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Neolithic/Eneolithic settlement patterns and Holocene environmental changes in Bela Krajina (south-eastern Slovenia)

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ABSTRACT – *This paper examines the archaeological settlement pattern and vegetation history of Bela krajina region of Slovenia in order to better understand the interaction of human activities and environmental processes in the landscape. Pollen record of two small palaeoecological sites (Mlaka and Griblje) indicates that human impact on the vegetation at circa 4150 calBC was intensive (forest cutting/burning, beech decline and formation of fields, pastures, meadows) and can be associated with numerous Neolithic/Eneolithic sites, located in the Lahinja river basin and the Kolpa lowlands. Human pressure on the (lowland/riverine) environment slightly decreased between* c. *3750–2850 calBC. This coincides with the appearance of a more dispersed settlement pattern, including the formation of short-term settlement/activity areas on the karst plateau. This change to a more extensive Eneolithic settlement pattern can be presumably associated with change in economy (more intensive pastoralism and transhumance, possibly also soil erosion) and is partially borne out by evidence from excavated sites in the area.*

IZVLEČEK – *Članek primerja arheološki poselitveni vzorec in zgodovino razvoja vegetacije na področju Bele krajine, z namenom, da bi bolje razumeli povezavo med človekovo dejavnostjo in okoljskimi procesi v pokrajini. Pelodni zapis dveh majhnih paleoekoloških najdišč (Mlake in močvirja pri Gribljah) kaže, da je bil človekov vpliv na vegetacijo pred c. 4150 pr. n. št. intenziven (sekanje/ požiganje gozda in upad bukve, pojav polj, pašnikov in travnikov), kar lahko povežemo s številnimi neolitskimi in eneolitskimi arheološkimi najdišči ob Lahinji in Kolpi. Človekov pritisk na nižinsko okolje ob rekah je bil nekoliko manj intenziven v obdobju pred c. 3750–2850 pr. n. št. To sovpada s pojavom bolj razpršenega arheološkega poselitvenega vzorca in nastankom kratkotrajnih naselbin/ uporabo prostora na kraškem višavju. Ta prehod v bolj ekstenziven eneolitski poselitveni vzorec domnevno lahko povežemo s spremembo ekonomije (intenzivnejše pašništvo, verjetno tudi erozija tal), kar deloma potrjujejo tudi rezultati arheoloških izkopavanj.*

KEY WORDS – *Palynology; beech decline; anthropogenic indicator; karst; core settlement; dispersed settlement pattern; off-site activity; Lengyel; Lasinja*

Introduction

Bela krajina is a lowland karst region in south-eastern Slovenia. It is bounded on the east and south by the river Kolpa and on the west by the high dinaric uplands of Kočevski rog. It is separated from central Slovenia by the Gorjanci hills. The lowland karst plateau has limited surface water, particularly rivers and streams in deeply incised valleys or gorges. The karst itself is characterised by a range of karst features, such as uvalas and swallow holes, but there are extensive areas of Pleistocene deposits in the Kolpa valley and to a lesser extent in the catchments of the river Lahinja (*Plut 1985.13–15; Radovčić, Galović 2002.10–31*).

The region has a relatively long tradition as an area of research into the Neolithic and Eneolithic, due to

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the relatively rich data from these periods (*Dular 1985.18–19, 42–43*). It was arguably the first area in the country, for which targeted research led to the formulation of a coherent model of Neolithic and Eneolthic settlement dynamics (*Budja 1988.50–55; 1989.83–102; 1990.113–134; 1992.95–109*) The expansion of archaeological fieldwork (field survey, trial trenching and excavation) has much increased the available archaeological data (*Mason 2008.18–22*). This data and that from earlier research can now be examined and compared against an increasing corpus of new data that of recent palynological research in the region (*Andrič 2007*), to assess the nature and dynamics of Neolithic and Eneolithic settlement patterns in the light of Holocene environmental changes.

Vegetation history and human impact on environment

To date palaeoecological research in the area focused on studies of vegetation development in lowland Bela krajina. The vegetation history of the karst plateau was not investigated, therefore only lowland vegetation can be presented and compared with the archaeological settlement pattern (Pl. 1).

