ratio of wheat and barley is 40 %/60 % in the studied material (Tab. 1; Fig. 5).

The following categories were determined while identifying wheat: possibly wheat (cf. *Triticum* sp.: grains and rachis internodes), unidentifiable wheat (*Triticum* sp.: grains and glumes), tetra- and/or hexaploid wheat, possibly hexaploid bread wheat (Fig. 2,3–4; *T. aestivum/turgidum*: grains, and *T.* cf. *aestivum*: grains and rachis internode)[3], definitely hexaploid bread wheat (*T. aestivum*: rachis internode)[4], possibly emmer and clearly distinguishable emmer (*T.* cf. *dicoccum* and *T. dicoccum:* grains). There were also a few grains which belong either to emmer or rye (*Secale* sp.; Tab. 1).

Remains (grains and one bad preserved internode) of cultivated barley[5] were recorded as *Hordeum vulgare* and cf. *H. vulgare*. Almost 12 % of all recovered barley grains were hulled, i. e. belonged to hulled variety(es) (Fig. 2,1–2). Hulled grains of barley were found from locations with a more favourable preservation level of plant remains in general. This allows us to consider the appearance of the hulled barley variety simply as matter of preservation. In addition, some lateral hulled grains of barley triplet were found from room E7 (MBA/LBA transitional period, cf. Kunze et al. in this volume). These barley triplet lateral hulled grains are evidence for the presence of hulled six-rowed cultivated barley (*Hordeum vulgare* ssp. *vulgare* convar. *vulgare*). The fact that so few lateral grains of barley triplet survive amongst barley grains, leads us to suppose that two-rowed barley is also presented in Sotk[6].

The varieties of weedy herbaceous plants diaspores that were recovered from Sotk 2 (Tab. 1) include bio-mineralized erems of boraginaceous plants (Boraginaceae) identified as *Buglossoides arvensis* (Fig. 2,14–16), *Lithospermum officinale* (Fig. 2,13), and *Anchusa arvensis*. Part of these nutlets (erems) lack the outermost layer and/or are also burnt. The quantity of burnt nutlets is essential because it provides evidence that they are part of the anthropogenic plant assemblage (Tab. 1).

The next most common remains belong to the Poaceae family. Although most of the grains are not identifiable, it was possible to identify some of those with *Hordeum*, *Lolium, Bromus*, and *Aegilops*.

Charred mericarps of plants from the Rubiaceae family are identified mostly as *Galium* cf. *spurium*, and some of the mericarps can be assigned to *G.* cf. *aparine* and *Asperula* sp.

The triangle nutlets found on the site are mostly charred, and belonged to representatives of the Polygonaceae and Cyperaceae families. Some of the nutlets were so eroded that it was not possible to distinguish between these two families (Polygonaceae/Cyperaceae fam. gen. sp.; Tab. 1).

2 Radiocarbon Cal B.C. data from Sotk 2 Trenches/Units A5 (1607–1455), D2 (1726–1532; 1747–1618), E7 (1685–1534), F2a (1607–1460; 1612–1506) demonstrate that we are either at the very end of the MBA (Trenches D, E), or at the MBA/LBA transitional period (Trenches A, F). Before the final definition of the stratigraphic sequence of the site we prefer to use the term MBA/LBA (transitional period).

3 The differentiation of *Triticum aestivum/turgidum* and *Triticum* cf. *aestivum* by us is somewhat artificial as we simply put better preserved grains with more similarities with hexaploid wheats under '*Triticum* cf. *aestivum*' category, and badly preserved ones under the '*Triticum aestivum/turgidum*' category.

4 Rachis internodes of hexaploid wheats are very diagnostic for *Triticum aestivum* (Zohary et al. 2012).

5 We also identified some grains of wild barley (*Hordeum* sp.; Tab. 1).

6 More and better preserved material is necessary to make accurate statistical analyses and reach a final conclusion about the presence of two-rowed barley.

Table 1 Archaeocarpological remains from the settlement of Sotk 2 (Armenia).

