Traces et fonction : les gestes retrouvés
Colloque international de Liège
Éditions ERAUL, vol. 50, 1993

Agricultural implements in the Neolithic and Eneolithic cultures of Bulgaria

*Natalia N. SKAKUN**

RÉSUMÉ

Divers instruments agricoles en os, bois de cervidé et pierre de sites néolithiques et énéolithiques (Chalcolithique, 6000 BC) de Bulgarie ont fait l'objet d'analyses typologiques et tracéologiques, sur la base d'expérimentations détaillées. Deux technologies agricoles sont distinguées entre ces deux périodes. Des houes lithiques et osseuses sont décrites pour le Néolithique, ainsi que des meules et des faucilles de type Karanovo. A l'Énéolithique, de nouveaux outils tels que les socs d'araire en bois de cervidé, parallèlement à la présence du bœuf, indiquent le début d'une agriculture de labours. Des houes métalliques, aussi bien qu'osseuses et lithiques, sont utilisées. La dimension des meules est plus importante qu'au Néolithique, et des outils pour l'extraction et le broyage des minerais font leur apparition. On commence à trouver des éléments de *tribulum*, et, bien que les faucilles restent du type de Karanovo, les armatures de ces deux types d'instruments utilisent de nouveaux supports laminaires grands et standardisés. L'auteur considère que la technologie agricole plus développée mise en évidence par ces observations a contribué à transformer la structure économique et à accroître la prospérité du Chalcolithique et de l'Âge du Bronze.

ABSTRACT

This article uses typological and detailed experimental use-wear observations of bone, antler and stone tools, centering upon various agricultural tools from Neolithic and Eneolithic (Chalcolithic, 6000 BC) sites of Bulgaria. The author contrasts the agricultural technology of these two periods. Neolithic stone and bone hoes are described, as well as querns and Karanovo-type sickles. In the Eneolithic, new tools such as antler ardshares and the presence of oxen show the beginning of arable farming ; metal hoes are used as well as ones of bone and stone. Querns are larger than during the Neolithic, and tools for extraction and grinding of ore also appear. Inserts for threshing sledges begin to be found, and, although sickles remain of Karanovo type, inserts for them as well as threshing sledges are made from newly-appeared large, standardized blades. The author considers that the more intensive level of agricultural technology shown by these observations for the Chalcolithic and the following Bronze Age plays a role in bringing about a new economic structure and increased prosperity.

Systematic typological and experimental use-wear analyses of implements and their raw materials from Neolithic and Eneolithic sites from Bulgaria were carried out on a large scale, producing a number of interesting observations concerning the sites' cultural and chronological affiliation and

Main branches of economy and special primitive crafts	Functional groups of implements	Functional types of implements	The name of implements and main special activities	Number of implements	% of total implements
1	2	3	4	5	6
A			*Agricultural implements*		
	I		*Implements for cultivation of the land*	229	1,81
		1	ralos (ardshares)	12	0,10
		2	hoes	217	0,71
	II		*Reaping, threshing, grain-grinding tools*	4 431	35,12
		3	sickle-inserts	4 098	32,49
		4	threshing-sledge inserts	227	1,80
		5	querns	106	0,84
	III		tools for cutting of grass	139	1,10
		6	knives for grass	139	1,10
B	IV		*Implements for hunting and fishing*	134	1,06
		7	arrow-heads, dart-heads	99	0,78
		8	fish-hooks	5	0,04
		9	harpoons	6	0,05
		10	plummets	24	0,19
C			*Implements for treatment of hunting and cattle-breeding products*		
I	V		*Implements for leather-skin-working*	2 944	23,34
		11	endscrapers	1 129	8,95
		12	scrapers-shavers	976	7,74
		13	inserts from leather-dressing tools	343	2,72
		14	knives for dehairing of skins	36	0,28
		15	knives for cutting skins	171	1,35
		16, 17	tools for piercing skins (borers, needles, avis)	184	1,46
		18	burnishers	96	0,83
	VI		*Tools for butchering (for dressing of carcasses)*		
		19	knives	817	6,48
II	VII		*implements for wood-working*	2 191	17,37
		20	scrapers	279	2,21
		21	scrapers-shavers	720	5,71
		22	saws	363	2,88
		23	plane-knives	194	1,54
		24	drills	172	1,36
		25	fly-wheels	3	0,02
		26	burins	113	0,89
		27	axes	61	0,48
		28	adzes	116	0,92
		29	chisel-shaped tools	170	1,35
III	VIII		*Bone-working implements*	1 039	8,24
		30	saws	252	1,99
		31	scrapers	323	2,56
		32	plane-knives	173	1,37
		33	burins	164	1,30
		34	drills	100	0,79
		35	abrasives	27	0,21
IV	IX		*Stone-working implements*	444	3,52
		36	pressure-flakers	182	1,44
		37	hammers	34	0,27
		38	saws	198	1,57
		39	abrasives, anvils	30	0,24
V	X		*Implements for use of coloring matter*		
		40	implements for grinding coloring matter	55	0,44
			Implements for weaving	64	0,50
		41	plummets	24	0,19
VI	XI	42	splindle-whorls	40	0,32
VII	XII	43	implements for plaiting	13	0,10
	XII	44	hooks for bast-plaiting-« Kotchedyk »	13	0,10
VIII	XIII		*Implements for ceramic production*	89	0,70
		44	pellets	15	0,12
		45	burnishers	71	0,56
		46	*cliches*	3	0,02
IX	XIV		*Metal-working implements*	26	0,21
		47	whetstones	12	0,09
		48	ore-breakers, ore-anvils	14	0,11
			Total	12 615	100,00