Palynological research at Mlaka and Griblje wetlands (Figs. 1, 2) showed that, on the local scale, the Holocene vegetation development was very dynamic, with significant human impact on the environment (*Andrič 2007*). This became apparent due to natural characteristics of selected study sites, which are small (with small relevant source area of pollen, *Sugita 1994*) and therefore sensitive to local vegetation changes and human impact on the environment. Both study sites are located in the vicinity of Neolithic/Eneolithic settlements (Figs. 3, 4; Ržišča, Pusti Gradac, Griblje).

The results of pollen analysis at Mlaka (Fig. 1, Tab. 2) suggest that at *c.* 6900 calBC the early Holocene open woodland of oak (*Quercus*), hazel (*Corylus*), lime (*Tilia*), birch (*Betula*) and pine (*Pinus*) was suddenly replaced by beech (*Fagus*) forest. This is presumably associated with an increase in precipitation; a similar spread of beech also occurred at Griblje (Fig. 2, Tab. 3), probably simultaneously with Mlaka (*Andrič 2007*). Between *c.* 6900 and 5500 calBC beech canopy was occasionally opened by small-scale landscape burning at both study sites. However it is not clear from the present state of research, whether this fire disturbance regime was natural or anthropogenic (*e.g.* Mesolithic people were using fire to open the landscape).

The initial spread of beech forest was followed by beech decline and a change in forest composition, with an increase of monolete fern spores and initially lime at Mlaka and pine and trilete fern spores at Griblje. Landscape also became more open. This unusual beech decline is specific for Bela krajina region and it seems unlikely to be triggered by a global cold climatic fluctuation, although it is possible that vegetation composition was affected by local climate (*e.g.* drier and hotter summers in Bela krajina region of Slovenia). It is also possible that this vegetation change was caused by human impact, but the main problem of this explanation is that no archaeological sites, dated to 5500–5000 calBC were discovered in the area, so further archaeological and palaeoclimatological research is needed to better understand this unusual vegetation change.

After 5000 calBC open areas were regrown by hazel and oak and, between 4700 and 4100 calBC, hornbeam forest at Mlaka. An increase of 'anthropogenic indicator' herb taxa, *e.g.* ribwort plantain (*Plantago lanceolata*), plants of the *Centaurea* family (*e.g.*

Pl. 1. A view of the Palynological site of Mlake in a typical Bela krajina landscape (photo by Maja Andrič).