Trench & Unit				A2	A2	A5	C2	D2/1	D3	E4	E4	E6	E7	E7	E7	E8	E8	E10	E11	E12	F1	F2	F3	F4	F4	F4
				U↑	U↓	U	Ch	U	R?	V	V	-	R↑	R↓	R↓	U↑	U↓	U	U↓	R↓	U?	Cl	Ash	U	U/n	U/n→
Period				EIA	EIA	MBA/LBA	EBA?/EIA?	MBA/LBA	EBA	LBA	LBA	LBA?	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	MBA/LBA	EBA	EBA	EBA	EBA
Volume of processed sediments, liter			**687**	**30**	**30**	**30**	**9**	**40**	**60**	**10**	**5**	**30**	**40**	**12**	**30**	**110**	**10**	**20**	**30**	**40**	**30**	**40**	**48**	**10**	**3**	**20**
Quantity of recovered carpological material, unit			**1,369**	**17**	**101**	**25**	**42**	**19**	**28**	**3**	**3**	**35**	**69**	**28**	**124**	**164**	**17**	**26**	**65**	**177**	**26**	**88**	**13**	**24**	**23**	**53**
Concentration of carpological material in sediments, unit /10 liter			*19.9*	*5.7*	*33.7*	*8.3*	*46.7*	*4.8*	*4.7*	*3.0*	*6.0*	*11.7*	*17.3*	*23.3*	*107.8*	*14.9*	*17.0*	*13.0*	*21.7*	*44.3*	*8.7*	*22.0*	*2.7*	*23.5*	*76.7*	*26.5*
Concentration of cereals grains in sediments, unit /10 liter			*9.0*	*4.3*	*12.0*	*0.3*	*0.0*	*3.0*	*3.8*	*3.0*	*4.0*	*8.3*	*8.0*	*11.7*	*53.7*	*5.7*	*9.0*	*5.5*	*9.0*	*21.3*	*4.7*	*16.3*	*1.0*	*5.0*	*16.7*	*2.5*
Plant Taxon	**Finding (Organ)**	**Preservation**																								
Cultivated plants (Cereals) / Weeds ratio			**33%**	**76%**	**37%**	**25%**	**0%**	**67%**	**82%**	**100%**	**67%**	**71%**	**46%**	**50%**	**50%**	**39%**	**53%**	**44%**	**42%**	**48%**	**51%**	**18%**	**3%**	**20%**	**20%**	**9%**
Poaceae																										
Cereals' unidentifiable grains / identifiable grains ratio			**39%**	**25%**	**6%**	**0%**	**0%**	**67%**	**62%**	**40%**	**50%**	**72%**	**9%**	**36%**	**46%**	**46%**	**22%**	**58%**	**48%**	**46%**	**13%**	**66%**	**29%**	**40%**	**40%**	**0%**
cf. Triticeae gen. sp.	grains fragments	charred	103	19	75		1		3	2								1				2				
Triticeae gen. sp.	awns	mineralized	+												+											
	grains fragments	charred	284	8	7			8	16	2	1	18	3	5	74	29	2	7	13	39	2	44	2	2	2	
Wheats / Barley ratio			**40%**	**80%**	**31%**	**0%**	**0%**	**25%**	**86%**	**0%**	**0%**	**43%**	**48%**	**67%**	**25%**	**35%**	**43%**	**75%**	**64%**	**33%**	**36%**	**48%**	**100%**	**67%**	**100%**	**20%**
cf. *Triticum* sp.	grains	charred	15	2	1								1		5	2	2		2							
	internode	charred	2																	1						1
Triticum sp.	grains	charred	53		2				3				5	6	2	9	1	1		8	3	9	1	1	2	
	glumes	charred	1																					1		
		desiccated	4																		2		2			
Triticum aestivum L./ *turgidum* L.	grains	charred	25	2	2				2			2	7		4	1		1	3						1	
Triticum cf. *aestivum* L.	grains	charred	17		3			1	1						4				4	2			2			
	internode	charred	1																	1						
Triticum aestivum L.	internode	charred	1												1											
Triticum cf. *dicoccum*	grain	charred	1																	1						
Triticum dicoccum (Schrank) Schuebl. (=*T. turgidum* L. subsp. *dicoccum* (Schrank) Schuebl.)	grain	charred	9		1							1	1		5			1								
Triticum dicoccum / *Secale* sp.	grain	charred	4												1					2		1				
Barley / Wheats ratio			**60%**	**20%**	**69%**	**100%**	**0%**	**75%**	**14%**	**100%**	**100%**	**57%**	**52%**	**33%**	**75%**	**65%**	**57%**	**25%**	**36%**	**67%**	**64%**	**52%**	**0%**	**33%**	**0%**	**80%**
cf. *Hordeum vulgare*	internode	charred	1		1																					
	grains	charred	29		8										10	2	2		1	4		2				
Hordeum vulgare L.	grains	charred	146	1	11	1		3	1	1	1	3	10	1	47	20	2	1	3	25	9	4				2
Hordeum vulgare, hulled, mostly middle grains	grains	charred	23									1	3	2	6				1	2		5		1		2
Hordeum vulgare ssp. *vulgare* convar. *vulgare*	triplet left hulled grains	charred	2										1		1											
	triplet right hulled grains	charred	2										1		1											
Weeds / Cultivated plants (Cereals) ratio			**63%**	**11%**	**36%**	**75%**	**98%**	**33%**	**16%**	**0%**	**33%**	**29%**	**54%**	**50%**	**50%**	**61%**	**47%**	**54%**	**58%**	**52%**	**49%**	**82%**	**97%**	**80%**	**80%**	**91%**
Boraginaceae																										
Buglossoides arvensis (L.) Johnst.	enems	mineralized	65					2						1	30	23	5		1	3						
		mineralized,	48		3							2	3		21	6	1	4		4	1			2		1

Trench & Unit				A2	A2	A5	C2	D2/1	D3	E4	E4	E6	E7	E7	E7	E8	E8	E10	E11	E12	F1	F2	F3	F4	F4	F4
(= *Lithospermum arvense* L.)		burnt																								
	coatless	mineralized	10													8				2						
	ereems	mineralized, burnt	4		3											1										
Lithospermum officinale L.	ereems	mineralized	13		6										1	5							1			
		mineralized, burnt	3									1				2										
Anchusa arvensis (L.) M. Bieb.	ereems	mineralized	1																				1			
		desiccated	2																				2			
cf. *Anchusa* sp.	coatless ereem	mineralized	10		1										2	7										
Poaceae																										
Poaceae gen. sp. (wild species)	grains	charred	5		2		1								2											
Poaceae gen. sp. (wild species), larger and long grain	grains	charred	57										8	4	15	9		1	2	14	2			1	1	
Poaceae gen. sp. (wild species), smaller and shorter grains	grains	charred	29										1	1	3						1	1		1		21
cf. *Hordeum* sp. (wild)	grains	charred	1															1								
cf. *Lolium* sp.	grains	charred	9										1		7					1						
cf. *Bromus* sp.	grains	charred	3										2													1
cf. *Aegilops* sp.	grains	charred	1												1											
Rubiaceae																										
Rubiaceae gen. sp.	mericarps	charred	2												1											1
cf. *Galium* sp.	mericarps	charred	1													1										
Galium cf. *spurium* L.	mericarps	charred	94	1	7		12	1					5	5	22	5		1	4	14	2	5	1	2	4	3
Galium cf. *spurium* L.	mericarps	charred	3	1																		1		1		
cf. *Asperula* sp.	mericarps	charred	1													1										
Asperula sp.	mericarps	charred	2																1							1
Fabaceae																										
Viceae spp.	seeds	charred	1									1														
cf. *Vicia* sp.	seeds	charred	22.5									2	2		3.5	1.5			1	1		2		2.5		7
cf. *Melilotus/Medicago/Trifolium* sp.	seeds	mineralized	3																			3				
Polygonaceae/Cyperaceae																										
Polygonaceae/Cyperaceae fam. gen. spp.	nutlets	charred	38		4								6		6	3		1		7				2	7	2
		mineralized	1		1																					
Polygonaceae																										
Polygonaceae gen. spp.	nutlets	charred	3		2																			1		
		mineralized	1		1																					
		desiccated	1																			1				
Rumex sp.	nutlet	charred	4										1		1	1				1						
Polygonum sp.	nutlet	charred	4				1									1									1	1
		desiccated	1																				1			
Polygonum cf. *aviculare*	nutlet	charred	3				1								1					1						
Polygonum aviculare	nutlet	charred	2				1																	1		
Polygonum cf. *convolvulus*	nutlets	charred	10		1	2			1				1		3	1				1						
Polygonum convolvulus	nutlets	charred	13		5			1							2				2	2		1				
		mineralized	1																1							
		desiccated	8																			8				
Cyperaceae																										
cf. Cyperaceae gen. spp.	nutlets	charred	6		3															3						
Cyperaceae gen. spp.	nutlets	charred	2		1		1																			
Cyperaceae gen. sp., cf. *Carex* sp.	nutlets	charred	5										1									1		3		
Cyperaceae gen. sp., cf. *Scirpus/Bolboschoenus* sp.	nutlets	charred	1																			1				
Cyperaceae gen. sp., cf.	nutlets	charred	1												1											