Table 1. The functional classification of implements and major crafts in the Eneolithic of the Warna culture (Bulgaria).

paleo-economic nature (Skakun, 1987, 1989). The technical and morphological analysis of implements showed that the various Bulgarian Neolithic cultural complexes have different heritages : in particular, the material from northeastern Bulgaria sharply contrasts with that from the Thrace valley and from the western part of the country. Even more marked differences were found to exist between implements from Neolithic and Eneolithic sites : although a connection between these two epochs can be shown for the central regions on the basis of particular components of the tool tradition, this relationship is almost entirely absent in the Northeast. The use of different local flint types was replaced during the Eneolithic by use of flint from Dobrogea in most settlements of Bulgaria. A key factor of change was the reorientation of the flint-working industry towards a new type of blank, a large blade with standardized proportions and a large size which had optimal technical characteristics as a blank for most implements (Skakun, 1984). This radical transformation of one of the traditional industries, flint-working, reflects major changes within the Eneolithic economy, both in terms of the complexity of its structure and the technical elaboration of its implements. A good illustration of this may be found in the functional classification of implements we have made for the main industries (tab. 1). Here we shall consider the progressive evolution of agricultural tools in particular (fig. 1).

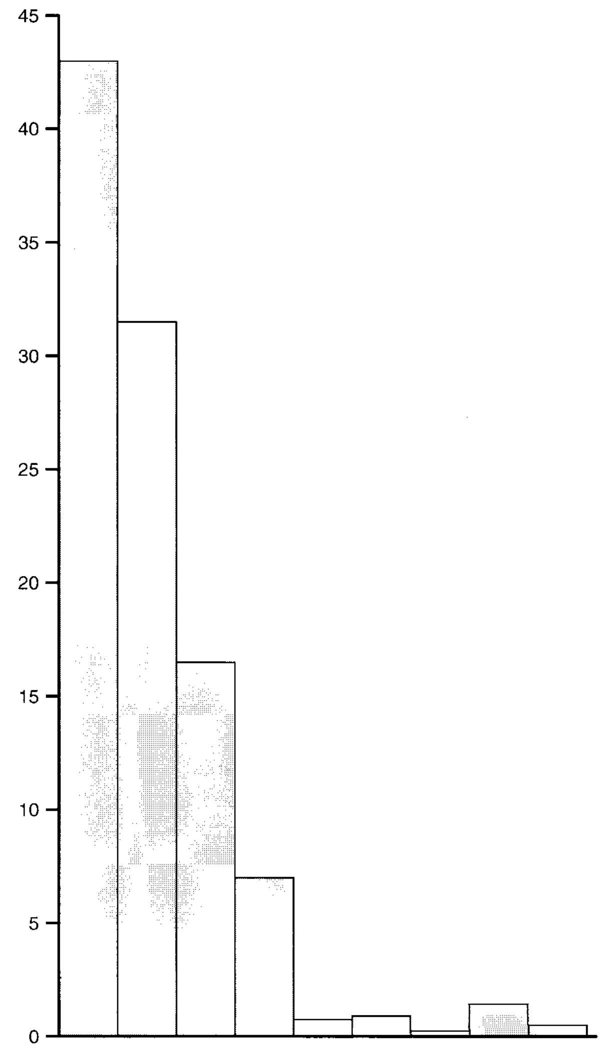


Fig. 1. Special primitive craft activities (see table 1, column 1).

Agriculture becomes one of the main branches of the economy in Bulgaria in the early Eneolithic, dated to 6000 BC (Todorova, 1981a). Numerous agricultural implements – hoes for cultivation, sickles with flint inserts and querns – were found on sites from this period.

