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Flutes of the first European farmers

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(with 8 figures and 3 tables)

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Abstract

During the 6th millennium BC new cultures developed though new subsistence strategies like farming and cattle breeding – combined with sedentariness, new types of houses, new tools and vessels made of burnt clay. Musical instruments created after own imaginations were formed from clay. Fragments of six possible vessel flutes were discovered in Brunn am Gebirge/locality Wolfholz in site 2 and 3, which date 5670–5350 calBC respectively 5300–5250 calBC. Their shapes are cylindrical and subconical. On the front side, they show three finger holes, on the backside one. Reconstruction with suitable mouth pieces allow five tunes in the fourth and fifth octave with sound levels between 74–93 db. The ranges were calculated until maximal 62 m at surroundings sound level in the free field of 42 dB. Similar objects, interpreted as idols, were found in the Late Starčevo site of Gellénháza, Hungary, in Ovcharovo-gorata and Hotnitsa in Bulgaria. One ball shaped ocarina derives from Mramor in Makedonia. Longbones of birds were still used in creating musical instruments as the small bone whistle from Sesklo, Greece, Middle Sesklo culture proves. Another fragment of a pipe with a finger hole was unearthed in Anzabegovo, Macedonia. The oldest pan pipe belonged to the grave good of a rich man's burial in Mariupol, Ukraine, from the Lower Don culture. Music – compositions with melodies up from the fourth octave – played certainly an important role in every day's live as well as in cultic ceremonies of the Early Neolithic people.

Keywords: Early Neolithic, clay vesselflutes, pan pipe, whistles, acoustics, distribution.

Zusammenfassung

Im 6. Jahrtausend v. Chr. entstanden neue Kulturen bedingt durch neue Wirtschaftsweisen – Ackerbau, Viehzucht – kombiniert mit Sesshaftigkeit, neuen Haustypen, neuen Geräten und Gefäßen aus gebranntem Ton. Doch nicht nur Geschirr, sondern auch Musikinstrumente, erzeugt

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nach eigenen Vorstellungen, wurden hergestellt, die bei jener der Lebensweise angeglichenen Kulte möglicherweise eine Rolle spielten. Insgesamt sechs Gefäßflöten, fragmentarisch erhalten, wurden in Brunn am Gebirge/Flur Wolfholz, Fundstelle 2 und 3, die 5670–5350 calBC bzw. 5300–5250 calBC datieren, entdeckt. Sie sind zylindrisch oder leicht konisch, weisen in der oberen Hälfte drei Grifflöcher vorne sowie ein weiteres Loch auf der Rückseite auf. Der untere offene Hohlraum dient wohl zum Aufstecken auf einen in die Erde getriebenen Stab. Genaue Nachbauten aus gebranntem Ton mit entsprechenden Mundstücken erlauben das Blasen von fünf Tönen in der vierten und fünften Oktave und somit pentatonische Melodien. Der gemessene Schallpegel liegt zwischen 74 und 93 dB, die kalkulierte Reichweite bei einem Umfeldschallpegel von 42 dB im freien Schallfeld bei maximal 62 m. Ähnliche Objekte, die als Idole angesprochen werden, gibt es im spätstarčevo-zeitlichen Fundort von Gellénháza, Ungarn, in Ovcharovo-gorata und Hotnitsa in Bulgarien. Eine kugelfunde Okarina wurde in Makedonien in Mramor aufgefunden. Tierknochen fanden weiterhin auch Verwendung beim Bau von Pfeiferln und Flöten. Ein kleines Knochenpfeiferl mit einem Grundton in der 7. Oktave stammt aus Sesklo, Griechenland, und gehört der mittelnolithischen Sesklo Kultur an. Ein weiteres Fragment einer Pfeife mit Griffloch ist aus Anzabegovo, Makedonien, bekannt. Die älteste Panflöte wurde in einem reich ausgestatteten Grab der Unteren Donkulture in Mariupol, Ukraine, entdeckt. Diese Syrinx mit Tönen in der 5. Oktave, wurde aus verzierten Vogelröhrenknochen gebaut. Musik mit Melodien ab der 4. Oktave aufwärts spielte im profanen und sakralen Leben der Frühneolithiker gewiss eine wichtige Rolle.

Schlüsselwörter: Frühneolithikum, Gefäßflöten aus gebranntem Ton, Syrinx, Pfeiferl, Akustik, Verbreitung.

Introduction

For a large part of Europe, the 6th millennium BC was a time of transition from the economy of hunter-gatherers to the first farmers as well as a time of forming new cultures in the Neolithic period. This process began in the South-East region and gradually enveloped the whole of Europe. The transition to a new way of life with the adoption of agriculture and cattle-breeding also included the appearance of the first pottery, new tools and new types of houses. New farming cults came up to replace those of hunter-gatherers'. A part of those old ceremonies was probably connected with music. The plastic ductile material clay allowed people to form instruments after their own imaginations. Burning them in fire made them stable. Flutes were one of the first terracotta musical instruments.

The instruments, cultures and sites

In Fig. 1 we show the distribution of the music instruments presented in this article. The numbers on the map corresponds with Tab. 1.

