Kornelija Minichreiter

Zorko Marković

BEKETINCI BENTEŽ

NASELJA IZ ENEOLITIKA, RANOGA I KASNOGA SREDNJEGA VIJEKA

ENEOLITHIC, EARLY MEDIAEVAL AND LATE MEDIAEVAL SETTLEMENTS

s prilozima suradnika / authors of other texts

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Institut za arheologiju
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PROSLOV

Institut za arheologiju, kao krovna znanstvena ustanova Republike Hrvatske bio je, u razdoblju od 2006. do 2009. godine, uključen u realizaciju arheološko-konzervatorskih istraživanja na nekoliko registriranih arheoloških položaja u okviru velikog infrastrukturnoga projekta Vlade Republike Hrvatske – izgradnje dijela europskoga prometnoga koridora, tj. autoceste 5C od Budimpešte do Ploča. Istraživanja djelatnika iz Instituta za arheologiju obuhvatila su dva nalazišta na dionici auto-ceste između Osijeka i Đakova. Pored položaja Čepinski Martinci (AN 17), istraživanja su obuhvatila i arheološko nalazište na položaju *Bentež* kraj Beketinaca (AN 18). Stručna voditeljica arheološko-konzervatorskih istraživanja na arheološkom nalazištu Beketinci – *Bentež* bila je dr. sc. Kornelija Minichreiter, znanstvena savjetnica, a njezin zamjenik dr. sc. Zorko Marković, viši znanstveni suradnik Instituta za arheologiju.

Pred čitateljima serije *Monografije Instituta za arheologiju* (MIA) je novi, vrlo zanimljivi uradak marljivoga autorskoga para, voditelja arheološko-konzervatorskih istraživanja, koji je na površini većoj od 6 hektara uspio registrirati, odnosno detaljno istražiti i, dakako, stručno i znanstveno obraditi vrlo složenu i nadasve slojevitu sliku nalazišta Beketinci – *Bentež*. Unutar položaja *Bentež* dr. sc. Kornelija Minichreiter i dr. sc. Zorko Marković, otkrili su i prepoznali velike segmente prapovijesnoga eneolitičkoga naselja lasinjske kulture koje se datira oko 4000. godina prije Krista, potom ranosrednjovjekovnoga naselja iz 9. do 11. stoljeća, odnosno kasnosrednjovjekovnoga naselja u kojemu je život materijalno zasvjedočen u vremenskome okviru od 14. do početka 16. stoljeća.

Novim brojem *Monografije Instituta za arheologiju* prikazana je, možemo to slobodno istaknuti, uobičajena višestruka kulturna slojevitost jednoga posebice važnoga i iskazljivoga dijela hrvatskoga Podunavlja. Zahvaljujući opsežnim infrastrukturnim radovima koji su na pragu 21. stoljeća oblikovali novi kulturni krajobraz, tj. novi sloj života, realizirani su zaslugom Ministarstva kulture Republike Hrvatske, hvale vrijedni i vrlo zahtjevni zaštitni arheološki radovi, propraćeni uobičajenim interdisciplinarnim istraživanjima. Stoga je razumljivo da se unutar prikaza o spomenutim istraživanjima, pored autora dr. sc. Kornelije Minichreiter i dr. sc. Zorka Markovića, u novom broju *MIA* pod naslovom: BEKETINCI, BENTEŽ, NASELJA IZ ENEOLITIKA, RANOGA I KASNOGA SREDNJEGA VIJEKA, susrećemo i s autorima priloga o klimatskim prilikama, kamenim artefaktima, arheozooloških, odnosno pojedinim unikatnim nalazima te, konačno, posebice o dragocjenim radioizotopnim datiranjima.

Glavni i odgovorni urednik edicije:
Prof. dr. sc. Željko Tomičić

FOREWORD

In the period between 2006 and 2009, the Institute of Archaeology, as the leading scientific archaeological institution of the Republic of Croatia took part in archaeological and conservation investigations at several registered archaeological sites within the Croatian Government's large-scale infrastructure project – the construction of a part of the European traffic corridor, i.e. motorway 5c from Budapest to Ploče. The staff of the Institute of Archaeology carried out investigations at two sites on the Osijek-Đakovo section of the motorway. In addition to the Čepinski Martinci site (AN 17), investigations were carried out at the archaeological site of *Bentež* near Beketinci (AN 18). The professional manager of archaeological and conservation investigations at the Beketinci-*Bentež* archaeological site was Dr. Kornelija Minichreiter, scientific advisor, whose deputy was Dr. Zorko Marković, a senior scientific associate of the Institute of Archaeology.

We present to the readers of the series *Monographs of the Institute of Archaeology* (MIA) the latest, very interesting work by this diligent pair of authors, the managers of the archaeological and conservation investigations, who succeeded in registering, or in other words, excavating in detail and carrying out a professional and scholarly analysis of the highly complex and above all multilayered picture of the Beketinci-*Bentež* site, which covers more than 6 hectares of land. Dr. Kornelija Minichreiter and Dr. Zorko Marković discovered and recognized at Bentež large segments of a prehistoric Copper Age settlement of the Lasinja culture, dated around 4000 BC, as well as the remains of an early mediaeval settlement—dated between the 9th and 11th century—and a late mediaeval settlement, whose material remains bear testimony to life between the 14th and 16th century.

The new volume of the *Monographs of the Institute of Archaeology* presents—we can safely point this out—the usual multiple cultural stratification of a particularly important and expressive part of the Croatian Danubian region. Thanks to the comprehensive infrastructure works that shaped, at the threshold of the 21st century, a new cultural landscape, i.e. a new layer of life, praiseworthy and highly demanding archaeological investigations were carried out under the aegis of the Croatian Ministry of Culture, accompanied by the usual interdisciplinary research. It is therefore understandable that within the publication of the mentioned investigations, in addition to the authors Dr. Kornelija Minichreiter and Dr. Zorko Marković, in the new volume of the *MIA* entitled: BEKETINCI BENTEŽ – ENEOLITHIC, EARLY MEDIAEVAL AND LATE MEDIAEVAL SETTLEMENTS, we also come across authors of contributions on the climatic conditions, stone artefacts, archaeozoological finds, as well as certain unique finds and, finally, on valuable radioisotope dating.