Hoes were made from bent parts of antler and have a cone-shaped working end and straight or salient butt (fig. 2). Some of them have a lug hole. The surface of some tools shows the natural horn cover, whereas others have completely polished surfaces. Many hoes have characteristic use-wear traces, the most marked being intensive polish of their working part, and deep scratches oriented parallel to the longitudinal axis of the tool. The mode of attachment of the antler hoes to a handle was experimentally reconstructed by S. A. Semenov (Semenov, 1974 ; Korobkova, 1975).

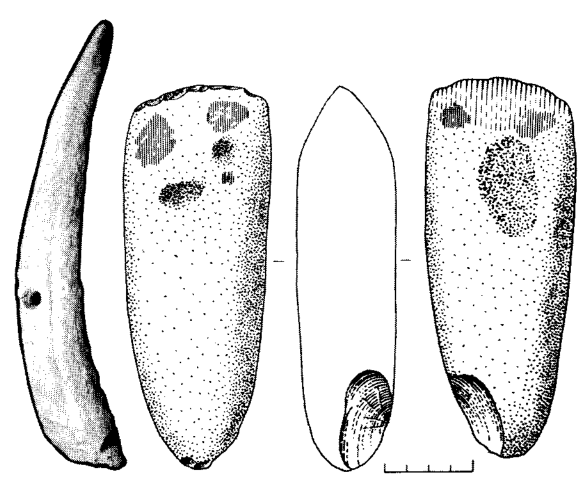


Fig. 2. Antler and stone hoes from Eneolithic sites of Bulgaria.

Experiments also showed that the depth of soil loosened by these antler hoes is about 5 cm and they can work an area of about 60 m^2 of loessic soil.

In addition to antler hoes, stone hoes were found on Neolithic settlements. These have an oblong outline, an ellipsoid cross-section, and a trapezoid-shaped working end. Their surfaces have been shaped by either pecking or polishing. The working edges of intensively-used hoes are extremely blunted and rounded in profile. The striations and luster typical of agricultural implements are visible even with the naked eye on some areas adjacent to these edges.

The reaping implements are sickles of Karanovo type. Intact specimens of handles with their flint inserts were found *in situ* in some sites. The antler handles of some sickles are worked by polishing, whereas others have a natural horn surface. The lower end is usually rounded, or sometimes is decorated by engraving (fig. 3). The depth of the slot for inserts measures up to 1.5 cm. The inserts, fragments of the standardized blade type of medium size – measuring up to 1.5 cm in width – were set in groups of 4 or 5 into the slot of the handle at an oblique angle, forming a serrated working edge (fig. 4). Numerous experiments showed the high effectiveness of such sickles. They were shown to be more efficient and practical than the reaping knives with straight handles which are commonly found in the Neolithic of Middle Asia (Korobkova, 1979), and their output was only 2.5 times less than that of modern iron implements. The characteristic « mirror-like » sheen and comet-shaped striations formed on the inserts after the first hours of uninterrupted work.