Trench & Unit				A2	A2	A5	C2	D2/1	D3	E4	E4	E6	E7	E7	E7	E8	E8	E10	E11	E12	F1	F2	F3	F4	F4	F4
Eleocharis sp.																										
Brassicaceae																										
Brassica/Sinapis sp.	seeds	desiccated	5																				5			
cf. *Brassica/Sinapis* sp.(?)	seeds	mineralized	6																6							
Neslia sp.	capsules	charred	7	1			2	1					1			1				1						
		desiccated	53.5																		3		50.5			
Thlaspi sp.	seeds	mineralized	2													1	1									
cf. *Camelina/Lepidium* sp.?	seeds	charred	0																							
		mineralized	1													1										
Caryophyllaceae																										
Cariophyllaceae gen. sp.	seeds	charred	1																	1						
		mineralized	7		4										2	1										
cf. *Vaccaria* sp.	seed	charred	2					1																1		
Asteraceae																										
Asteraceae gen. sp.1	seed	charred	3		1																	2				
		desiccated	48.5																		1.5	46				1
Asteraceae gen. sp.2,	seed	charred	1				1																			
Centaurea type		desiccated	93																			57	36			
Convolvulaceae																										
cf. *Convolvulus* sp.	nutlets	charred	1												1											
Chenopodiaceae																										
Chenopodium sp. & cf. *Chenopodium* sp.	seeds	charred& desiccated	184				3								4					1		166	4	1	2	3
cf. *Chenopodium* sp.	seeds	mineralized	23												14	2			7							
Lamiaceae																										
Lamiaceae gen. sp. & cf. Lamiaceae gen. sp.	seeds	charred	4												1	1								1		1
Lamiaceae gen. sp.	seeds	mineralized	3												1	2										
Solanaceae																										
Hyoscyamus sp.	seeds	mineralized	12		6											3			3							
Ranunculaceae																										
Adonis sp.	nutlets	charred	2				2																			
		desiccated	122																				122			
Apiaceae																										
Apiaceae gen. sp.2	seed	mineralized	2										1													1
Unidentified group			162	1	11	1	20		4		1	4	4	3	18	13	1	6	10	36	5	6	5		5	8
Arboreal plants / All plants ratio			2%	0%	3%	84%	0%	5%	0%	0%	0%	0%	0%	0%	1%	0%	0%	4%	0%	0%	4%	0%	0%	0%	0%	0%
Rosaceae																										
cf. *Rosa* sp.	nutstones	charred	3			2															1					
Rosa sp.	nutstones	charred	26		2	19		1							3			1								
Species A (Rosaceae? Cerasus?)	remain of fruit with nutstone	charred	1		1																					

Tab. 1 Archaeocarpological remains from the settlement of Sotk 2.
Notes: * In addition to these samples one sample (1 litre volume) of Unit 3 of Trench B and one sample (0.3 litre) from a LBA vessel from Unit 4 of Trench E were processed, but nothing was found there. ** Quantities of 'cf. *Triticeae gen.* sp.' remains and unidentifiable remains are not included in countings because of the high level of fragmentation.

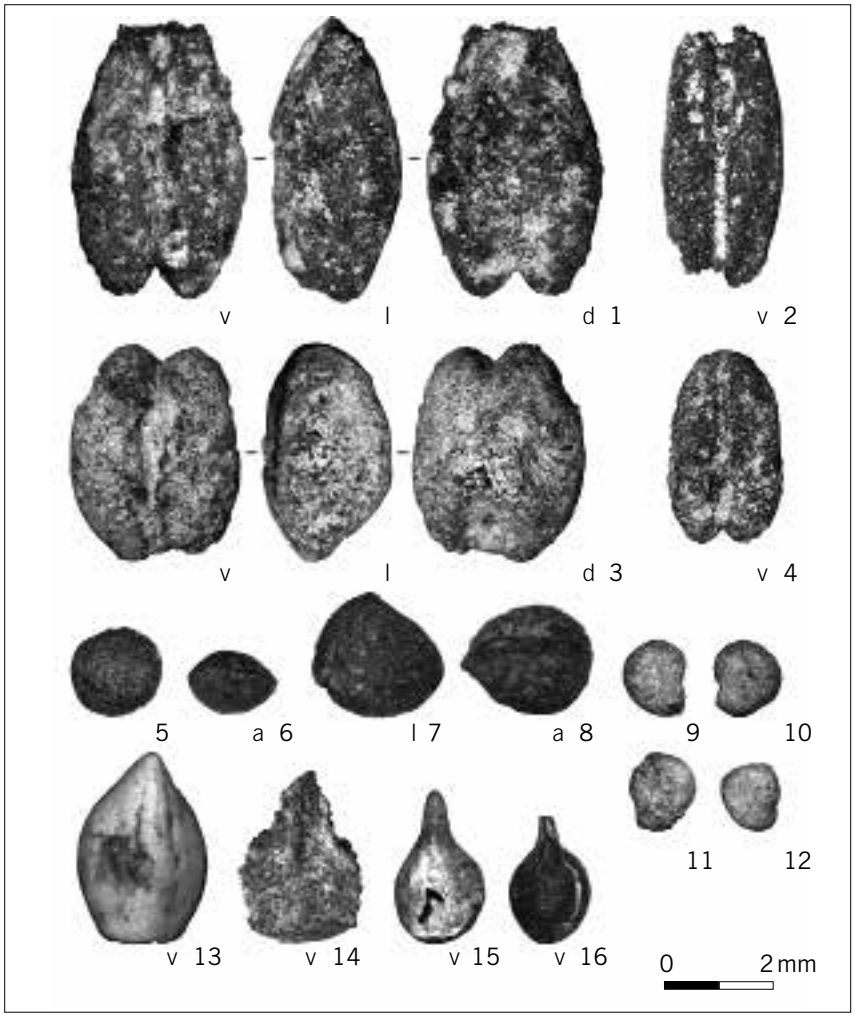

Fig. 2 Some archaeobotanical samples from the settlement of Sotk 2 (from excavations in 2011).