Clay flutes (Figs 2–5)

The oldest clay ware which can be interpreted as flutes were found at the Neolithic sites dated about 5750–5250 calBC. They belonged to some of the archaeological cultures



Fig. 1. Distribution map of all aerophones in 6th Millennium in Europe, mentioned in this article. Images: ©2017 TerraMetrics, Map data: ©2017 GeoBasis-DE/BKG (©2009), Google, Inst. Geogr. Nacional, Mapa GISrael, ORION-ME.

of the Balkan-Carpathian region. Fragments from six possible flutes were found at the Neolithic sites in Brunn am Gebirge, Wolfholz, near Vienna in Austria. These sites have shown a development of the Linear Pottery culture from 5670 until the end of the 6th millennium calBC (STADLER & KOTOVA 2013). The flutes occurred in the oldest of them (Brunn 2 and 3). The first article about the first possible vessel flute of Site 2 was written. It was proposed to be horn shaped and approximately reconstructed with a mouth bone piece (POMBERGER 2009). At the ÖGUF conference fragments of tow further ocarinas were introduced. Both were still in horn shape replicated with mouth pieces carved of elderberry branches (POMBERGER 2014). Because the sound production was not satisfying all three flutes were exact rebuilt again and equipped with hemispherical clay

Table 1. Aerophones from the 6th Millennium in Europe, mentioned in this article.

culture	Number	site	Country	instrument
LBK	1	Brunn 2	AT	Flute
LBK	2	Brunn 3	AT	Flute
Late Starčevo	3	Gellénháza Városrét	HU	Flute
Ovcharovo	4	Ovcharovo-gorata	BG	Flute
Hotnitsa	5	Hotnitsa	BG	Flute
Anzabegovo-Vršnik	6	Čaška Mramor	MK	Flute
Anzabegovo-Vršnik	7	Anzabegovo	MK	Whistle
Sesklo	8	Sesklo	GR	Whistle
Lower Don culture	9	Mariupol cemetery	UA	syrinx

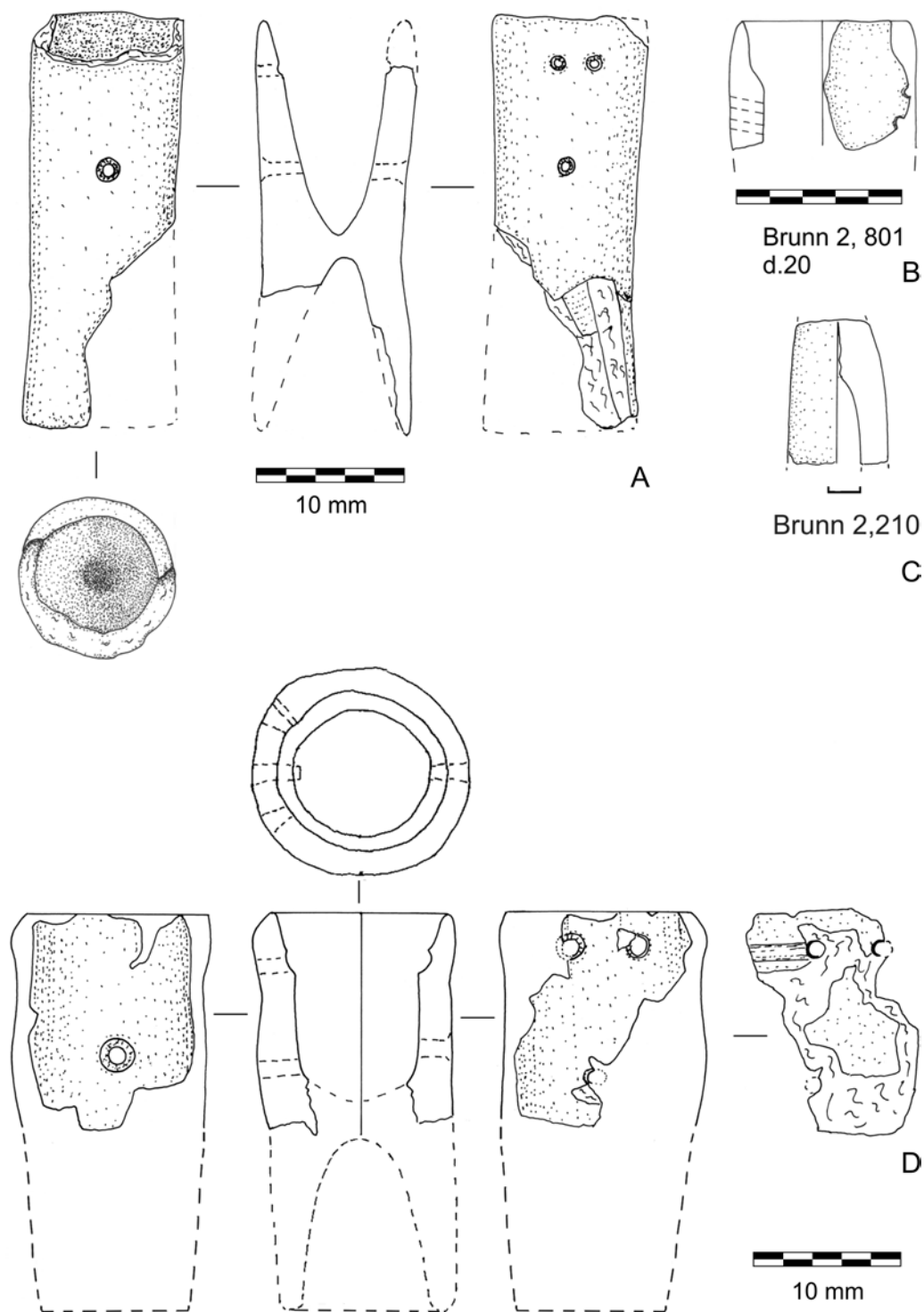


Fig. 2. Clay flutes from the Brunn 2 site; A: object 700; B: object 801; C: object 210; D: object 2305.

mouthpieces. Frequency analyses, sound level measuring and range calculation were done (POMBERGER 2016). During her researches with all the ceramic finds of the Linear Pottery culture of the Brunn sites Nadja KOTOVA found out, that there exist six fragments of flutes and the so-called flutes 2 and 3 belong to only one example. She also found out that the form of the objects is not horn shaped.

The Brunn 2 site is dated about 5670–5350 calBC and it is the oldest site of the Linear Pottery culture. Fragments from four flutes were discovered there belonging to the Formative phase of the Linear Pottery culture. Their lengths measure about 140 mm. The best-preserved example has a cylindrical shape, two conical holes inside and three holes in the upper part. One of them is a reach-through hole (Fig. 2A). A ledge with a sort of circular-oval shape – better described a long bone's diameter – is located inside near the upper edge.