Editor-in-chief:
Prof. dr. sc. Željko Tomičić

U jami – spremištu zapadno uz kuću 4 – SJ 8905, uz koštane fragmente lisice, pronađen je i gotovo cjeloviti kostur (oko 25 fragmenata) vodenoga voluhara (*Arvicola terrestris*), koji se položajem nalaza i bojom koštanih ostataka u potpunosti uklapa u arheološki kontekst.

Od 50 determiniranih fragmenata ptica, oko 30% određeno je da pripada kokoši (*Gallus gallus*), dok za ostale nije bilo moguće utvrditi točnu taksonomsku pripadnost. Najviše je koštanih ostataka noge (*femur, tibiotarsus, tarsometatarsus*), odnosno batak i zabatak. Od kosti krila dominira nadlaktična kost (*humerus*), a u malome su broju prisutne i ostale kosti peradi (dijelovi kralježnice i zdjeličnih kostiju).

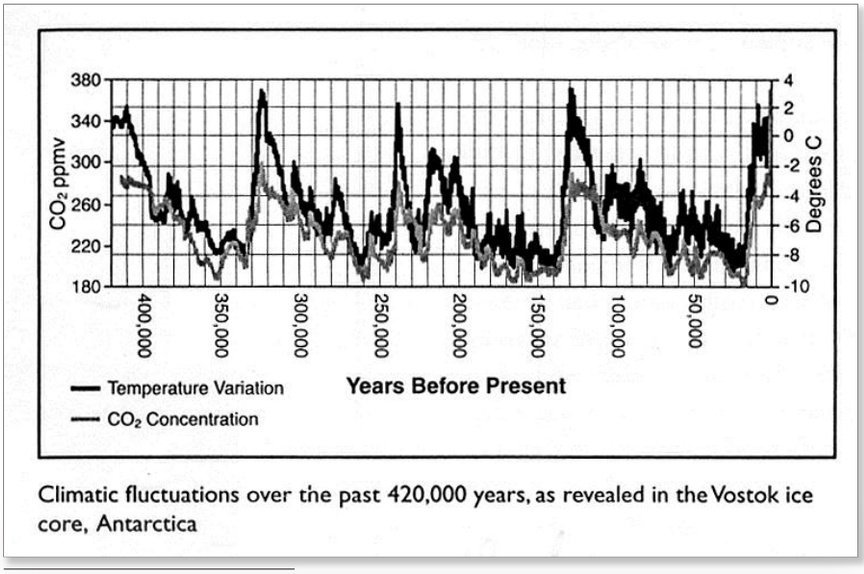
Među mnoštvom nedeterminiranih fragmenata, po 10% otpada na ostatke rebara, fragmente kralježaka i dijelove lubanje i donje čeljusti. Oko 6% su ostatci zubiju kojim se nije mogla odrediti taksonomska pripadnost, a 4% su fragmenti plosnatih kostiju (lopatice i zdjelične kosti). Fragmenat dugih kostiju kojima se nije mogla odrediti ni kosturna ni taksonomska pripadnost je 35%, a među njima, oko 5% otpada na duge kosti ptica. Preostali su fragmenti oštećeni u tolikoj mjeri da ih se nije moglo svrstati čak ni u veće skupine kostiju.

POSTGLACIJALNI KLIMATSKI UVJETI

Katarina Botić

Klimatske promjene koje su uslijedile nakon posljednjega velikoga ledenoga doba, kasne oledbe/pleistocena, između 12000 i 9000 BP[23] (SÜMEGI et al. 2002, 171), označile su početak novoga razdoblja nazvanoga holocen (SÜMEGI et al. 2002, 171) koje sa svojim podpodjelama traje i danas.[24] Ovo je razdoblje predstavljalo početak toplijih i povoljnijih uvjeta za život u pojedinim dijelovima svijeta, pa tako i u Europi, iako su njegove temperaturne oscilacije, posebno u početku, dovodile do vrlo nepovoljnih klimatskih uvjeta. Vrlo dobar primjer takve negativne temperaturne promjene i poremećaja globalnih klimatskih uvjeta zabilježen je kao „8.2 ka BP event" (ALLEY et al. 1997; HU et al. 1999; BARBER et al. 1999; MAYEWSKI et al. 2004; BUDJA 2007 i dr.).

Na klimatske promjene tijekom holocena utjecalo je više faktora. Jedan od glavnih pokretača naglih klimatskih promjena početkom holocena bilo je otapanje ledenih ploča u sjevernoj hemisferi od kojih je najveći utjecaj na globalne klimatske promjene imala Laurentide ledena ploča (TORACINTA et al. 2004; FAGAN 2005, 46–48). Prekrivala je veći dio sjevernoameričkoga kontinenta, a otjecanjem vode i sedimenata u sjeverni dio Atlantskoga oceana prekidale su se tople struje što je dovodilo do nagloga globalnoga zahlađivanja. Ciklusi otapanja, otjecanja i zahlađivanja poznati su pod nazivom *Heinrich event* (DOWDESWELL et al. 1995; FAGAN 2005, 46). Prilikom zahlađivanja dolazilo je i do slabijega dotoka vlažnoga zraka tako da se klima mijenjala u hladnu, suhu i vjetrovitu.



Sl. 1 Klimatske promjene zabilježene u ledenim jezgrama: a) Grenlandska jezgra, b) Vostok jezgra (Fagan, 2005, 24–25).

Fig. 1 Climatic changes registered in ice cores: a) the Greenland ice core, b) the Vostok ice core (Fagan, 2005, 24–25).

23 BP = „before present" odnosno prije 1950. godine.

24 Predboreal – 10000-9000 BP; boreal - 9000-8000 BP; atlantik - 8000-5000 BP; subboreal - 5000-2500 BP; subatlantik - 2500 BP-do danas (v. Tabla 1-3)

and hind limbs is balanced, it can be surmised that their fur was also used.

Most of the bone remains of fox (*Vulpes vulpes* L.) come from the storage pit west of house 4 – SJ 8905 (Fig. 53, 54) and most likely belong to a single animal. Since the remaining fragments belong to different contexts, they must represent several individual animals. There are no visible cut marks on the bones of fox that would suggest that they were used for meat, but it is very likely that—like hare—they were hunted for fur.

There is less than 10% remains of dog (*Canis familiaris* L.), but their presence within the settlement is visible not only in the remains of bones and teeth, but in the teeth marks on bones of other animal species, above all pigs and small ruminants.