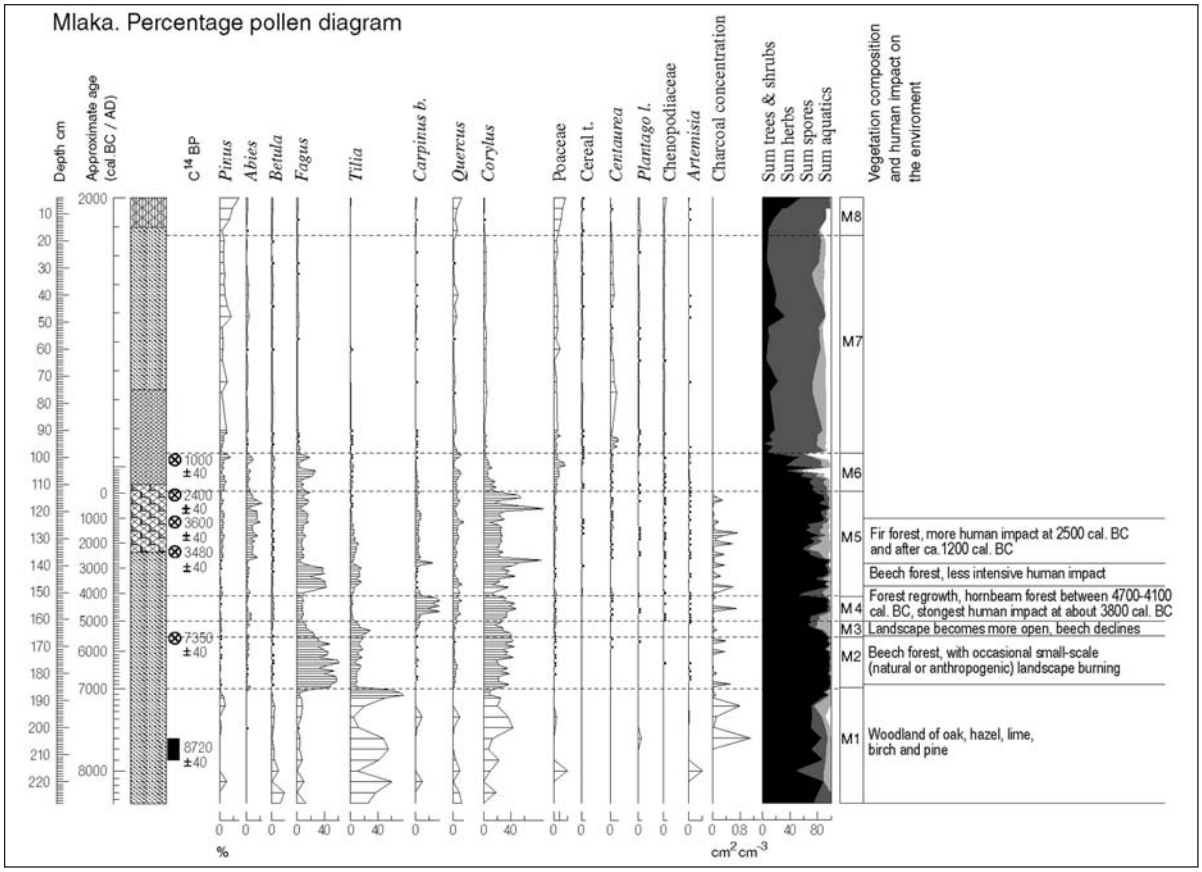

Fig. 1. Mlaka: Percentage pollen diagram (prepared by Tamara Korošec).

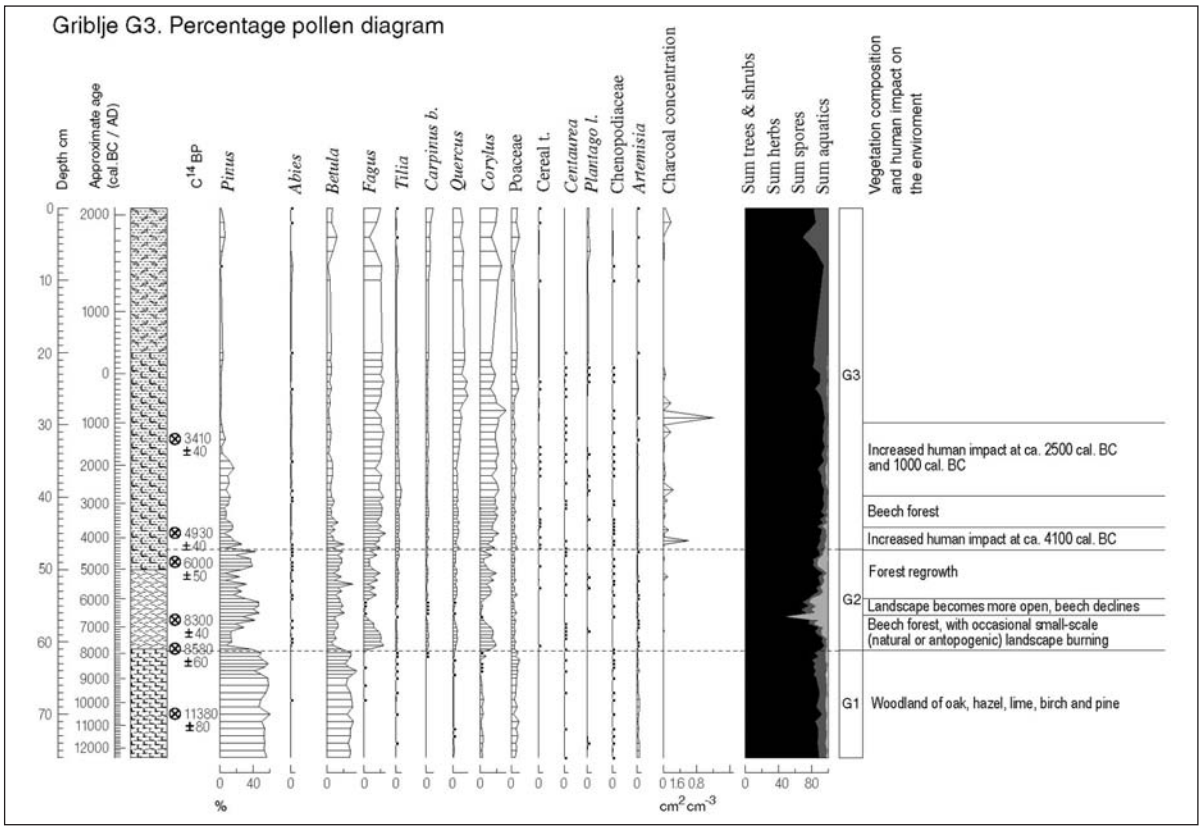

Fig. 2. Griblje G3: Percentage pollen diagram (prepared by Tamara Korošec).