Two fragments belonged to the upper part of a second flute (Fig. 2D). It has three holes. A channel is located inside on a level of two upper holes. The third flute is represented by a small fragment of the upper part with traces of two holes and a ledge (Fig. 2B). A fragment of the lower part with a conical hole belonged to the fourth flute (Fig. 2C).

Fragments of two flutes were found in one pit at the Brunn 3 site, belonging to the Milanovce phase of the Linear Pottery culture and dated about 5300–5250 calBC. Two fragments belonged to one flute with a conical shape. Its upper part with three holes was wider than the lower part (Fig. 3A). A similar lower part was connected with the second flute (Fig. 3B).

Three objects were published from the Gellénháza site of the Late Starčevo culture in Hungary and interpreted as plummets (SIMON 1996). However, they are identical with the finds from Brunn. The best-preserved sample has a wide upper part with three holes and a narrow lower part (Fig. 3C). Two other flutes, preserved only as small fragments, show wide upper parts with holes and channels inside (Fig. 3D, E).

Similar objects were found at the sites Ovcharovo-gorata and Hotnitsa in Bulgaria (Fig. 3F–I) and considered to be a special type of idol (KRAUSS 2014). The Ovcharovo-gorata site is dated about 5750–5500 calBC (KRAUSS 2014) and it was synchronous with the oldest part of Brunn 2. The Hotnitsa wares were younger and could be contemporaneous with the Brunn 3 site.

Another type of vessel flute was discovered at the Chashka-Mramor (Čaška Mramor) site in Macedonia. This globular flute shows two finger holes and a mouth hole (Fig. 4) and measures 50 mm in diameter. It was found outside an archaeological context in an area of the site, which was cultivated by mechanical tools. This site belongs to the local Middle Neolithic: chronological horizons II–III of the Anzabegovo-Vršnik group, which are characterized by dark painted pottery (NAUMOV *et al.* 2009: p. 34). It is dated about 5850–5500 calBC (ANGELESKI 2012: p. 20).

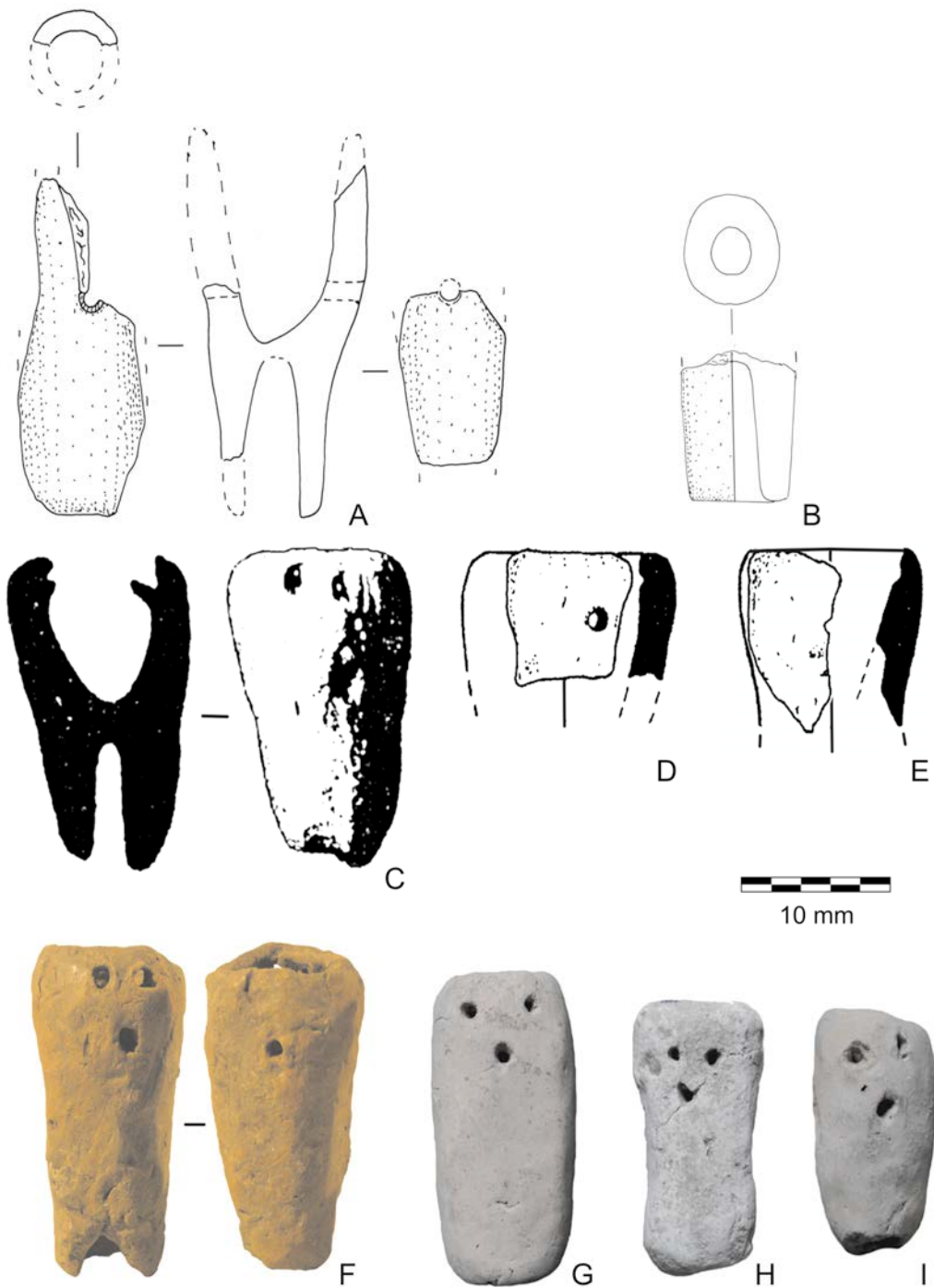


Fig. 3. Composed vessel flutes of type 2; A: clay reconstruction of conical subtype by B. M. POMBERGER; B: cylindrical subtype from Brunn 2; C–E: Gellénháza (after SIMON 1996); F: Ovcharovo-gorata; G–I: Hotnitsa (after KRAUSS 2014).