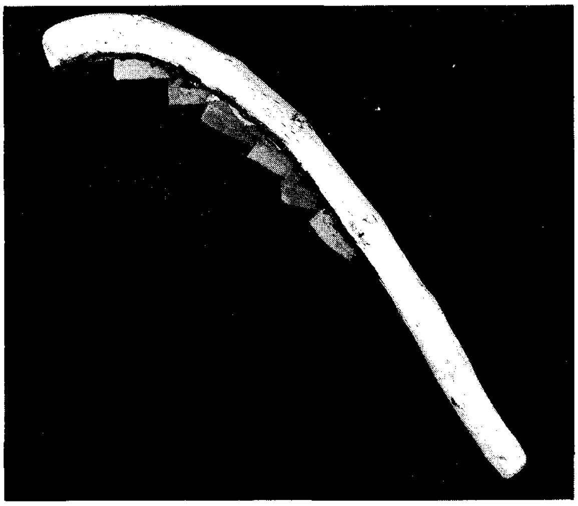


Fig. 3. An experimental sickle of Karanovo-type.

Sickles from Bulgaria appear to be at a fully evolved stage, making it impossible to retrace the evolution of this tool from simpler forms such as reaping knives to more complicated ones with a curved handle, like the evolution which took place during the Neolithic and the Eneolithic cultures of Middle Asia. This may be due to the presence of different traditions of reaping implements in the Balkans, in Rumania and in the southeastern part of the USSR. On the other hand, there is no information showing even single-insert reaping knives were present in the Mesolithic of Bulgaria, although admittedly this area is still poorly-known. The finds of individual tools for cutting of plants in the Upper Paleolithic can be considered only as evidence of gathering wild plants, because at the present time there is no indisputable proof of the cultivation of wild cereals in the Balkans. It is interesting to note that this sickle form is identical in different Neolithic cultures of Bulgaria which are otherwise different from one another in many aspects. This observation supports the hypothesis of the introduction of agriculture from Middle Asia to the Balkans.

Stone querns, used to grind grain, were found on most sites. They have a boat-like, rounded or oval form. Their working surfaces are shaped by pecking, and the lateral surfaces are partially ground. The working areas of querns have intensive use-wear traces from rubbing and grinding.

For the first time, besides the functional types with their distinctive use-wear traces already described in the literature, we have discovered several completely new kinds of implements in the Eneolithic. Functions of implements were determined using magnifications up to 200x, taking into account the whole complex of traces discovered on the working parts and backs of tools :

a. the pattern of blunting, chipping and configuration of the cutting edge ;

b. types and topography of microwear polishes ;

c. linear traces.

In this way a series of seven objects of the same kind were discovered among the tools, made from red deer antler (fig. 5). They are large, elbow-shaped artefacts made from the long part of a main shaft of an antler with the tine oriented at an obtuse angle. Careful microscopic examination showed that the use-wear traces on them were concentrated on the tine ; its entire surface is intensely polished, and striations, deep scratches, and grooves are visible on some parts, oriented along the longitudinal axis towards the antler shaft. Particularly intense luster and deformation appear on the lower part of the tine. At the other end of the antler shaft, wear occurs on the retouched area, on the facet ridges, which appear slightly rubbed and smoothed (fig. 4 : A, B).

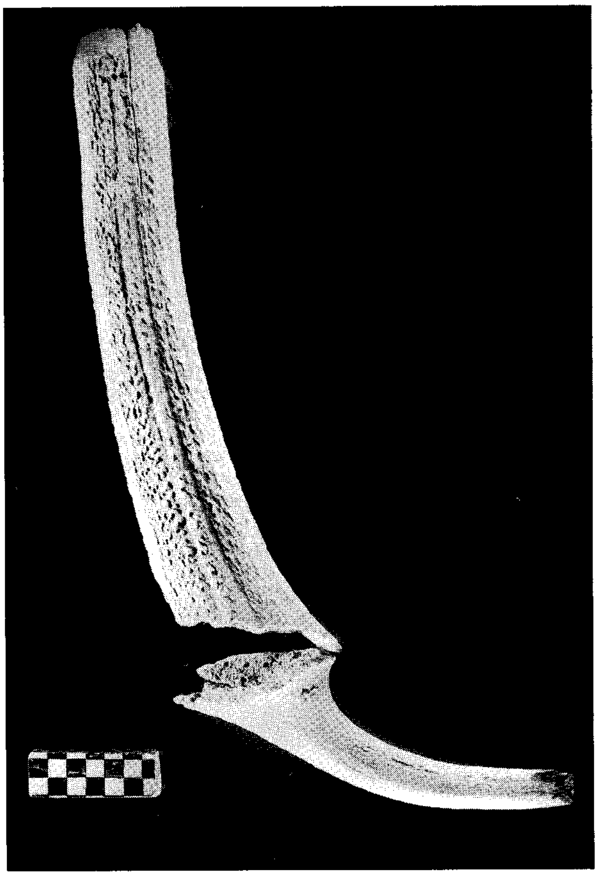
The experimental use-wear analysis we carried out over many years shows that this type of use-wear is typical of soil-cultivation implements. The type of polish seen on the antler is due to contact with soil, and the striations result from striking against stones and abrasive particles in the soil. The distribution of the polish, plastic deformation of the tool and the orientation of scratches or striations show that :