1–2 charred grains of cultivated barley (*Hordeum vulgare*);
3–4 charred grains of wheat, possibly bread wheat (*Triticum* cf. *aestivum*);
5–6 charred capsules of *Neslia* sp.;
7–8 charred nutlets of *Adonis* sp.;
9–12 bio-mineralized seeds of *Hyoscyamus* sp.;
13 bio-mineralized erem of *Lithospermum officinale*;
14 bio-mineralized erem of *Buglossoides arvensis*;
15 bio-mineralized coatless erem of *B. arvensis*;
16 bio-mineralized and burnt coatless erem of *B. arvensis*.

v – ventral side, l – lateral side, d – dorsal side, a – apical side. 1–4, 9–16 Trench A, Unit 2, bottom; 5–8 Trench C, Unit 2.

Nutlets from the Polygonaceae plant family were identified as *Polygonum convolvulus*, *Polygonum aviculare*, *Polygonum* sp., *Rumex* sp.

Badly preserved of plants from the Cyperaceae family are very similar to nutlets of the Polygonaceae plant family. Interestingly, it was possible to record cf. *Carex* sp., cf. *Scirpus/Bolboschoenus* sp., cf. *Eleocharis* sp., and genus and species unidentifiable cyperaceous plants. All plants from this family are wetland plants or at least prefer very humid conditions to grow. So, they can be used as indicators for humid conditions.

The presence of fabaceous plants seeds, especially large seeds from the Viceae tribe is interesting as there is, to date, no evidence for cultivated pulses in the region during the Bronze Age and Early Iron Age periods. The presence of leguminous plants from the Viceae tribe is an argument that while cultivated pulses could grow in the period under discussion they were not planted, i.e. their absence was not a matter of environmental conditions but was rather a choice made by the people.

Seed material belonging to other families is rare. It includes seeds and fruit remains from the following plants: *Neslia* sp. (Fig. 2,5–6), *Thlaspi* sp., cf. *Camelina/Lepidium* sp. (?) (Brassicaceae), cf. *Vaccaria* sp. and *Cariophyllaceae gen.* sp. (Caryophyllaceae), *Asteraceae gen.* sp. 1, *Asteraceae gen.* sp. 2, *Centaurea* type (Asteraceae), cf. *Convolvulus* sp. (Convolvulaceae), cf. *Chenopodium* sp. (Chenopodiaceae), Lamiaceae gen. sp., *Hyoscyamus* sp. (Fig. 2,9–12; Solanaceae), *Adonis* sp. (Fig. 2,7–8; Ranunculaceae), *Apiaceae gen.* sp. 2 and some unidentifiable charred seeds of herbaceous plants.

In addition to these remains a lot of desiccated seeds of *Chenopodium* sp.[7], *Adonis* sp., *Asteraceae gen.* sp. 2 (*Centaurea* type), *Neslia* sp., *Asteraceae gen.* sp. 1, *Brassica/Sinapis* sp. were found which were probably collected and stored in archaeological deposits by small rodents. Data on seeds of those plants are presented in Tab. 1, but they are not included in any calculations.

There are also some carpological remains from arboreal plants, which consist of 2 % of all recovered seed material. These include charred nutstones of rose-hip (Fig. 3; *Rosa* sp., cf. *Rosa* sp.; Rosaceae) and one charred remain of a fruit with nut stone. It has some similarities with cherry (Species A: *Cerasus*?; Rosaceae?) fruit, but might be also something else (final identification is impossible because of its very

7 Here we separated charred and desiccated seeds of *Chenopodium* as they are not possible to distinguish from each other. But we also have evidence for mineralized *Chenopodium* seeds, which are definitely old and those are included in calculations as are other plant seeds from this list, with charred or mineralized preservation.

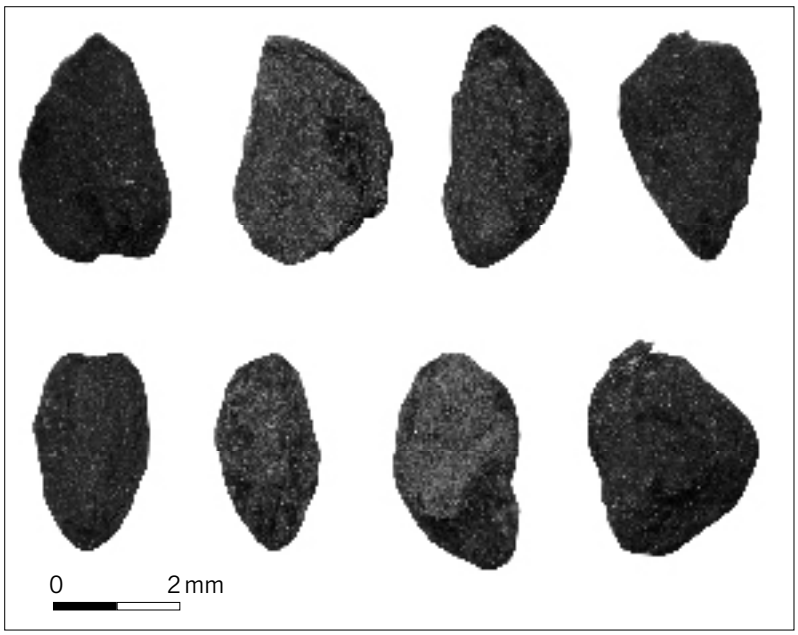

Fig. 3 Some rose-hip (*Rosa* sp.) nutstones from the MBA/LBA settlement of Sotk 2 (from excavations in 2011, Trench A, Unit 5).

poor preservation). Rose-hip is recorded from the transitional MBA/LBA period and from EIA period layers, but has probably also existed in the EBA and LBA periods as it is a very adaptive plant.