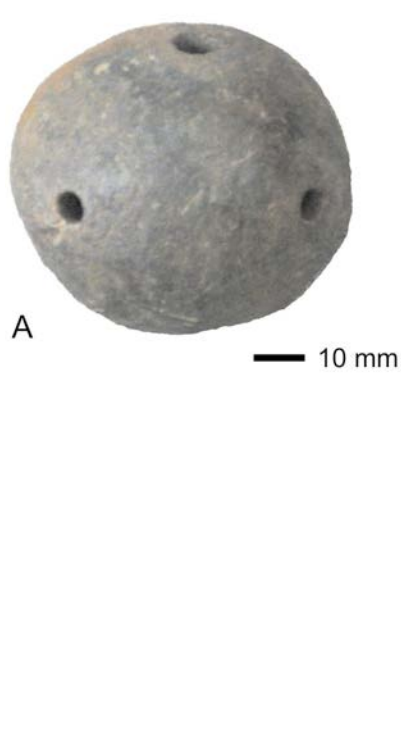


Fig. 4. Vessel flutes of type 1 made from one piece of clay (1, 2): A: Chashka-Mramor, Macedonia (according to JOVCESVSKA 2007); B: Yarim Tepe 1, Iran (after MERPERT & MUNCHAJEV 1971: pl. V, fig. 5b);



Fig. 5. A: reconstruction of flute 2 from Brunn site 2; B: original of flute 1.

Whistle and flutes made of bones

A small whistle (length 64 mm), probably made of an animal's long bone, was discovered at the acropolis of Sesklo, Thessaly, Greek, in 1957 (THEOCHARIS & PAPADOPOULOS 1973: fig. 241; Volos Museum M 5505; DOUMAS 1994: p. 507). It belongs to the Middle Neolithic Sesklo culture, which dates to the first half of the 6th millennium calBC (Fig. 6A).

A fragment of a second whistle from the layer 1b of the Anzabegovo site was a little bigger (GIMBUTAS 1976: pp. 244–245). A preserved part showing a half of a finger hole has a length of 46 mm (Fig. 6C). This layer contains white painted pottery as well as the first red painted pottery (SCHUBERT 1999: p. 78). It is dated about 6000–5800 cal BC.

A syrinx made of long bones was unearthed in the Mariupol cemetery in the Ukrainian steppe. That cemetery was excavated by Mykola Makarenko in the town Mariupol in