Bone fragments of badger (*Meles meles* L.) belong to at least two individual animals.

In addition to the mentioned animal species, the analysed assemblage contains a fragment of an antler (*cornua*) of red deer (*Cervus elaphus* L.). The visible coarse surface of the seal with the coronet indicate that this was a naturally shed antler that was most likely brought into the settlement.

In addition to the bone fragments of fox, the storage pit west of house 4—SU 8905—yielded an almost complete skeleton (around 25 fragments) of water vole (*Arvicola terrestris*), whose position and colour of bone remains entirely correspond with the archaeological context.

Around 30% of the 50 determined fowl fragments were identified as chicken (*Gallus gallus*), while the accurate taxonomy of the remaining fragments could not be ascertained. Most bone remains belong to legs (*femur, tibiotarsus, tarsometatarsus*), namely drumstick and thigh. The dominant wing bone is the humerus. There are few other bones of poultry (parts of the backbone and pelvic bones).

The remains of ribs, vertebrae, cranium and mandible each account for 10% of indeterminate fragments. Around 6% are dental remains of indeterminate taxonomy, while 4% are fragments of flat bones (scapulae and hip bones). There is a total of 35% of fragments of long bones whose skeletal and taxonomic identity could not be determined. Of those, 5% belong to fowl. The remaining fragments were damaged to such a degree that not even an attribution to larger bone groups was possible.

POSTGLACIAL CLIMATIC CONDITIONS

Katarina Botić

The changes in climate that followed the end of the last great Ice Age, the late glacial/Pleistocene, between 12000 and 9000 BP[23] (SÜMEGI et al., 2002, 171), marked the beginning of a new epoch, named the Holocene (SÜMEGI et al., 2002, 171), continuing, with its subdivisions, to this day.[24] This epoch marked the beginning of warmer and more favourable living conditions in certain parts of the world, including Europe, even though the oscillations in the temperature, particularly in the beginning, sometimes resulted in quite unfavourable climatic conditions. A very good example of such a negative change in temperature and deterioration of global climatic conditions was the so-called " 8.2 ka BP event" (ALLEY et al. 1997; HU et al. 1999; BARBER et al. 1999; MAYEWSKI et al. 2004; BUDJA 2007 etc.).

Several factors influenced the climatic changes during the Holocene. The melting of ice sheets in the northern hemisphere was one of the main triggers of the abrupt climatic changes at the beginning of the Holocene. The Laurentide ice sheet (TORACINTA et al. 2004; FAGAN 2005, 46–48), which covered most of the North American continent, had the greatest impact on the global climatic changes. The runoff of water and sediments into the northern part of the Atlantic Ocean interrupted the warm currents there, causing abrupt global cooling. Cycles of melting, runoff and cooling are known as the Heinrich event (DOWDESWELL et al. 1995; FAGAN 2005, 46). The cooling also reduced the flow of moist air, changing the climate into cold, dry and windy.

The level of moisture in the global atmosphere was influenced also by the phenomena known as El Niño and La Niña. Though connected with the Pacific Ocean, they also directly influenced the precipitation levels in Europe. El Niño, a pheno-

23 BP = ''before present'', i.e. before the year 1950.

24 Preboreal - 10000-9000 BP; Boreal - 9000-8000 BP; Atlantic - 8000-5000 BP; Subboreal - 5000-2500 BP; Subatlantic - 2500 BP-present (see Table 1-3).

Na razinu vlage u globalnome atmosferskome okruženju utjecale su i pojave poznate pod nazivom El Niño i La Niña. Iako vezane uz Pacifički ocean, one su posredno utjecale i na količinu oborina u Europi. El Niño, pojava vezana uz zimske oborine, donosi i danas vlažan zrak preko Pacifika u južne dijelove sjevernoameričkoga kontinenta dok je La Niña njegova suprotnost i predstavlja sušna razdoblja (MENKING, ANDERSON 2003; KOUTAVAS et al. 2006; RENFREW, BAHN 2008, 234). Prema nekim autorima El Niño i La Niña javili su se vrlo rano (čak već oko 13000 BP) i moguće je da su djelomično zaslužni za otapanje Laurentide ledene ploče, posebno u njenom južnom dijelu.

Podatci o globalnim klimatskim promjenama danas su dostupni iz više izvora. Uz različite modele kompjutorskih simulacija (TORACINTA et al. 2004), istraživanja se vrše na proučavanju jezgri sedimenata dna mora (RENFREW, BAHN 2008, 130, 232–233), ledenih jezgri (MAYEWSKI et al. 2004) (sl. 1) i rastu koraljnih grebena u tropskom ekvatorijalnome pojasu (KOUTAVAS et al. 2006, 993; RENFREW, BAHN 2008, 232).

PRIBL. VREMEN. GRANICE	RAZDOBLJA	SREDNJA EUROPA	JUŽNA I JUGOISTOČNA EUROPA
2500 BP, 800 BC	SUBATLANTIK blaža i suša klima (106 BC-370 AD zahlađenje 370-1220 AD toplije razdoblje) *(željezno d. – recentno r.)*	- devastacija prirodnih šuma - razvoj gospodarskih tipova šuma	
5000 BP, 3800 BC	SUBBOREAL zahlađenje i pogoršanje s puno padalina *(kasni neolitik, brončano doba)*	- razvoj bukovih šuma i njihova dominacija nad ostalim vrstama	
8000 BP, 7050 BC	ATLANTIK vlažnija i blaža – oceanska klima, klimatski optimum *(neolitik)*	- miješane listopadne šume hrasta	- širenje bukovih šuma prema S i SZ - razvoj vazdazelenih mediteranskih šuma
9000 BP, 7850 BC	BOREAL zahlađenje oko 6000 BC *(mezolitik)*	- lijeska - početak razvoja miješanih hrast. šuma	- širenje miješanih hrast. šuma prema S i SZ - povećanje areala bukve
10000 BP	PREDBOREAL toplija i suša kontinentalna klima	- šume breze i bora	- miješane listopad. šume s dominirajućim hrastom - diskretna prisutnost bukve i jele
11000 BP	MLAĐI DRYAS	- doba siromašno šumom	- šumske stepe s listopadnim drvećem
12000 BP	ALLERØD		
13000 BP	BØLLING (+ STARIJI DRYAS)		
15000 BP	NAJSTARIJI DRYAS	- „stepa-tundra" (*Artemisia, Chenopodiaceae, Ephedra* i dr.)	- refugijalno šumsko područje (mali otoci listopadnih šuma)