1. Only one tine was in the soil, with its end and its lower part, the foot, being exposed to the greatest load.

2. The tool moved with the tine in front as if it were opening the soil.

The bar-like shaft of the antler served as the long part of the tool, and its worked extremity shows traces of rubbing, perhaps showing this part was hafted to various handle devices. Given these observations, it is possible to attribute these implements to a use for soil-cultivation and to consider them as a kind of ardshare or ploughshare. Only two antler objects can be cited as likely analogies : one is from the site Zedmar in Romania, and the other, the well-known « ralo » (primitive form of plough), from the Tripoli settlement Noviye Rusesti studied by Korobkova, although the latter differs from the Bulgarian implements in that it is multi-ribbed. The beginning of arable farming in the Eneolithic Age is confirmed by finds of draught animals : oxen. Possible explanations for the relatively small number of antler shares found include that the same tool was used over a long period of time in several farms of the Eneolithic settlement and that this tool type existed also in wood, which has not been preserved.

Numerous ethnographic examples are known of the use of wooden soil-working implements made of a part of a tree trunk with branches ; the main trunk is drawn through the soil, and the branch(es) harnessed to an animal. Wooden farming implements without metal points were used in



A

B

Fig. 4. A. The antler soil-working tool (*i. e.* ardshare). **B.** Striations on the working part of the tool.

Bulgarian villages as far back as the end of the 19th century, and are still in use on several farms. The Bulgarian ethnographer V. Marinov thought that the antler implements we discovered were quite appropriate, in terms of their morphological and technical attributes, for ploughing of soil at a depth of 6-8 cm.

In the Eneolithic the first metal hoes appeared along with arable implements (Cernych, 1978), which included hoes of antler and of stone.

The other new type of agricultural tool is the threshing plank (threshing sledge) or *tribulum.* Flint inserts from threshing sledges were found among the otherwise typologically homogeneous group of blades with edge-damage, because of their distinctive use-wear attributes. These inserts were usually made from the midsection of the large blades with standard dimensions discussed above. Ventral retouch scars on the butt ends of some of these blades apparently served to thin them. Large, flat facet spalls are visible on the sides. The working part of the tool is located near to the blade edge itself, which is severely worn, deformed and chipped. The edge is crushed and flattened here and there, but its remaining part is rounded in cross-section (fig. 5). Polish resembling the mirror luster of sickle inserts in degree of intensity is visible on both surfaces of the cutting edge, whose

Fig. 5. Microphoto of the working part of a threshing plank insert.

Fig. 6. The threshing plank (*Tribulum*) from Nagornae, Ukraine.

microtexture is extremely smoothed. However, the macro- and micro-use-wear found on these two types of implements is completely different. The cutting edges of sickle inserts are never as heavily deformed as inserts from threshing sledges. The striations characteristic of sickle inserts are comet-shaped, whereas on the threshing plank inserts deep, small scratches oriented paralled and slightly at an angle to the edge are characteristic. The differences in micro- and macro-use-wear on these two kinds of insert are due to cinematic differences in tool motion during use.