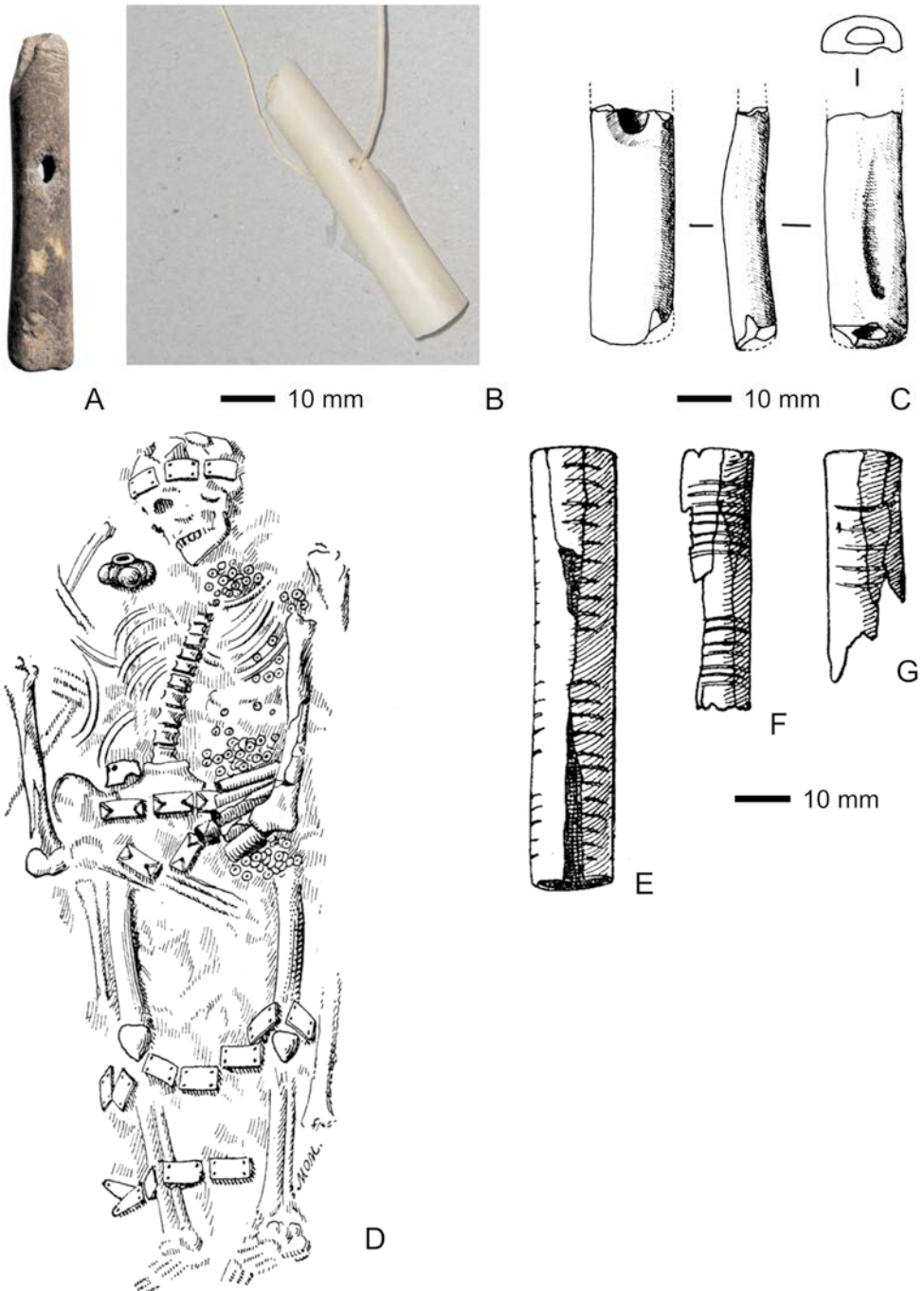


Fig. 6. A: original whistle from Sesklo 1a (according to TEOCHARIS 1973); B: reconstruction of this whistle by POMBERGER; C: whistle from layer 1b, Anzabegovo, Macedonia (after GIMBUTAS 1976); D: burial VIII of the Mariupol cemetery, Ukraine (according to МАКАРЕНКО 1933); E–G: pan pipe with 3 pipes from this burial.

Donetsk Region (МАКАРЕНКО 1933). It yielded 131 Neolithic burials of the Lower Don culture and some Early Eneolithic graves. Its Neolithic part consisted of inhumations in individual pits and one cremation. Skeletons in supine position laid with their heads to the East or to the West. The analysis of a sequence of burials allows the distinction of several phases of the cemetery used during 5550–5400 BC (КОТОВА 1990; КОТОВА 2003).

The syrinx was part of the grave goods in the burial VIII, which belonged to the youngest stage of the Neolithic cemetery (Fig. 6D). The burial was given an extraordinarily rich inventory: a frontlet made of plates from the fangs of a wild boar decorated the head. A belt of similar plates was wrapped around the waist and further plates were found around the knees and ankles. There were heaps of pearl beads concentrated on the left side of the body; the beads from bone and black stone were located under the chin near the right shoulder; a figurine of a bull with a hole in the upper part laid in the middle of the belly together with a sea shell. The stone black mace was near the right shoulder.

Near the left elbow seven bone tubes laying in an artificial group were found together with pearl beads. They laid near each other. The pipes show a length of about 100 mm and diameters of about 15 mm (Fig. 6E–G). Their walls were very thin and МАКАРЕНКО assumed that they were made of birds' long bones (МАКАРЕНКО 1933: p. 43). The tubes were decorated with incised lines. Only a part of them were restored.

Typology and experimental reconstructions

Vessel flutes made of clay

Ideographical Typology (typography)

The vessel flutes were made by the early farmers of the Balkan-Carpathian region and in Austria. In principle, we distinguish two types: flutes made of one piece of clay (type 1) and composed flutes (type 2).

Flutes made of one-piece show a resonator corpus with a mouth hole and finger holes. The spherical instrument of Chashka-Mramor represents this type 1 (Fig. 4A; JOVCEVSKA 2007: p. 18–19).

One aerophone of type 1 leads us to North-Western Iran. In the settlement of Yarim Tepe I, in the Sinjar Valley, within construction level V in a house (room 57) a fir pine or cigar- or phallus-like aerophone with three finger holes was found (MERPERT & MUNCHAJEV 1971: pp. 16–17, pl. V: 5b). The lower end is closed and the upper end shows the head of a ram. Merpert and Munchajev call it a musical instrument or whistle. As it has finger holes, we may speak of a vessel flute. Its height measures 150 mm, the outer diameter is 25 mm. Finger holes were pierced at 20 mm, 35 mm and 125 mm from the upper end (Fig. 4B).

These flutes from Chashka-Mramor and Yarim Tepe I demonstrate two subtypes of the type 1: the elongate sample and spherical sample. The elongate flute from Yarim Tepe I was older and dated about 6200 calBC.

Composed vessel flutes (type 2) have a resonator corpus with finger holes and a separate mouthpiece with a blowhole, which must be fixed onto the resonator corpus with a pitch of birch-bark and tightened with bees' wax (POMBERGER 2014). Beekeeping is proved in the site Brunn am Gebirge/Locality Wolfholz (ROFFET-SALQUE *et al.* 2015). The globular flute from Chashka-Mramor has a carefully treated surface, while the elongated flutes, including the Yarim Tepe 1 sample of the type 1, were a little asymmetric and not polished.

The composed flutes had common constructions. Their length was about 13–14.1 cm. The large upper part shows a conical or slightly cylindrical-calotte-shaped cavity. Two finger holes were located near each other under the rim and the third, a reach-through hole (thumbhole), was lower. The rim of that part of the flute had a ledge inside for a mouthpiece. Nevertheless, we must mention, that no mouthpiece has been found.

The lower part of these flutes had a conical hole, which was less than the upper part. We can assume that it could be used for holding the flute in a vertical position on a wooden stick, which serves as a post and saves a place for the surely valuable instrument.

Despite being common constructions, this idiographic type of flute can be divided into two subtypes: subconical (Fig. 5A) and cylindrical (Fig. 5B). The cylindrical shape is represented at Brunn 2 (Fig. 2A) and two samples from Hotnitsa (Fig. 3G, H). The subconical shape existed at the same time and it was made by the people of the Ovcharovo culture and Hotnitsa in Bulgaria, the Late Starčevo in West Hungary, as well as Brunn 2 and 3 in Austria (Figs 2D, 3 A, C–F, I).

Simple and composed clay flutes appeared in the Balkan-Carpathian region in the first half of 6th millennium calBC together with dark painted pottery. However according to available materials, the composed elongated clay flutes are known longer (till the end of 6th millennium calBC), while the globular flute was less popular.

Reconstructions and experimental archaeology

The two best preserved of the Brunn flutes have been reconstructed and copied (Fig. 2A, D). For proving the possibility of a usage as functional vessel flutes clay copies were created by Beate Maria POMBERGER. A clay copy allows the generation of melodious sounds. Having all necessary measurements for the first flute from object 700 from Brunn Wolfholz 2, it was easily reconstructed.