There are also many plant diaspores, mostly charred, which are highly corroded and lack external layers making them completely unidentifiable.

All plant taxa recovered from the site are native for the investigated area. The cultivated ones, bread wheat, emmer, and barley, are the main cultivated field crops at the villages surrounding the site today. The recovered weedy and wild plant taxa are known weeds of today's cultivated cereal fields and the main elements of the native vegetation of the site and its environment.

Most of the samples from Sotk 2 contain charcoal fragments and many of them also excrements (coprolites) of small rodents. These excrements sometimes could serve as indirect indicators for grain storage or food remains.

Below we will try to interpret some archaeological contexts[8] based on recorded archaeobotanical material as far as botanical material allows (Tab. 1).

Trench A, Unit 2:
Bottom of rock cut pit with large quantity of bones. The depth is more than 1 m. MBA/LBA, with later unessential EIA intrusion. Probably used for cereal grain storage: an essential quantity of cereal grains and segetal weeds waste concentrated at the bottom of this pit.

Trench A, Unit 5:
Small pit with a lot of charcoal. MBA/LBA. Many nut stones of rose-hip (88 %; Fig. 3) possibly from a single fruit burnt in a fire are present in this location.

Trench C, Unit 2:
EBA, with an EIA intrusion. There is a large quantity of charcoal presented in this archaeological context indicating the active use of fire (for heating or metal smelting?). Practically no cultivated plants are recorded in this location. On the one hand many (more than in an average sample from Sotk 2) seeds of weeds/wild plants which were common for the fields of the studied area were found here. It could be a sign that peat and/or dung were also used to make a fire. On the other hand seeds of hygrophilous grasses (plants growing in very humid conditions like in water and marshy places) were rare in this context. This means that it is more probable that recovered seeds were derived from dung rather than from peat. Many charred seeds with eroded surfaces confirm this supposition (erosion could be result of digestion). Animal dung is still in use in the region as fuel to make a fire.

Trench D, Unit 3:
EBA. Very few weed seeds with some cereal grains present. These might be food remains.

Trench E, Unit 4:
LBA vessels from the intramural grave. Perhaps they served as barley container or for beer (?).

Trench E, Unit 6:
MBA/LBA. Possibly a cooking area: many burnt boraginaceous plants and fragmented cereal grains were present here.

Trench E, Unit 7:
Floor of MBA/LBA transitional period rock cut room (ca. 2,0 m in diameter and ca. 1,3 m depth). The most representative sample among the entire Sotk 2 samples excavated in 2011 and 2012. In all probability white residues presented in

8 Information about archaeological contexts and their dates have been provided by A. Bobokhyan and his students.

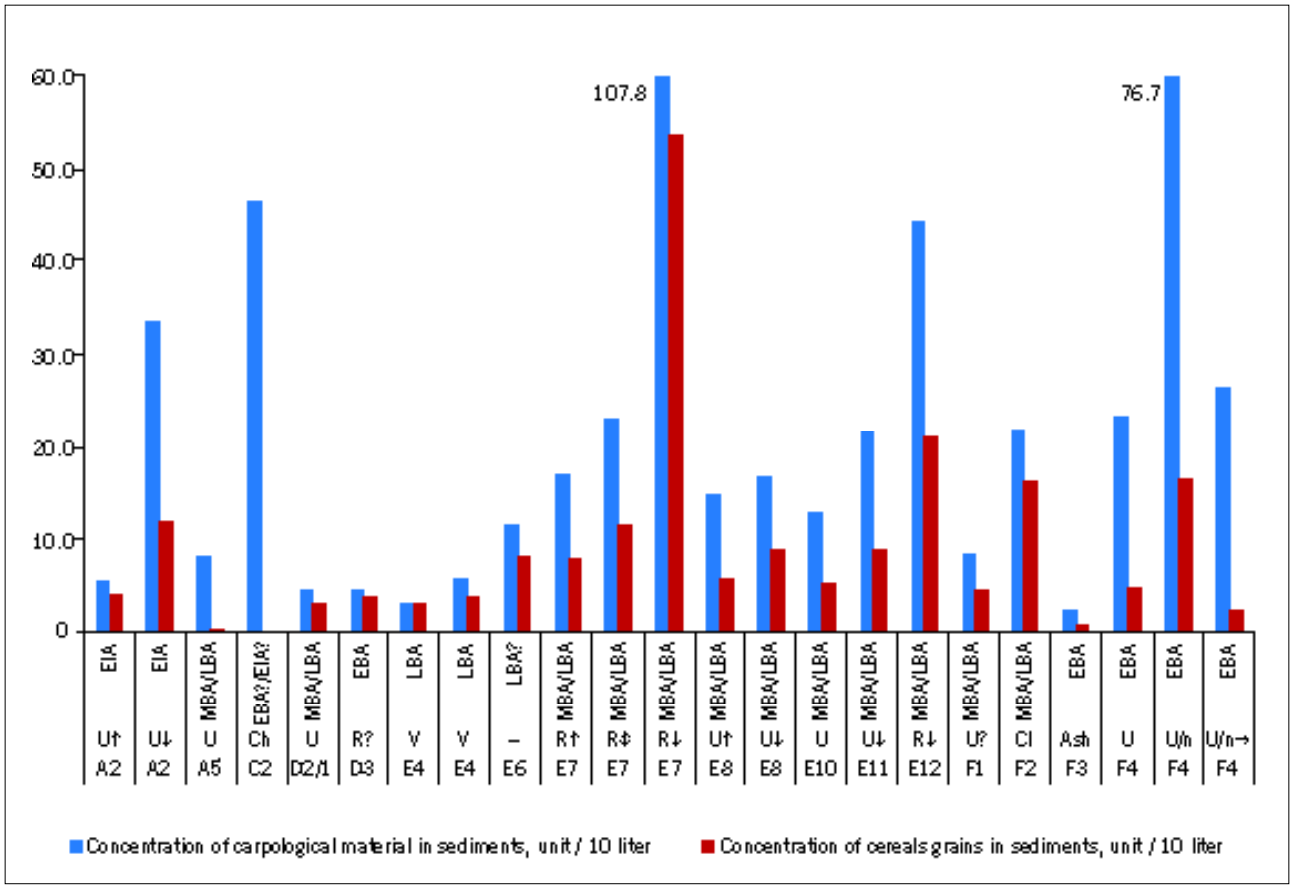

Fig. 4 Concentration of carpological material and cereal grains in Sotk 2 samples.