Tabla 1. Pregled razdoblja kasnoga glacijala (Pleistocen) i postglacijala (Holocen) sa opisom razvoja šuma u srednjoj, južnoj i jugoistočnoj Europi (GYULAI 1993; LANG 1994; MÄGDEFRAI, EHRENDORFER 1988 – prema: ŠOŠTARIĆ 2003, 21).

menon connected with winter precipitation, still brings moist air across the Pacific to the southern parts of the North American continent, while La Niña, as its opposite, represents dry periods (MENKING, ANDERSON 2003; KOUTAVAS et al. 2006; RENFREW, BAHN 2008, 234). Certain authors believe that El Niño and La Niña appeared very early on (as much as 13000 years BP), and that they are partly responsible for the melting of the Laurentide ice sheet, its southern part in particular.

Several sources of data on the global climatic changes exist today. In addition to various computer simulation models (TORACINTA et al. 2004), investigations are carried out on the cores of deep-sea sediments (RENFREW, BAHN 2008, 130, 232–233), ice cores (MAYEWSKI et al. 2004) (Fig. 1) and the growth of coral reefs in the tropical equatorial belt (KOUTAVAS et al. 2006, 993; RENFREW, BAHN 2008, 232).

Ice cores provided evidence of rapid warming after 11600 BP – the temperature on Greenland rose 7˚C in 50 years. Several even more drastic warming periods occurred at that time, with the temperature rise of nearly 12˚C over a period of

APPROX. TIME LIMITS	PERIODS	CENTRAL EUROPE	SOUTH AND SOUTHEAST EUROPE
2500 BP, 800 BC	SUBATLANTIC milder and drier climate (106 BC-370 AD cooler p., 370-1220 AD warmer period) (*Iron Age - recent period*)	- devastation of natural forests - development of forest types for exploitation	
5000 BP, 3800 BC	SUBBOREAL cooling and deterioration with a lot of precipitation (*Late Neolithic, Bronze Age*)	- development and domination of beech forests over other types	
8000 BP, 7050 BC	ATLANTIC more humid and milder -oceanic- climate, climatic optimum (*Neolithic*)	- mixed deciduous oak forests	- N and NW spread of beech forests - development of evergreen forests in the Mediterranean
9000 BP, 7850 BC	BOREAL cooling around 6000 BC (*Mesolithic*)	- hazel - beginning of development of mixed oak forests	- N and NW spread of mixed oak forests - increase of the area of beech forests
10000 BP	PREBOREAL warmer and drier continental climate	- birch and pine forests	- mixed deciduous forests with dominant oak - discreet presence of beech and fir
11000 BP	YOUNGER DRYAS	- period of scarce forests	- forest steppes with deciduous trees
12000 BP	ALLERØD		
13000 BP	BØLLING (+ OLDER DRYAS)		
15000 BP	OLDEST DRYAS	- "steppe-tundra" (*Artemisia, Chenopodiaceae, Ephedra* etc.)	- refugial forest area (small isles of deciduous forests)

Table 1. Review of the Late Glacial period (Pleistocene) and the Post-glacial period (Holocene) with a description of forest development in central, southern and southeastern Europe (GYULAI 1993; LANG 1994; MÄGDEFRAU, EHRENDORFER 1988 - after: ŠOŠTARIĆ 2003, 21).

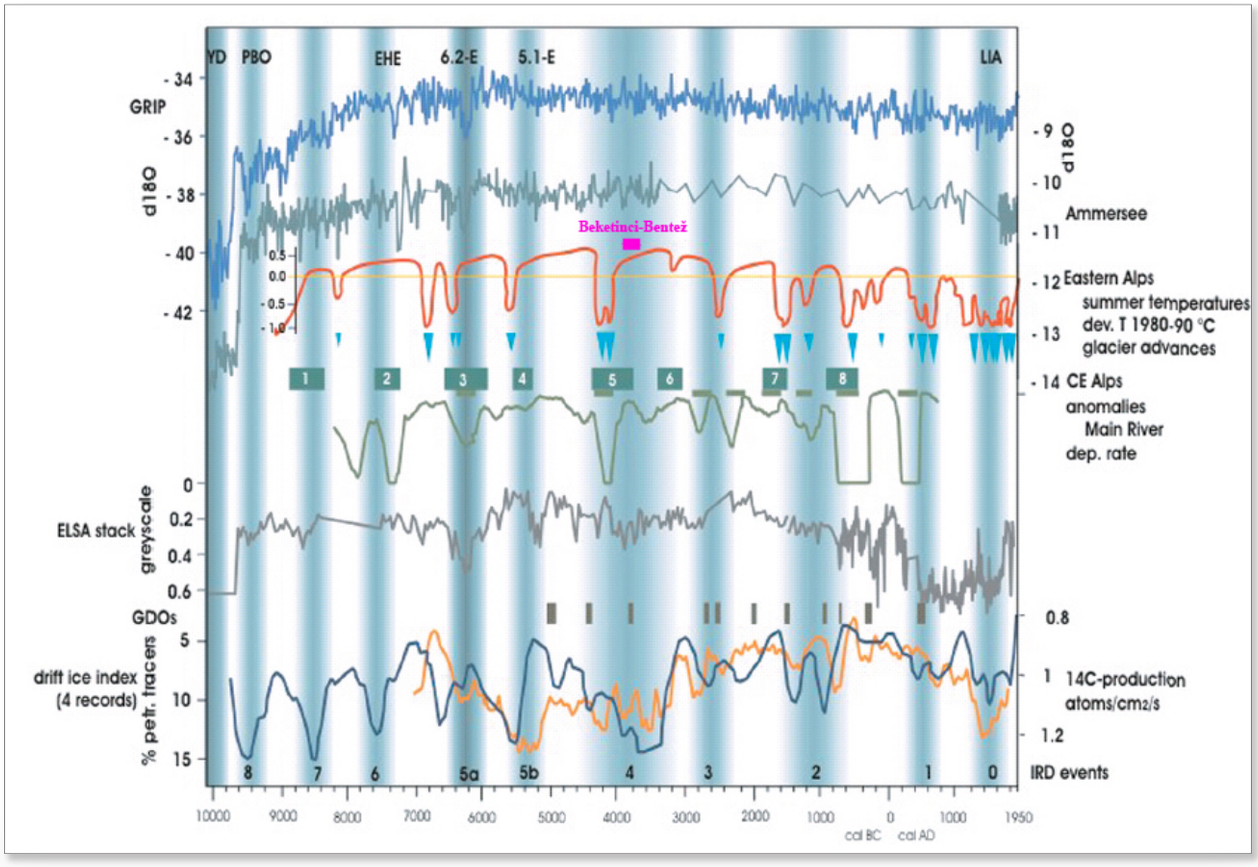
Ledene jezgre pokazale su da je nakon 11600 BP došlo do nagloga zatopljivanja – temperatura na Grenlandu povećala se za 7˚C u 50 godina. U to je vrijeme došlo i do nekoliko još drastičnijih razdoblja zatopljavanja za gotovo 12˚C u razdoblju od jedne do dvije godine (RENFREW, BAHN 2008, 232). Ove epizode nisu bile dugoga vijeka, pa se temperatura od 10000 BP do danas, uz poneke iznimke, održala gotovo jednakom. Usporedbom s kasnijim razdobljima kao što je **srednjovjekovno** *Malo ledeno doba*, tijekom kojeg je prosječna godišnja temperatura bila manje od 1˚C niža od današnje, a koje je zajedno s više čimbenika prouzročilo velike promjene u privredi i društvenome poretku, može se bolje razumjeti drastičnost temperaturnih oscilacija od gotovo 12˚C.