The second flute from object 2305 first had to be drawn and put together on paper (Fig. 2D), afterwards it was formed with clay (Fig. 5A). The inner slightly narrowing curves of the fragments allow the tracing of a rather precise size and shape of the space. Its cavity is not conical like the first flute, but cylindrical with a calotte shaped end.

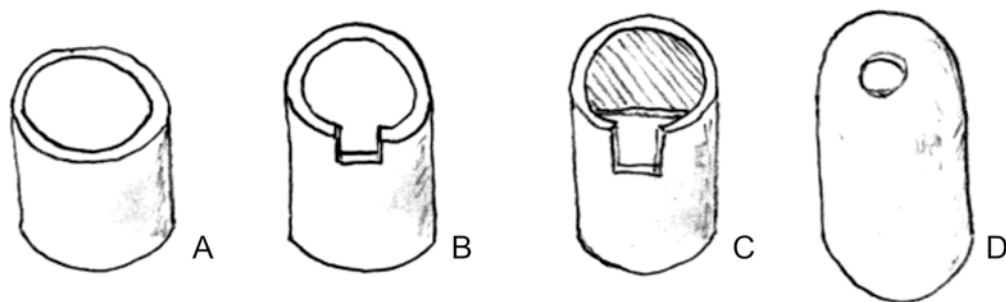


Fig. 7. Types of possible mouthpieces: A: rim blown; B: with a notch; C: with a notch and partly covered; D: hemispherical with a blow hole; A–C: bone or wood; D: clay.

The next step was to shape the cores of the cavities (a negative copy). Around them the upper bodies of the aerophones were formed. For shaping the lower parts, a stick served as a form. As the upper parts of the flutes are principally a little bit longer than the lower parts (approximate proportion 60% to 40%), the second flute was reconstructed with a total length of 13 cm. After having removed the clay cores the finger holes had to be pierced. A slender stick served for making the slightly conical finger holes of 4 mm in diameter for the first flute. The second vessel flute got finger holes of 5 mm in diameter. Calotte-shaped clay mouthpieces of 4 cm length for the first flute and of 5 cm for the second flute were slightly pressed into the upper aperture of the flutes. After drying and burning the ware, the mouth pieces were fixed with glue and sealed with bees' wax.

As there is no mouthpiece conserved, it was necessary to find out which model works best. There are four possibilities of embouchures. Three possible embouchures were made by a piece of long bone of the early Neolithic cattle. The imprint of a long bone of early Neolithic cattle in the flute was identified by Erich PUCHER, Archaeozoologist of the Naturhistorisches Museum Wien, whom we want to thank for this statement and congratulate in this place. Such an imprint is shown on the upper end of two flutes. The bone mouthpieces may be simply end blown (Fig. 7A), with a notch (Fig. 7B) or with a notch and a half-covered end (Fig. 7C) which forms a sort of windway. The same system is possible with short tubes of elder branches. In imitating the upper form of the system of the globular flute from Mramor, a cylindrical-hemispherical embouchure formed of clay with blow-holes was created (Fig. 7D). In lack of early Neolithic cattle's long bone, a pig's bone was taken for the experiment. Possibility c (tube with a notch and half covered) and d (hemispherical mouthpiece with a blow-hole) showed the best results.

Bone pipes

Idiographic Typology

Flutes of bone appear as whistles with a notch, as flutes with finger holes and as a float of combined tubes.

Reconstruction

For investigating whether a pipe also generate a sound when a thin cord is pulled through the two side holes, the Sesklo whistle was reconstructed. A bird's long bone served as a tube. On the upper end, a notch was cut. The two holes on the left and the right side were drilled and a thin cord was pulled through. When blowing the pipe, the string did not disturb the flow of the air (Fig. 6B). The whistle was probably worn around the neck.

Acoustics and Instrumental Classifications

Instrumental Classification

Vessel flutes belong to the group of aerophones (system number 421.13 according to HORNBOSTEL & SACHS 1914: p. 585). Their resonant corpora are shaped in different, but closed forms. These winds might be constructed with a simple blow hole, a cylindrical mouthpiece or a beak-shaped mouthpiece with a labium. Higher developed instruments have finger holes, but very simple globular flutes exist without them. Any vessel – eggshells, dried pumpkins, snail shells, horns, bones, bottles and pottery bodies of unburnt or burnt clay – may be played as globular flutes.

The globular flute's system works like a Helmholtz resonator (FLETCHER & ROSSING 1998: pp. 13–15), the enclosed air in the cavity of which begins to resonate when someone blows against the sharp edge of the neck or blow hole. There the stream of air will be cut, turbulences are produced and the pressure inside the container increases. It decreases when the air forcing power stops and air is flowing outside.

The bone whistle belongs to the open end-blown flutes without duct and finger holes (system number 421.111.11 according to HORNBOSTEL & SACHS 1914: p. 584). The fragment of the bone flute belongs to the open end-blown flutes with finger holes (421.111.12 according to HORNBOSTEL & SACHS 1914: p. 584).

The pan flute is a set of end-blown flutes. The single pipes can be open or stopped (system number 421.112.2 according to HORNBOSTEL & SACHS 1914: p. 584), bundled or strung in a row. The lower end of the pipes can be closed with bees' wax. For playing these simple flutes, the player should create a ribbon-shaped stream of air with his lips, which is cut at the edge of the pipe.

Acoustical analyses and calculated frequencies

Vessel flutes

Both reconstructed flutes of Brunn am Gebirge were recorded and acoustically analysed with a tuner and the audio visualisation programs Adobe Audition 3.0 and Sonic

Visualiser 2.3. The concert pitch A4 is fixed with 440 Hz. The metering of the sound level was done within 17 cm to the technical instrument. For calculating the range in the open sound field with a sound level of 42 dB, the audio engineering calculator “sengpie-audio” (<http://sengpielaudio.com/Rechner-entfernung.htm>, 13.12.2015) was used.