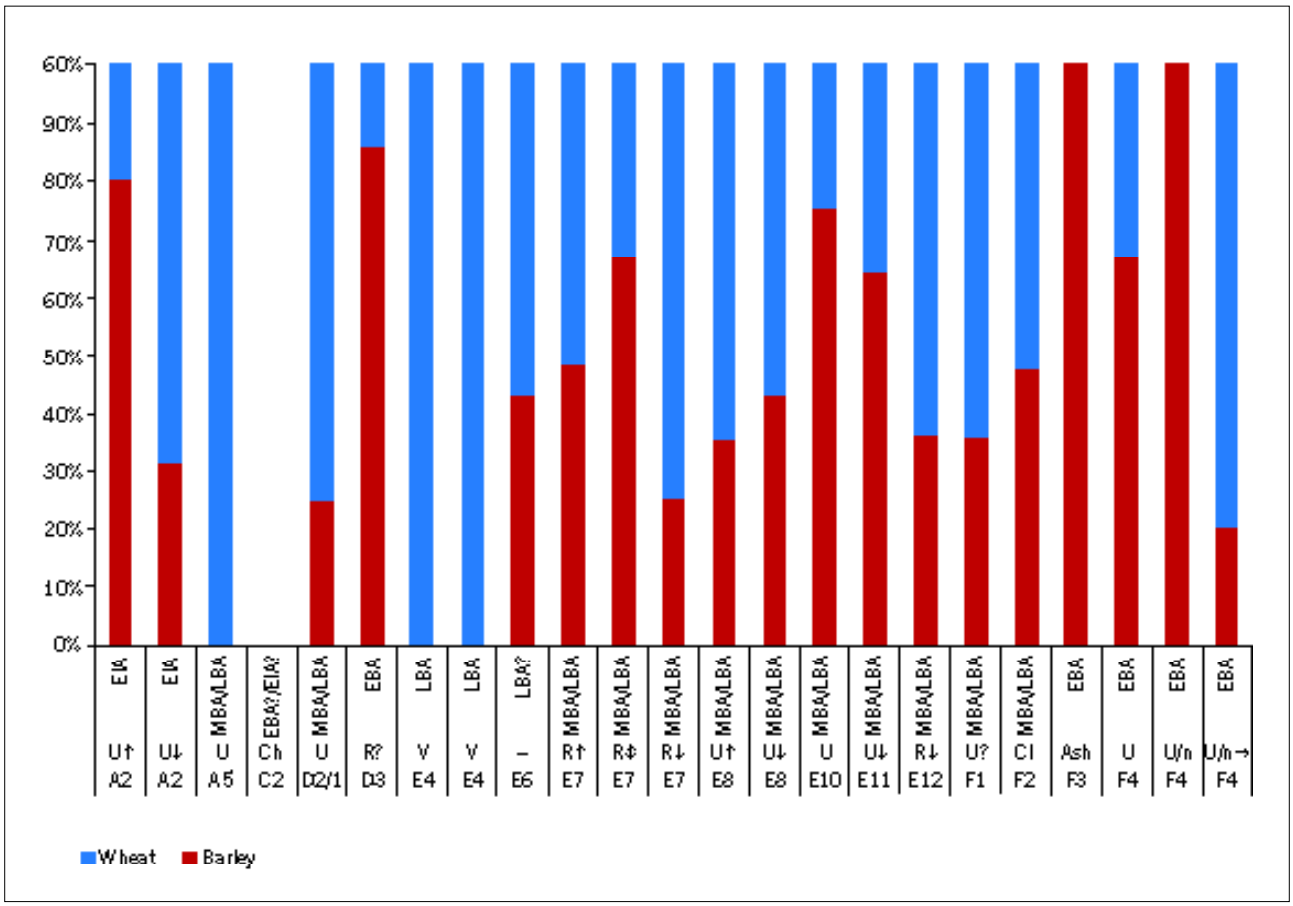

Fig. 5 Wheat and barley ratio in Sotk 2 samples.

Fig. 6 Proportions of cereals and weeds in Sotk 2 samples.

Context			IIT1a Δ4 pit	IIT1c Δ3 pit	
				upper layers	lower layers
Volume of the processed sediments (Liter)		**7.0**	2.5	2.5	2.0
Concentration of carpological material *(units/liter sediments)*		*3.7*	*2.0*	*6.0*	*3.0*
Plant Taxa	**Findings**	**26**	**5**	**15**	**6**
Triticeae gen. spp.	grains fragments	**3**	–	2	1
Triticum sp.	grains fragment	**1**	–	–	1
Hordeum vulgare	grains fragment	**1**	–	–	1
Triticum dicoccum	grain	**1**	1	–	–
Poaceae gen. sp.1 (longer kernel)	grain	**1**	1	–	–
Poaceae gen. sp.2 (shorter kernel)	grain	**1**	–	1	–
Hordeum sp. (wild)	grain	**1**	–	1	–
Galium cf. *spurium*	mericarp	**1**	–	1	–
Galium sp. 2	mericarp	**1**	–	1	–
Neslia sp.	capsule	**1**	–	1	–
Fabaceae gen. sp. (small seeded), cf. *Trifolium sp.*	seeds	**3**	–	3	–
Cyperaceae gen. sp. , cf. *Carex sp.*	nutlet	**1**	–	1	–
cf. Lamiaceae gen. sp.	seed	**1**	–	1	–
Chenopodium sp.	seed	**1**	–	–	1
Unid. Species 1	capsules?	**2**	–	2	–
Unid. Species 2	seed	**1**	–	–	1
Unid. Species	unidentified fragments	**5**	3	1	1
Mice coprolite, *mineralized*			–	+	+

Tab. 2. Archaeocarpological material recovered from the site of Geghakar in 2012.
Note: All finds presented in this table are charred.