Analize peludnih uzoraka prikupljenih iz jezgri leda i sedimenata, ali i onih iz arheoloških istraživanja, dale su uvid u postupno mijenjanje biljnog pokrova (T. 1) (SÜMEGI et al. 2002, 173, sl. 2). Za Karpatsku kotlinu, pa tako i za dio sjeveroistočne Hrvatske, uočeno je slijedeće:

U vrijeme kasnoga glacijala (prije 10000 BP) šumske stepe polako su u južnim i središnjim dijelovima Karpatske kotline prešle u miješane listopadne šume u kojima prevladava hrast (*Quercus*) dok se u područjima sjeverno od njih javljaju borealne šume bora (*Pinus*) i breze (*Betula*) (SÜMEGI et al. 2002, 172; ŠOŠTARIĆ 2003, 9)

Razdoblje prelaska iz kasne oledbe u postoledbu (10000 – 9000 BP) obilježeno je sve većim povlačenjem tajga šuma i pojavom više vrsta listopadnih šuma. Sastav šuma razlikovao se od područja do područja – lipa (*Tilia*) te hrast (*Quercus*) i lješnjak (*Corylus*) u istočnom dijelu Karpatske kotline, lješnjak (*Corylus*) i hrast (*Quercus*) u sjevernom i zapadnom dijelu Karpatske kotline i miješana šuma brijesta (*Ulmus*) i hrasta (*Quercus*) u središnjim područjima Karpatske kotline (SÜMEGI et al. 2002, 172)

Tijekom boreala (9000 – 8000 BP) došlo je do nagloga velikoga zahlađenja (8.2 ka BP event/oko 6000 BC), ali se biljne vrste nisu ozbiljnije promijenile (T. 1). U Karpatskoj kotlini pojavljuju se tragovi peludi poljskih biljaka i ugljena, pa je moguće da je tadašnje mezolitičko stanovništvo oko 7000 BC koristilo vatru kako bi dovelo do promjena biljnoga pokrova odnosno povećalo površine niskog raslinja, vjerojatno kao pokušaj uvođenja neolitičkih tradicija (SÜMEGI et al. 2002, 172; ŠOŠTARIĆ 2003, 9)



Sl. 2 Prikaz holocenskih temperaturnih oscilacija (prema GRONENBORN 2009, 99).
Fig. 2 Depiction of Holocene oscillations in the temperature (after GRONENBORN 2009, 99).

1 to 2 years (RENFREW, BAHN 2008, 232). These episodes were not long-lasting though, and the temperature since 10000 BP to this day has remained almost the same, with a few exceptions. Comparisons with later periods, for instance, the Little Ice Age in the Middle Ages, when the average temperature was less than 1˚C below the present temperature, and which nevertheless, coupled with several other factors caused major changes in the economy and social order, will help us better understand the extreme severity of temperature oscillations of almost 12˚C.

Pollen analyses from ice core and sediment samples, as well as those from archaeological investigations, provided insight into the gradual change of the plant cover (T. 1) (SÜMEGI et al. 2002, 173, Fig. 2). The following was observed for the Carpathian basin and part of northeastern Croatia:

During the late glacial (before 10000 BP) forest steppes in the southern and central parts of the Carpathian Basin gradually transformed into mixed deciduous forests with dominant oak (Quercus), while in the areas to the north appeared Boreal forests of pine (Pinus) and birch (Betula) (SÜMEGI et al. 2002, 172; ŠOŠTARIĆ 2003, 9)

The transition from the late glacial into post-glacial period (10000 – 9000 BP) was marked by the increasing retreat of taiga forests and the appearance of several types of deciduous forests. The composition of forests varied from one area to another – lime (Tilia), and oak (Quercus) and hazel (Corylus) in the eastern part of the Carpathian Basin, hazel (Corylus) and oak (Quercus) in the northern and western part of the Carpathian Basin, and mixed forest of elm (Ulmus) and oak (Quercus) in the central areas of the Carpathian Basin (SÜMEGI et al. 2002, 172)

During the Boreal (9000-8000 BP), a sudden big cooling (8.2 ka BP event/around 6000 BC) occurred, although it did not produce major changes in plant species (T. 1). Pollen traces of field species and charcoal appeared in the Carpathian basin, pointing to the possibility that the Mesolithic populations around 7000 BC were using fire to change the plant cover, that is, to expand the areas of undergrowth, probably as an attempt to introduce the Neolithic traditions (SÜMEGI et al. 2002, 172; ŠOŠTARIĆ 2003, 9).