The sound pitches of the instruments depend, on the one side, on the volume of the resonant corpus and its swinging air, and on the other side, on the sizes and diameters of the finger holes as well as the air pressure. Flute 1 from site 2a has a cavity of ca. 40 cm³, flute 2 from site 2b of ca. 58 cm³.

Showing four finger holes the vessel flutes allow the playing of five tunes (●●●●; ○●●●; ○○●●; ○○○●; ○○○○). Flute 1 from Brunn 2a (Tab. 2) shows the tunes A4+25 – C5+20c – D5+45c – E5+20c- F#5-25c (444–740 Hz). The metered sound levels are located between 74–93 dB. It ranges with all sounds at 7.9 m and reaches with its highest tune 62.44 m (POMBERGER 2016: p. 40).

Flute 2 from Brunn 2b sounds with F#4-4c – A4-40c – A#4+25/B4c – C#5+14c – D5+43c (344–602 Hz) (Fig. 8A). Its sound levels are between 76.8–78 dB (Tab. 3). With all tunes the flute ranges only 3.68 m. The loudest ones – the second and fifth sound – range about 10 m. Both flutes therefore have a sound compass of a major sixth. Modulations of a half tune per tune pitch up and down are possible. Chiffs can be heard very clearly. The globular flute of Mramor has sound compass within a major third: F#5 until A#5 (POMBERGER *et al.* 2014: pp. 97–114).

Table 2. Sounds and sound level metering of the flute 1, Brunn 2a.

Tune	Sound Level	Frequencies	Range in the open sound field
Tune 1	74.0 dB	A#4+25c (473 Hz)	7.59 m
Tune 2	76.5 dB	D5+43c (602 Hz)	9.03 m
Tune 3	79.3 dB	E5-38c (645 Hz)	12.46 m
Tune 4	81.1 dB	F5-24c (689 Hz)	16.61 m
Tune 5	93.3 dB	G5-20c (75 Hz)	62.44 m

Table 3. Sounds and sound level metering of the flute 2, Brunn 2b.

Tune	Sound Level	Frequencies	Range in the open sound field
Tune 1	76.8 dB	F#4-4c (344, 5 Hz)	9.34 m
Tune 2	77.4 dB	A4-40c (430,6 Hz)	10.01 m
Tune 3	68.7 dB	B4/A#4+25c (473,7 Hz)	3.68 m
Tune 4	72.1 dB	C#5+14c (559,8 Hz)	5.44 m
Tune 5	78 dB	D5+43c (602,9 Hz)	10.73

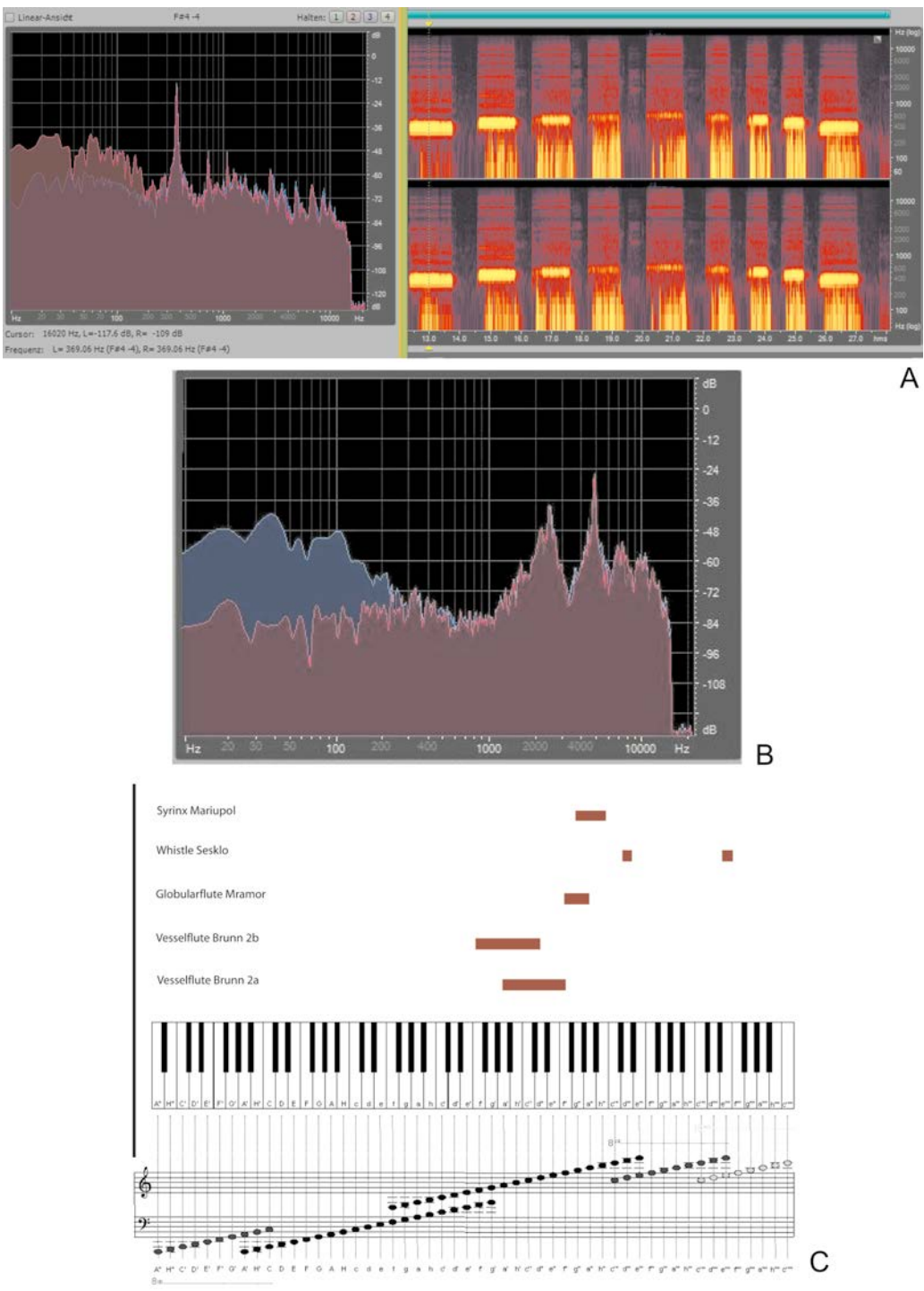


Fig. 8. A: Frequency analyses of the vessel flute Brunn 2; B: Frequency analyses of the Sesklo whistle; C: Ranges of tunes of all aerophones (POMBERGER).