Trench			A
Unit			5
Stratum			3
Plant Taxa	**Findings**	**Preservation**	**192**
Triticeae gen. sp.	grains fragments	charred	12
Triticum aestivum/turgidum	grains	charred	2
Triticum cf. *aestivum*	grains	charred	3
Poaceae gen. sp.1*	grains	charred	2
Poaceae gen. sp.2**	grains	charred	1
Galium cf. *spurium*	mericarp	charred	1
Buglossoides arvensis (= *Lithospermum arvense*)	erem	mineralized, burnt	1
Polygonaceae gen. sp.	nutlet	charred	1
Cyperaceae gen. sp., cf. *Carex sp.*	nutlet	charred	1
Hyoscyamus niger ***	seeds	dessicated &/or biomineralized	166
cf. *Camelina/Lepidium sp.* (?)	seed	charred	1
Unidentified grassy plant	seed	charred	1

Tab. 3 Archaeocarpological material in one litre volume sample from the site of Norabak 1 in 2012.
Notes: * Wild species with larger and long kernels, ** Wild species with smaller and shorter kernels,
*** All seeds recovered from this small sample could come from single capsule (fruit) of this plant.

abundance in E7 situations are silicium rich remains of cereals chaff. This indicates a large quantity of straw and chaff. Chaff also accumulated in the bottom of this pit where many fragments of awns of cultivated cereals spikes are recorded. Although this is a single sample, the ratio of wheat and barley in Sotk 2 is best defined on the basis of this sample – 25 %/75 % – while for average in MBA/LBA material from Sotk 2 it is 37 %/63 %.

The situation in this room is very similar to that found in storage pits. As in the case of pit bottoms, many weed seeds settled on to the floor of this feature. Very often weeds are more common in the bottom of the pits than in other places. Usually ratio of weeds and cultivated plants in the bottoms of pits are 50 %/50 % ± 10 % (Hovsepyan 2011).

Trench E, Unit 8:
MBA/LBA pit bottom. Ratio of cereals and weeds corresponds with that of the other pit bottoms (e.g. Hovsepyan 2011).

Trench E, Unit 12:
MBA/LBA period room floor, extension of Trench E, Unit 7. There is an essential quantity of cereal grains in this location. The wheat/barley ratio in this structure is also reliable.

Trench F, Unit 1:
This location was later inhabited by rodents that collected seeds of *Neslia*, *Asteraceous*, and other plants.

Trench F, Unit 2b:
A channel in a clay made floor, EBA period. This channel was later inhabited by rodents that collected seeds of Asteraceous plants, *Polygonum convolvulus*, and other plants.

Trench F, Unit 3:
EBA period ashy layer. Later inhabited by rodents that collected seeds of *Neslia*, other brassicaceous plants, *Adonis*, asteraceous plants, and other unidentified plants. Large quantity of rodents' excrements and grazed seeds are present in this sample.

Trench F, Unit 4:
EBA. Many seeds of a short grained poaceous plant were present here, probably remains of a complete spike which fell into fire. Possibly the same situation applies to vetch (*Vicia*) seeds, i. e. those are from whole pod(s), as in general there are not many large fabaceous seeds in Sotk 2.

Trench F, Unit 4 (niche):
Niche nearby the above-mentioned EBA pit. The concentration of archaeocarpological material is comparably high here. Possibly this niche was a good place to conserve plants remains. Another possibility is that waste was cleaned from the pit nearby (see above) and placed in this niche. A higher concentration of carpological material at the bottom parts of the pits and rooms soil filling suggests that archaeobotanical materials were *in situ* there.

Palaeoethnobotanical investigations suggest that in all occupational periods of the high mountainous Sotk 2 settlement at least some of the inhabitants settled and practiced agriculture based on the cultivation of tetra- and hexaploid wheats, barley, and emmer at this site. It is probable that ecological conditions in the surroundings of the site in the past were generally similar to the present situation as cultivated plants and weeds recorded for the past of Sotk grow there at the present time and there is not any evidence of changes in the ecological conditions.

Geghakar

According to radiometric dating, pit Δ4 of trench ΠΤ 1a belongs to the Early Iron Age (Harutyunyan/Badalyan 2008), while the typology of ceramic sherds from pit Δ3 of trench ΠΤ 1c points to a Middle Bronze Age date (Harutyunyan, pers. com.).

Cultivated plant remains in processed samples from Geghakar were represented by charred grains and grains fragments of cereals. Three unidentifiable fragments of cereals (*Triticeae* gen. spp.), one grain of wheat (*Triticum* sp.), and one grain of barley (*Hordeum vulgare*) were recovered among the cultivated plants from pit Δ3 of trench ΠΤ 1c

(supposedly MBA) and one grain of emmer (*Triticum dicoccum*) from pit Δ 4 of trench ΠΤ 1a (EIA; Tab. 2). Single finds of *Carex* and *Trifolium* seeds from pit Δ 3 of trench ΠΤ 1c are indicating some humid conditions (this does not mean that climate definitely was humid in that period; more data are necessary for final conclusions). Archaeobotanical data retrieved from Middle and Late Bronze Age occupational stages of Sotk 2 and Geghakar are especially important for the archaeology of Armenia as there are not many sites of the above-mentioned periods with archaeobotanical evidence for plant economy and environment[9].

In 2010 the author presented a working hypothesis about main phases of agriculture in prehistory at the South Caucasus (Hovsepyan 2010a) based on a review of all available archaeobotanical records (e. g. Lisitsina/Prishchepenko 1977; Gandilyan 1998; Hovsepyan 2009; Hovsepyan 2010; Wasylikowa et al. 1991) from the territories of Armenia, Georgia, Azerbaijan, and Dagestan. There he particularly mentioned that cereal cultivation, based mostly on the cultivation of two-rowed and six-rowed hulled barleys, common and club bread wheats and emmer, was the main focus of EBA up to EIA (the period from the second half of the 4th to the beginning of the 1st millennium cal. B.C.) agriculture at the South Caucasus (Hovsepyan 2010a). Also the absence of cultivated pulses and oil-producing plants in archaeobotanical record of the South Caucasus during the entire Bronze Age was noted in that hypothesis (Hovsepyan 2010a; noted also in Hovsepyan 2011). These recent archaeobotanical investigations at the settlements of Sotk 2 as well as Geghakar confirm this hypothesis. The situation described for the Bronze Age and Early Iron Age agricultures of the South Caucasus differed from agriculture of the earlier, Neolithic and Chalcolithic periods (Hovsepyan/Willcox 2008), and following Middle Iron Age (Hovsepyan 2010a), when cultivation of pulses and oil-crops also was a common agricultural practice.