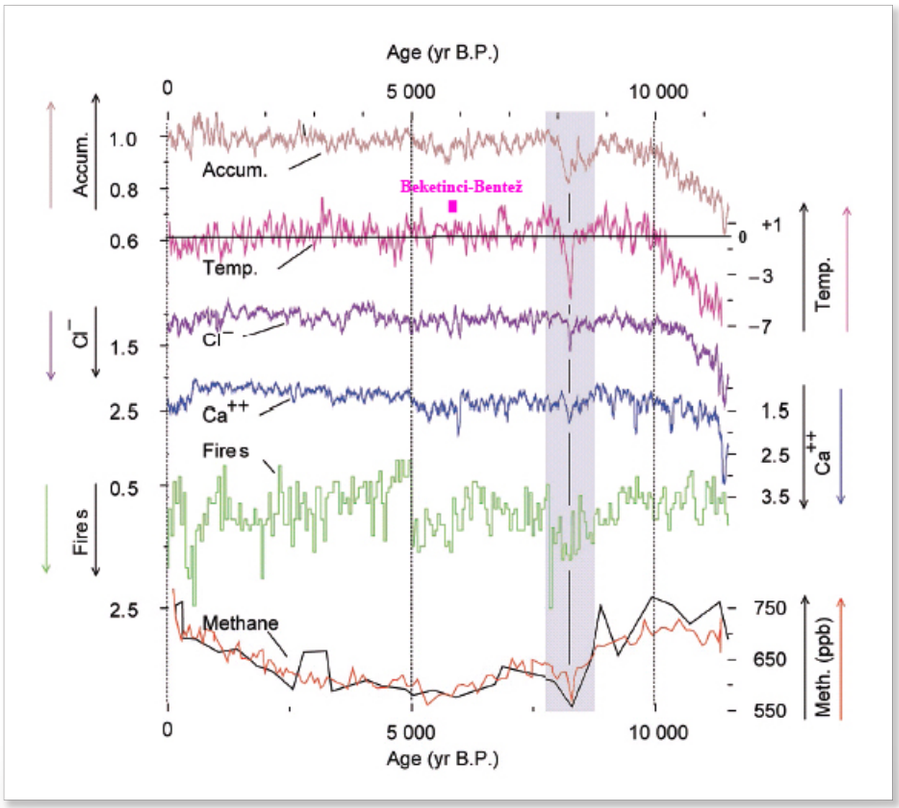
The Atlantic period (8000–5000 BP) corresponds to the beginning of the Neolithization, with accompanying changes in the environment. Cereals and other domesticated plants expand, while pine and birch forests transform into deciduous forest of oak (Quercus), elm (Ulmus), lime (Tilia), ash (Fraxinus) and maple (Acer), as well as hazel (Corylus), which is particularly widely spread in the west (SÜMEGI et al. 2002, 174; ŠOŠTARIĆ 2003, 9).

Around 6200 BC ensued another colder episode, followed by several centuries of relatively unstable climate (Fig. 2, 3). These conditions quieted down after 5100 BC (with warm and dry summers and cold and dry winters), resulting in more favourable living conditions and advances in social development.

The Neolithic period in Europe was marked by farming, initially focusing on fertile loess soils, generally on elevated terrain and easy to clear from undergrowth. Populations in the lowland forest areas of central Europe continued to rely on hunting and gathering as the main sources of diet. Flood areas were used as gardens and pasture (Fig. 4) (WILLIAMS 2000, 32). Occasional lack of cereal food was supplemented with products from small (sheep, pig) and large animals (cattle): meat, milk, cheese, blood (WILLIAMS 2000, 32). Williams also mentions an interesting calculation of natural sources necessary for the survival of a community of 30 members: 13.2 hectares for wheat cultivation, 40 cattle and 40 sheep or goats; they would need 4.5 hectares of land for construction of houses, accessory buildings and gardens; 52.8 hectares of forest and 4.8 hectares of woods for timber; 18.18 hectares of pasture land or thin forest for grazing; 19.66 hectares of meadows and 2.56 km^2 of forest for other needs. According to this calculation, a community of 30 persons would require a little more than 6 m^2 km of forest for survival (20 hectares per person) (WILLIAMS 2000, 32; 33, Fig. 1 – after GREGG 1988, 165).

Land cultivation gained momentum towards the end of the Neolithic, and cultivated land starts spreading into other lowland areas. Forests were mainly cleared by the slash-and-burn technique, which at places brought about charcoal-rich soils. The increasing demand for new fields is probably connected with population growth – according to Zimmermann (1966), the population density during the Neolithic was 2 persons/km^2 (DOTTERWEICH 2008, 196). Studies have not shown substantial soil erosion, but this may be due to several reasons – perhaps the subsequent periods erased traces of the earlier ones, small-scale cultivation of small fields and gardens effectively preserved soil from erosion, or perhaps a decline in precipitations meant that there were fewer landslides (DOTTERWEICH 2008, 199). Of course, it is also possible that this is merely a reflection of the insufficient level of research.

The prehistoric settlement at Bentež near Beketinci fits very well into such a description of social development, since



Sl. 3 Različiti klimatski pokazatelji za Europu i Bliski Istok u posljednjih 13000 godina; sivo je označen „8.2 ka BP event" (prema: BUDJA 2007, 193, Fig. 2)

Fig. 3 Various climatic indicators for Europe and the Near East in the last 13000 years; the "8.2 ka BP event" is marked grey (after: BUDJA 2007, 193, Fig. 2)

Vremenu atlantika (8000 – 5000 BP) odgovaraju početci neolitizacije, pa se tako okoliš mijenja. Sve više se pojavljuju žitarice i druge uzgojene biljke, a šume bora i breze prelaze u listopadne šume hrasta (*Quercus*), brijesta (*Ulmus*), lipe (*Tilia*), jasena (*Fraxinus*) i javora (*Acer*) te na zapadu obilno prisutna lijeska (*Corylus*) (SÜMEGI et al. 2002, 174; ŠOŠTARIĆ 2003, 9).

Oko 6200 BC dolazi do još jedne hladnije epizode nakon koje slijedi nekoliko stoljeća relativno nestabilnih klimatskih uvjeta (sl. 2, 3), a nakon 5100 BC ti se uvjeti smiruju (ljeta su topla i suha, a zime hladne i suhe), pa dolazi do boljih životnih uvjeta i napretka u razvoju društva (sl. 5).