cornflower), Cereal type pollen grains and other herb taxa, characteristic for agricultural fields and pastures, can be associated with Neolitihic settlements, located in the vicinity of both study sites. It is possible that people living near the Mlaka site were using local hornbeam forest (coppicing and wood pasture, which prevented beech regeneration). At about 3800 calBC human pressure on the environment increased, hornbeam forest was probably burnt and the landscape became open again, with meadows and fields located in vicinity of the Mlaka site. Similar vegetation development, but without a hornbeam phase and with less intensive forest clearance, was detected also at Griblje.

Later, with decreased human impact on the environment, beech forest returned between 3700 and 2800 calBC. Forest composition changed again at 2800 calBC, when fir (*Abies*) replaced beech at the Mlaka site, whereas fir increase is not that pronounced at Griblje. This vegetation change could be associated with wetter climate and/or beech cutting (if beech wood was needed for metallurgy). Human impact on the environment slightly increased by 2500 calBC and after *c.* 1200–1000 calBC. The landscape was gradually becoming more open at both study sites, which could be associated with numerous Bronze Age and Iron Age sites in the area (*Andrič 2007.763–776*).

The early Holocene archaeological evidence

An examination of the archaeological evidence for the Neolithic/Eneolithic settlement pattern in Bela krajina provides a more episodic view of human activity in the early Holocene within the broad trends, shown by the palaeoecological research.

There is only minimal archaeological evidence for human activity in the region prior to the 5th millennium BC. This is confined to a single site of Epigravettian occupation in a cave site, Judovska hiša, in the Krupa gorge (*Pohar 1985.7–15*). Thus the palaeoecological evidence gives us the strongest for potential Mesolithic activity outside the area of the single known site (Tabs. 2, 3).

Models of Neolithic/Eneolithic settlement

The existing model of spatial exploitation in the Neolithic and Eneolithic in Bela krajina was developed in the 1980's. It was based on the results of the Moverna vas field survey project in the Krupsko polje, which was supplemented by small scale excavation on the central site of Moverna vas in 1988 (*Budja op. cit.; Tomaž 1997.113–142*). The model formulated from this work also includes field survey work around Pusti Gradac and Zorenci on the upper reaches of the river Lahinja (*Budja op. cit.*). The small-scale excavation on the Gradac settlement from 1993–1995 showed a broadly similar chronological situation to that at Moverna vas (*Mason 1995.183–199*). The field survey data and the data from the two limited stratigraphic excavations were employed in conjunction with data from previously known sites that had not been subject to either modern excavation or extensive field survey to extend the model to whole of the river Lahinja river system and by inference to the whole of Bela krajina.

The model can now be supplemented by the results of developer-funded field survey and excavation, as well as research oriented field survey over the last

Sample no. (material dated)	Site sample no.	Conventional radiocarbon age	C^{13}/C^{12} ratio	2 sigma calibration (Intcal 04)
Čardak				
Beta–229147 (charcoal)	CARDAKII1038	2760±40 BP	–24.7 o/oo	1000–820 calBC
Beta–229148 (charcoal)	CARDAKII1039	2940±40 BP	–27.7 o/oo	1280–1010 calBC
Beta–229149 (charcoal)	CARDAKII492	2130±40 BP	–25.6 o/oo	350–290 and 220–50 calBC
Beta–229150 (charcoal)	CARDAKII566	2840±40 BP	–24.5 o/oo	1120–910 calBC
Beta–229151 (charcoal)	CARDAKIISE405	4590±50 BP	–24.8 o/oo	3510–3420, 3380–3320, 3230–3110 calBC
Ržišča				
Beta–229154 (charcoal)	RZISCE753	5040±50 BP	–25.2 o/oo	3960–3700 calBC
Beta–229155 (charcoal)	RZISCE1022	2970±40 BP	–24.3 o/oo	1360–1350, 1310–1050 calBC
Beta–229156 (charcoal)	RZISCE1349	5840±70 BP	–26.0 o/oo	4840–4530 calBC
Vinji vrh				
Beta–229157 (charcoal)	VINJIVRH262	3600±50 BP	–25.9 o/oo	2130–2090, 2050–1870, 1840–1820, 1790–1780 calBC
Beta–229158 (charcoal)	VINJIVRH275	3650±60 BP	–25.5 o/oo	2200–1880 calBC

Tab. 1. The Radiocarbon dates of Neolithic/Eneolithic archaeological sites in Bela krajina.