The *tribulum* is described by Latin writers, and it is also mentioned in the Bible. Not long ago this device, armed with flint inserts, was in use in some regions of Southern Europe and Asia Minor. During the excavations of the Eneolithic settlement Nagornoye II in the Odessa province (Ukraine, lower Danube) we discovered some complete threshing planks kept in the neighbouring village, which had been populated by Bulgarian immigrants in the 19th century. According to the accounts of older residents, this threshing device, called « dikanya », was made in the following way (fig. 6) : Two or three boards of, most often, willow were steeped for some days. Then slots were carved in the underside of the threshing sledge, and flint inserts were hammered into these slots using wooden hammers so that a corner and part of an adjacent edge projected outside the slots. Large, flat damage spalls were usually produced on the edge of the inserts by this hammering. The finished threshing sledge had a distinctive upcurved front end to which a harness was fastened. Then a flat, well-compacted area of ground was chosen

Fig. 7. Use of the threshing plank.

for the threshing operation. Wheat or barley plants were then evenly spread over the area radially, with the ears pointing to the center, and well-trampled. Then oxen or horses harnessed to the « dikanya » pulled the threshing plank in a circle (fig. 7). Stones or children were used to weight down the plank, and the sharp flint inserts both cut straw and detached grain from the glumes or husk. The cut straw was used, dry or steamed, as fodder for cattle, for house-building, etc. Since the inhabitants of the village of Nagornoye still have an excellent memory of the use of the threshing plank, we had the chance to fully record this process. We used a plank belonging to one village inhabitant which had been made there in the 1930's, and for the purpose of microwear observations, took parts of blades excavated from the Eneolithic site Nagornoye II which had no traces of prior use, and inserted them into empty slots from which inserts had fallen. Comparison of the archaeological, ethnographical and experimental inserts of the threshing plank yielded identical macro- and micro-use-wear traces, confirming the accuracy of the interpretation of the function of the archeological inserts.

Eneolithic reaping implements are identical in construction to Neolithic sickles of Karanovo type, but their inserts are different from Neolithic ones because of they are made from the new type of blade blank appearing in the Eneolithic, described above. Pieces of the midsection of these large, standardized blades (2-2.5 x 3-4 cm), were used as inserts. Such standardization of insert morphology greatly facilitated the ability to produce a cutting edge of regular shape. The working edge was usually unretouched, and use-wear traces characteristic of sickle use are clearly visible on one specimen.

The grinding of grain was done on querns in the traditional way. Some of them are larger than those from the Neolithic, and, according to archaeological observations, they were were fixed in place in habitation areas. The working surfaces of many querns are intensively use-worn. Some of them were used for grinding of ore because in long, deep longitudinal traces or grooves small particles of ore still remain. In addition, several broken querns were found to have been re-used as anvils.

Contrary to general belief, grinding of grain on querns was not found to be very labour-intensive. In experiments, one glass of grain was ground in 20 minutes. The ethnographic data provide examples of long-term use of querns, which existed side by side with hand-mills to the end of the 19^{th} century in some Bulgarian villages.

Unfortunately, we cannot as yet adequately compare agricultural implements from the Eneolithic with those from the early Bronze Age, because of insufficient data concerning Bronze Age tools. But we have considerable evidence for the continuation of use of some kinds of non-metallic tools in the early part of the Bronze Age. For example, the considerable number of antler soil-preparation implements discovered in Bulgarian lakeside

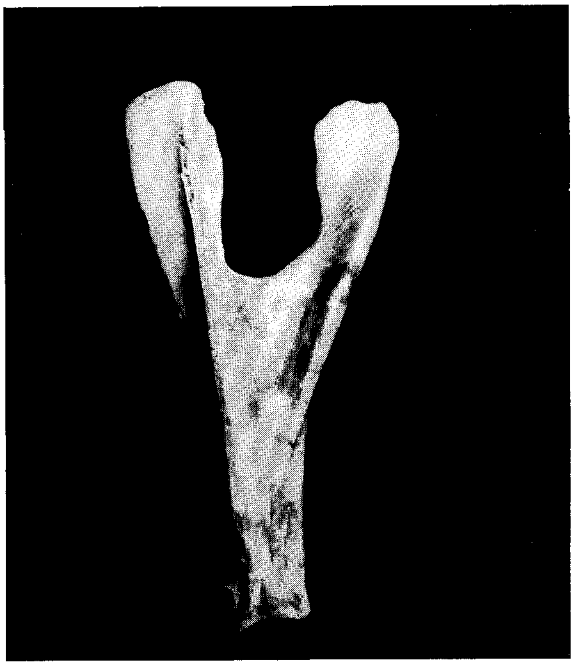


Fig. 8. Bone tool from an Early Bronze Age site in Bulgaria.