Norabak 1

Trench 1 material belongs to a developed medieval period. The preservation of the samples uncovered confirms this supposition: finds are mostly well preserved and complete grains and some other charred finds have well preserved, cleaner and shiny surfaces; seeds of *Hyoscyamus* which are in abundance in this small sample have intermediate preservation between desiccated and biomineralised states, i. e. taphonomic processes were in progress.

Only wheat, particularly bread wheat (*Triticum aestivum*), has been recorded as a cultivated plant (Tab. 3). All plants recorded by this sample are common for the entire historical and prehistoric times of the region since the Eneolithic. Unfortunately, the present sample is too small for more or less precise interpretations concerning medieval plant economy and environment of Norabak.

Recently archaeobotanical investigations began at two medieval period sites: the surroundings of the Tigranakert church (east of Lake Sevan, Nagorno-Karabakh Republic) and the caravanserai of Aray (west of Lake Sevan; Aparan, Prov. Aragazotn, Armenia). Data retrieved from those sites will make the comparison with the medieval material from Norabak 1 more interpretable.

Conclusions

Preliminary archaeobotanical data from the settlements of Sotk 2 and Geghakar show their similarities with other contemporary Bronze Age and Early Iron Age sites of the South Caucasus. According to this data the main focus of agriculture of Bronze Age population of the region was the cultivation of cereals, particularly barley, free-threshing wheat, and emmer. Archaeobotanical data suggest that moist steppes with some bushes of rose-hip could have been present in the studied region.

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9 There is archaeobotanical evidence from the MBA settlement Shaghat 1 and Nerkin Naver cemetery, the LBA settlements Gegharot, Margahovit, Tsaghkahovit, and Aragatsiberd, and from several tombs of Tsaghkahovit.

Bibliography

Biscione et al. 2002
R. Biscione/S. Hmayakyan/N. Parmegiani (eds.), The North-Eastern Frontier: Urartians and Non-Urartians in the Sevan Lake Basin, I. The Southern Shores. Documenta Asiana VII (Rome 2002).

Gandilyan 1998
P. A. Gandilyan, Archaeobotanical evidence for evolution of cultivated wheat and barley in Armenia. In: A. B. Damania/J. Valcoun/G. Willcox/C. Qualset (eds.), The origins of agriculture and crop domestication. Proceedings of the Harlan symposium, 10–14 May 1997, Aleppo, Syria (Aleppo 1998) 280–285.

Harutyunyan/Badalyan 2008
A. Harutyunyan/R. Badalyan, Geghakar settlement: new Middle Bronze Age site in the Sevan basin. Culture Ancient Armenia 14, 2008, 103–112.

Hovsepyan 2009
R. A. Hovsepyan, Field crops and common weeds at the territory of Armenia in Neolithic – Iron Age periods. Ph.D. thesis. Scientific centre of Agriculture and Plant protection MA, Armenia (Yerevan 2009). (in Armenian)

Hovsepyan 2010
R. A. Hovsepyan, New data on agriculture of Aparan-III Early Bronze Age settlement (Armenia). Biol. Journal Armenia 62,4, 2010, 31–37.

Hovsepyan 2010a
R. Hovsepyan, Preliminary data on the prehistoric agriculture of the Southern Caucasus (the main phases of development). 15th Conference of the International Work Group for Palaeoethnobotany. Wilhelmshaven, Germany, May 31–June 5, 2010, 41, <http://www.palaeoethnobotany.com/download/iwgp15_programme_abstracts.pdf> (19.03.2013).

Hovsepyan 2011
R. Hovsepyan, Palaeoethnobotanical data from the high mountainous Early Bronze Age settlement of Tsaghkasar 1 (Mt. Aragats, Armenia). Ethnobiol. Letters 2, 2011, 58–62.

Hovsepyan/Willcox 2008
R. Hovsepyan/G. Willcox, The earliest finds of cultivated plants in Armenia: evidence from charred remains and crop processing residues in pisé from the Neolithic settlements of Aratashen and Aknashen. Vegetation History and Archaeobotany 17, Suppl. 1, 2008, 63–71.

Kunze et al. 2011
R. Kunze/A. Bobokhyan/K. Meliksetian/E. Pernicka/D. Wolf, Archäologische Untersuchungen zur Umgebung der Goldgruben in Armenien mit Schwerpunkt Sotk, Provinz Gegharkunik. In: H. Meller/P. Avetisyan (eds.), Archäologie in Armenien. Ergebnisse der Kooperationsprojekte 2010 – Ein Vorbericht. Veröff. Landesamt Denkmalpfl. u. Arch. Sachsen-Anhalt 64 (Halle [Saale] 2011) 17–49.

Lisitsina/Prishchepenko 1977
G. L. Lisitsina/L. V. Prishchepenko, Palaeoethnobotanical finds of Caucasus and Near East (Moskow 1977). (in Russian)

Wasylikowa et al. 1991
K. Wasylikowa/M. Carciumaru/E. Hajnalova/B. P. Hartyanyi/A. Pashevich/Z. V. Yanushevich, East-Central Europe. In: W. van Zeist/K. Wasylikowa/K.-E. Behre (eds.), Progress in Old World Palaeoethnobotany. A retrospective view on the occasion of 20 years of the International Work Group for Palaeoethnobotany (Rotterdam, Brookfield 1991) 207–239.

Zohary et al. 2012
D. Zohary/M. Hopf/E. Weiss, Domestication of Plants in the Old World: The origin and spread of domesticated plants in Southwest Asia, Europe, and the Mediterranean Basin (New York 2012).

Source of figures

1 B. Parsche
2–6 R. Hovsepyan
Tab. 1–3 R. Hovsepyan

Address

Dr. Roman Hovsepyan
National Academy of Sciences
of the Republic of Armenia
Institute for Archaeology and Ethnography
Charents Str. 15
ARM-0025 Yerevan
roman.hovsepyan@yahoo.com