Neolitik Europe obilježila je poljoprivreda koja se u početku oslanjala na kvalitetnija lesna zemljišta koja je bilo lakše očistiti od raslinja, a nalazila su se uglavnom na uzvisinama. U šumskim nizinskim područjima srednje Europe stanovništvo se i dalje oslanjalo na lov i sakupljanje kao glavne izvore prehrane. Plavna područja korištena su za vrtove i ispašu (sl. 4) (WILLIAMS 2000, 32). Mogući povremeni nedostatci žitarica nadomještali su se manjom stokom (ovce, svinje) i većom (goveda): mesom, mlijekom, sirom, krvlju (WILLIAMS 2000, 32). Williams također prenosi zanimljiv izračun potreba jedne zajednice od 30 članova za prirodnim izvorima potrebnim za preživljavanje: 13,2 ha za uzgoj pšenice, 40 grla goveda i 40 ovaca ili koza; bilo bi im potrebno 4,5 ha površine za izgradnju kuća, pomoćnih zgrada i vrtova; 52,8 ha šume i 4,8 ha šume za građevni materijal; 18,18 ha pašnjaka ili prohodne šume za ispašu; 19,66 ha livada i 2,56 km^2 šume za druge potrebe. Ovom računicom zajednici od 30 osoba bilo bi potrebno nešto malo više od 6 km^2 šume za opstanak (20 ha po osobi) (WILLIAMS 2000, 32 i 33, Fig. 1 – prema GREGG 1988, 165).

Krajem neolitika obrada zemljišta se pojačava te se obradive površine šire i u druga nizinska područja. Tehnika korištena za krčenje šuma uglavnom se sastojala od sječe i poticanja požara što je na nekim mjestima dovelo do stvaranja tla bogatoga ugljenom. Sve veća potreba za novim poljima vjerojatno je vezana uz porast populacije – prema Zimmermannu (1996) gustoća naseljenosti u neolitiku bila je dva stanovnika/km^2 (DOTTERWEICH 2008, 196). Istraživanja nisu pokazala da je erozija tla u to vrijeme bila značajna, no to može biti iz više razloga – možda su kasnija razdoblja izbrisala tragove ovih ranijih, možda je obrada manjih površina i vrtova ustvari čuvala tlo od erozije ili je uzrok smanjena količina oborina koje tako nisu izazivale veća klizišta tla (DOTTERWEICH 2008, 199). Naravno, moguće je da se radi samo o nedovoljnome stanju istraženosti.

Naselje Bentež kod Beketinaca u svojemu se prapovijesnome dijelu vrlo dobro uklapa u ovakav prikaz razvoja društava jer se novim istraživanjima pokazalo da je lasinjska kultura, sa svojim dobro organiziranim naseljima i čvrstom gradnjom kuća, već vrlo napredna u tehnološkome i organizacijskome smislu. Naselje se moglo razvijati na ovome mjestu radi vjerojatno konstantne razine voda, iako je bilo smješteno u ravnici koja je sve do melioracije u 19. st. bila podložna poplavama. Potrebe zajednica ove kulture, kao uostalom i ostalih kultura kasnog neolitika i početka eneolitika, bile su znatno veće od

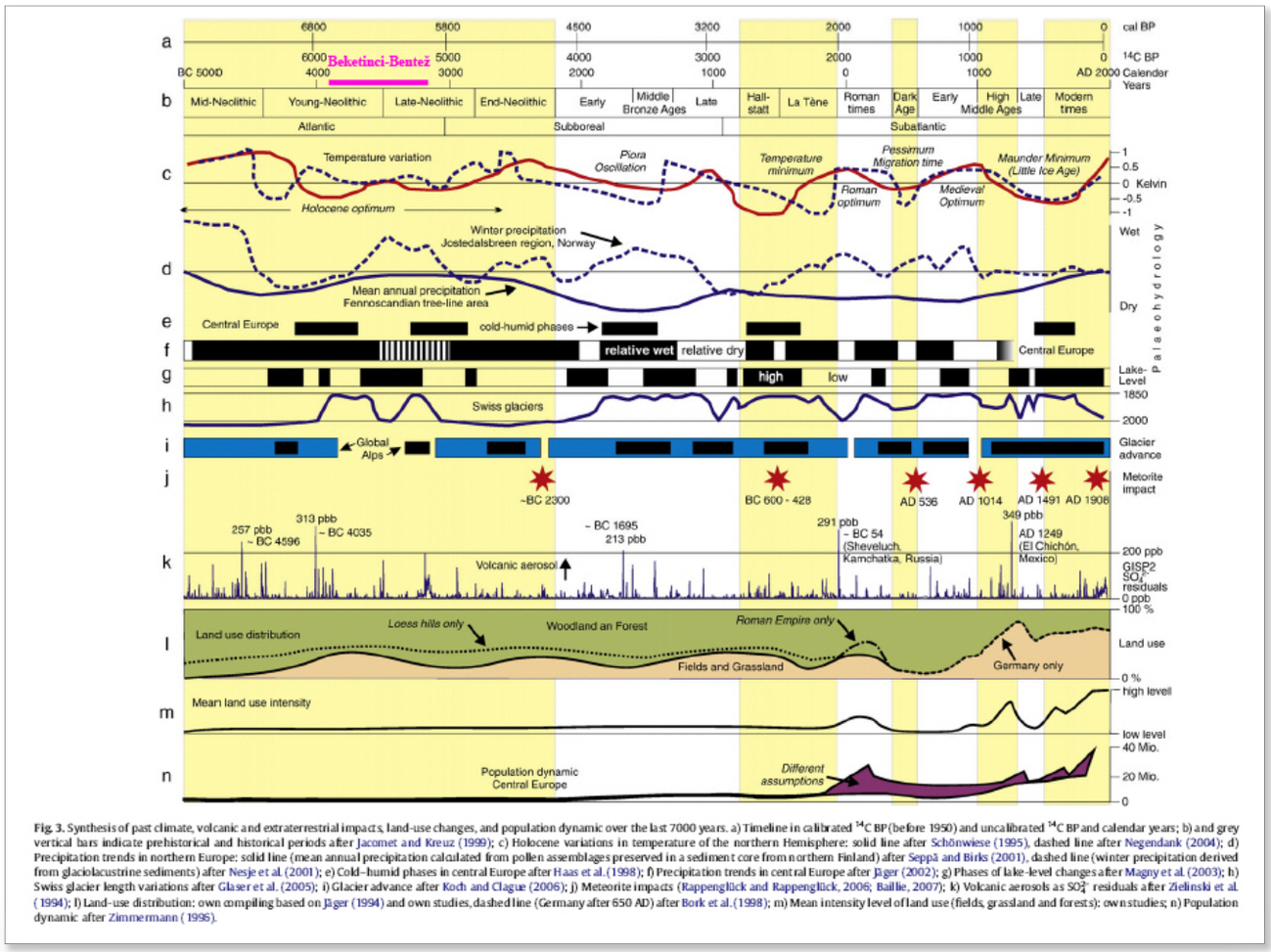
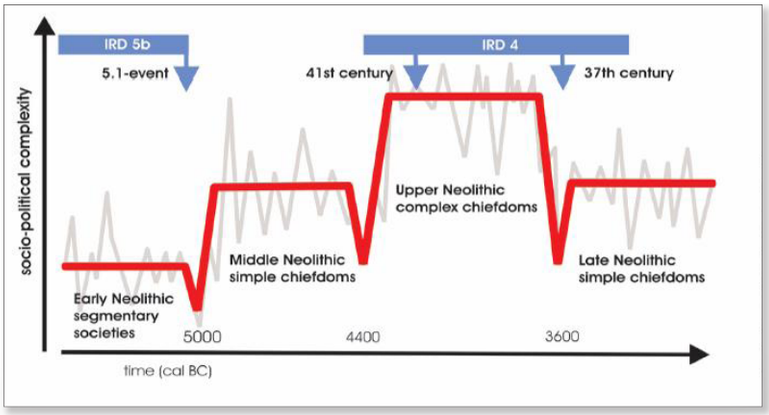