Bone flutes

The Sesklo whistle's calculated eigenfrequency is 2656.25 Hz (E#7). The simple formula for calculating the eigenfrequency of an open tube is $f = v/2 \times l$ (f = frequency, v is the velocity of sound in air – which is approximately 340 meters per second at 20 °C – and l = length of the tube). Playing experiences proved that the whistle can be blown with both small holes shut as well as open (●●, ○○). When being played it has the sounds D7-15 Hz and E8-23 Hz (Fig. 6B). Quickly closing and opening the lower end allows the making of trills. Chiffs and overtones can be heard very clearly. The whistle's sound level is approximately 76.4 dB and has a range of 8.92 m.

The syrinx of Mariupol with a tube length of 100 mm shows a calculated eigenfrequency of 850 Hz (A♭5), overblown 1700 Hz (A♭6). Here the formula for a tube closed on one end $f = v/4 \times l$ was used. Relevant for the eigenfrequency and the tune is the length of the tube. Maybe the syrinx sounded in a diatonic scale with seven tunes in the fifth respectively sixth octave. High tuned melodies were familiar to the player and the listeners in early Neolithic "Mariupol".

Some ideas about the place of music instruments in the Neolithic communities.

The conditions of the flute's finding allow us some assumptions about their place in the European Prehistory during 6th millennium calBC.

Four clay flutes from the Brunn 2 site were found together with idols and amphorae in pits, which belonged to the same houses. It is an interesting combination of things, which could be used together during cultic ceremonies. The early agriculture is reconstructed for the people of the Linear Pottery culture and an imprint of a barley grain is detected on one of the Brunn's idols.

It is possible that early cultivated cereals of the Brunn's people could be consumed as uncooked gruel and beer as it was assumed for early farmers (KATZ & VOIGT 1986: p. 27), because no traces of soot were found on the Brunn vessels and we must exclude the usage of pottery for cooking. The similar picture was typical for the Körös culture and Neolithic sites of east-south Europe, where only storage and serving food are assumed for pottery (STARNINI 2008: 106). The combination of idols, amphorae and music instruments around some houses allow an assumption about the use of those objects in ceremonies, which were accompanied by drinks and music.

These were no ceremonies connected directly with agriculture, because they would have had to take place at minimum once per each year, but we have only one broken idol, one flute and one or two amphorae near a house. It looks like traces of one ceremony connected with building of one house. Only a few houses have this combination of cult things (4 of 77). It is possible that they belonged to a leader of the community or a person with a religious function. We cannot exclude a combination of these functions

in one person. Idols and flutes could be broken during the ceremonies of building some houses. Immediately after building some broken objects could be put into the open pits near houses, from which clay for the construction was taken. After that those pits were closed as it is expected that the people did not fall into the open long pits during usage of houses. It is interesting that those houses do not have some specificity of constructions and did not differ from other ones regarding archaeological materials.

Probably it could be one variant of usage of music instruments among other numerous ceremonies with their participation, which took place in the lives of the first farmers of Europe. The flutes as well as idols are not present at all Neolithic sites of Europe. Valeška Becker assumes that the Neolithic plastic, pots with animals and human images were found at settlements, which were a place of religious ceremonies for some communities from neighboring sites (BECKER 2011: p. 352).

The Brunn 2 settlement looks like a center with religious function. It corresponds to central settlements in the interpretation by Kneipp (KNEIPP 2001). Its collection contains an unusual number of flint tools including imported radiolarite from the Balaton area, idols and music instruments. It could be a place for religious ceremonies, economic and cultural exchanges and connections for a group of sites located not far from Brunn 2. But these sites have not yet been found!

A similar role could be reconstructed for the Ovcharovo-gorata site in the North Bulgaria and the Gellénháza site in western Hungary. Idols together with flutes were found there (KRAUSS 2014; HANSEN 2007).

The bone flutes were found in graves. The syrinx was discovered in an extra rich burial of the Mariupol cemetery of the Lower Don culture, which differs from the other Neolithic cultures of Eastern Europe with numerous and various grave goods and decoration of burial clothes (KOTOVA 2010). It assumes a more complicated social structure with clear stratification of sex and age groups (KOTOVA 2013). Burial VIII with the flute was one of two skeletons of that cemetery, which, in addition to rich decoration of clothes, had a stone mace among the grave goods. This symbol of power allows a definition of this burial as the grave of the leader of the community. Rich burial clothes were typical for a man of fertile age (18–35 years) in the Ukrainian Neolithic cemeteries (KOTOVA 2013). It is possible to assume that an adult man combined a leader's function with participation in some ceremonies as a musician.

This fact together with the assumption about the usage of clay flutes by the early Neolithic farmers during religious ceremonies connected with the building of houses for leaders of communities testify an important role for music instruments during the 6th millennium calBC. A few instruments presented at a few sites speak about them as a part of religious life, but not everyday life.

However even if we say that the flutes were played during cultic ceremonies, we must consider that the musicians surely had to create melodies. This artistic process might have been done alone or together with other musicians. Improvisations, repeating traded melodies or variations of traded melodies might have sounded.

In contradistinction to flutes, whistles mostly served as signal- and luring instruments. But they also might have served as children's toys. As the Sesklo whistle is not very loud we favour to speak either of a luring instrument, especially for trapping birds, or a child's pipe.

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