dwelling sites are similar in construction to the Eneolithic ones. The Karanovo-type sickle was also being used, as is shown by finds of flint inserts, although these differ from Eneolithic ones in that their working edges are denticulated. Implements made from animal scapula exist which were used, in P. Anderson-Gerfaud's opinion (pers. comm.), for hand-threshing of grain crops, based upon similar use-wear obtained in threshing experiments and found on Neolithic bone tools from Iran (Stordeur and Anderson-Gerfaud, 1985). These tools are made from scapula from which a V- or a U-shape has been cut (fig. 8), forming a kind of large use-worn notch. The surfaces of the scapula adjacent to this « notch » area are polished to a mirror luster by use, with the distribution of use-traces spreading over a far larger area on one side than on the other. Long striations showing long parallel strokes oriented transversely to the notch edge are clearly visible in the use-polished areas of the tools.

Thus, an agricultural implement complex, including tools for soil-working, reaping and grain-processing, was present in Bulgaria in the early stages of the Neolithic. However, during the following, Eneolithic period these tools-hoes, sickles, and querns-underwent considerable changes. The new raw material, metal, began to be used for hoes, the cutting edge of sickles became more regular owing to the standardization of inserts, increasing their qualitative effectiveness, and querns became larger. In the Eneolithic new implements appear, such as antler ard/plough shares and the threshing sledge, and technical improvements are made in tool types already present in the Neolithic. These changes represent a transition to a new, more developed form of agriculture which includes animal-drawn tools, and these developments in agricultural technology play a role in the subsequent evolution and complexification of the economic structure, bringing about great prosperity in the material culture of the Balkans Eneolithic.

* *Institut of Archaeology, Academy of Sciences, Dvortzovaja nab. 18, St Petersbourg, 191065 Russia.*

Bibliographie

CERNYCH (E.N.), 1978.– *Gornoye delo i metallurgia v drevneyshey Bolgarii.* Sofia.

KOROBKOVA (G. F.), 1975.– Tripolskiye motigi i problema tripolskogo semledeliya. *In* : *150 let Odesskomu archeologitcheskomu museyu AN USSR.* Kiev.

KOROBKOVA (G. F.), 1979.– Drevneyshie jatvennie orudiya i ikh proisvoditelnost. *SA*, 4.

SEMENOV (S. A.), 1974.– *Proiskhojdenie zemledelia.*

SKAKUN (N. N.), 1954.– Drevneyshie kamennie serpi. *SA*, XXI.

SKAKUN (N. N.), 1980.– Proisvodstvenniy inventar kak istotchnik videleniya archeologitcheskikh kultur. *In* : *Metodika arheologitcheskogo issledovaniya i sakonomernostri rasvitiya dervnikh obtshestv.* Ashkhabad.

SKAKUN (N. N.), 1984.– Kremneobrabativayutshee proisvodstvo v epohupaleometall v Bolgarii. *In* : *III seminar Petroarcheology.* Plovdiv.

SKAKUN (N. N.), 1987.– *Opit rekonstruktsii khosyaystva drevnesemledeltcheskikh obtshestv epohi eneolita Pritchernomorskogo rayona Bolgarii (V svete elsperimentalno-trasologitcheskikh dannikh).* Leningrad.

STORDEUR (D.), ANDERSON-GERFAUD (P.), 1985.– Les omoplates encochées de Ganj Dareh : étude morphologique et fonctionnelle. *Cahiers de l'Euphrate*, 4, p. 239-313.

TODOROVA (H.), 1984.– Das Chronologiesystem von karanovo im Lichte der neuen Forschungenergebnisse in Bulgarien. *Slovenskia Archeologia*, 29.