Fig. 3. Synthesis of past climate, volcanic and extraterrestrial impacts, land-use changes, and population dynamic over the last 7000 years. a) Timeline in calibrated ^{14}C BP (before 1950) and uncalibrated ^{14}C BP and calendar years; b) and grey vertical bars indicate prehistorical and historical periods after Jacomet and Kreuz (1999); c) Holocene variations in temperature of the northern Hemisphere: solid line after Schönwiese (1995), dashed line after Negendank (2004); d) Precipitation trends in northern Europe: solid line (mean annual precipitation calculated from pollen assemblages preserved in a sediment core from northern Finland) after Seppä and Birks (2001), dashed line (winter precipitation derived from glaciolacustrine sediments) after Nesje et al. (2001); e) Cold–humid phases in central Europe after Haas et al. (1998); f) Precipitation trends in central Europe after Jäger (2002); g) Phases of lake-level changes after Magny et al. (2003); h) Swiss glacier length variations after Glaser et al. (2005); i) Glacier advance after Koch and Clague (2006); j) Meteorite impacts (Rappenglück and Rappenglück, 2006; Baillie, 2007); k) Volcanic aerosols as SO_4^{2-} residuals after Zielinski et al. (1994); l) Land-use distribution: own compiling based on Jäger (1994) and own studies, dashed line (Germany after 650 AD) after Bork et al. (1998); m) Mean intensity level of land use (fields, grassland and forests): own studies; n) Population dynamic after Zimmermann (1996).

Sl. 4 Sažetak prošlih klimatskih, vulkanskih i vanzemaljskih utjecaja (udari meteorita), promjena izazvanih korištenjem zemlje i dinamika stanovništva u posljednjih 7000 godina (prema: DOTTERWEICH 2008, 197, Fig. 3)

Fig. 4 Review of the past climatic, volcanic and extraterrestrial influences (meteorite impacts), changes caused by land use, and population dynamics in the last 7000 years (after: DOTTERWEICH 2008, 197, Fig. 3)



Sl. 5 Shematski prikaz sociopolitičkoga razvoja u srednjoeuropskim društvima (prema: GRONENBORN 2009, 102).

Fig. 5 Schematic plan of the socio-political development of central European societies (after: GRONENBORN 2009, 102).

the results of the recent investigations have shown that the Lasinja culture, with its well-organized settlements and solid house construction, is already quite advanced in terms of technology and organization. The settlement was able to develop at this place due to the presumably constant water level, in spite of the fact that it lay in the flatland prone to floods until as late as the 19th cent. reclamation. Due to population growth, the needs of the communities of this culture, like in

njihovih prethodnika zbog povećanja populacije, pa su se tražili i novi načini korištenja prirodnih resursa za opstanak zajednica. Ravnoteža između iskorištavanja tla, šuma i uzgoja stoke porastom stanovništva vjerojatno je bila ugrožena, a time su populacije bile osjetljivije na nepovoljne klimatske uvjete. Bilo je potrebno pronaći nove načine privrede i preživljavanja te zaštite već postojećih dobara što je vjerojatno dovelo do potreba za iskorištavanjem metala. Naselje lasinjske kulture u Beketincima živjelo je u vrijeme najpovoljnijega društvenoga razvoja Europe (sl. 5), iako su ga zahvatila dva kraća hladnija razdoblja (sl. 3 i 5) te se u drugoj polovici svojega života suočilo s naizmjeničnim suho-vlažnim uvjetima (sl. 4). Blizina drugih naselja lasinjske kulture (npr. u Čepinskim Martincima, Josipovcu Punitovačkom ili Jurjevcu Punitovačkom) govori o dobro organiziranome životu veće zajednice koja se mogla nositi s manje ili više nepovoljnim prirodnim uvjetima.

fact of the remaining Late Neolithic and Early Eneolithic cultures, were far greater than those of their predecessors, which led to quests of new ways of exploiting natural resources for the survival of communities. Population growth also probably jeopardized the balance between the exploitation of land and forests, and livestock rearing, rendering the populations more sensitive to unfavourable climatic conditions. It was necessary to introduce innovations into the economy, subsistence and protection of the already existing goods, which probably also resulted in the exploitation of metals. The Lasinja settlement in Beketinci existed during the heydey of social development in Europe (Fig. 5), even though it also passed through two brief colder periods (Fig. 3, 5). In its latter half it faced alternating dry-humid conditions (Fig. 4). The proximity of other settlements of the Lasinja culture (for instance in Čepinski Martinci, Josipovac Punitovački or Jurjevac Punitovački) speaks of well-organized life of a larger community able to deal with more or less unfavourable natural conditions.