Approximate age (Mlaka)	Vegetation composition and human impact on the environment	Archaeological settlement pattern
2800 – 1000 calBC	Fir forest, more human impact at 2500 calBC and after *c.* 1200 calBC	Ržišča
3700–2800 calBC	Beech forest, less intensive human impact	Ržišča, Moverna vas, Pusti gradec Gradac
5000–3700 calBC	Forest regrowth, predominantly hornbeam forest between 4700–4100 calBC, strongest human impact and forest clearance at about 3800 calBC	Ržišča, Moverna vas, Pusti Gadec Gradac
5500–5000 calBC	Landscape becomes more open, beech declines	
6900–5500 calBC	Beech forest, with occasional small-scale (natural or anthropogenic) landscape burning	
9500–6900 calBC	Woodland of oak, hazel, lime, birch and pine	

Tab. 2. Radiocarbon dating of vegetational phases at Mlaka and the associated archaeological settlement pattern.

ten years. This has led to the discovery of a range of new settlement sites and off-site data, as well as a range of associated radiocarbon dates and pedological data. It also means that there are now other excavated sites in the upper reaches of the Lahinja system (Ržišča, Gradinje) and two large sites (Griblje, Podklanec) in the Kolpa valley (*Mason 2001.10; 2008.20–21; Mason, Bricelj 2006.41–42; Mason, Pintér 2001.141–142; Mason, Tomažič, Novšak 2006.95–96; Pintér 1998*). These were defined by field survey that was supplemented by small-scale excavation and monitoring of infrastructure projects. This has permitted the extension of the model with a greater degree of veracity to the rest of Bela krajina.

Neolithic settlement (Fig. 3)

The model posits the first appearance of agricultural settlement in the Middle Neolithic in the 5th millennium BC. The initial colonisation of the interior of Bela krajina was centred on the drainage system of the river Lahinja and its tributaries. The primary settlements complexes were located on fertile soils, close to the rivers. Two typical locations can be identified – river meanders, *e.g.* Pusti Gradac and Gradac, and canyon or terrace edge sites, *e.g.* Griblje, Moverna vas, Podklanec, Ržišča and Zorenci (*Mason 1995.192; 2008.20*). The cave site of Judovska hiša also continued in use (*Pohar op.cit*).

The earliest dates for this initial Neolithic phase are 4900 calBC at Moverna vas and 4840 calBC at Ržišča, which would coincide with the hornbeam phase of strongest human impact (*Budja 1994.20, Fig. 5; Mason 2008.20*) (Tabs. 1, 2, 3). The other sites lack radiocarbon dates, but it can be asserted with some degree of certainty that those that are only known from small-scale excavation (Gradac) and field survey (Pusti Gradac, Gradac, Zorenci and Griblje) have produced material from secure contexts, which indicates that they probably have a similar early origin.

Approximate age (Griblje)	Vegetation composition and human impact on the environment	Archaeological settlement pattern
2800–1000 calBC	Increased human impact at *c.* 2500 calBC and 1000 calBC	Griblje
3700–2800 calBC	Beech forest	Griblje
4400–3700 calBC	Increased human impact ('anthropogenic indicator' taxa) at *c.* 4100 calBC	Griblje
6000–4400 calBC	Forest regrowth	
6600 – 6000 calBC	Landscape becomes more open beech declines	
7900–6600 calBC	Beech forest, with occasional small-scale (natural or anthropogenic) landscape burning	?
before7900 calBC	Woodland of oak, hazel, lime, birch and pine	?

Tab. 3. Radiocarbon dating of vegetational phases at Griblje and the associated archaeological settlement pattern.

It has been suggested that arable farming was an important part of the economy, but the site locations suggest that they were optimally placed to exploit riverine environments for summer grazing, fodder, fishing and wildfowling, as well as the arable potential of the first terrace and the grazing potential of the drier karst hinterland (*Mason 1995.185–187*).

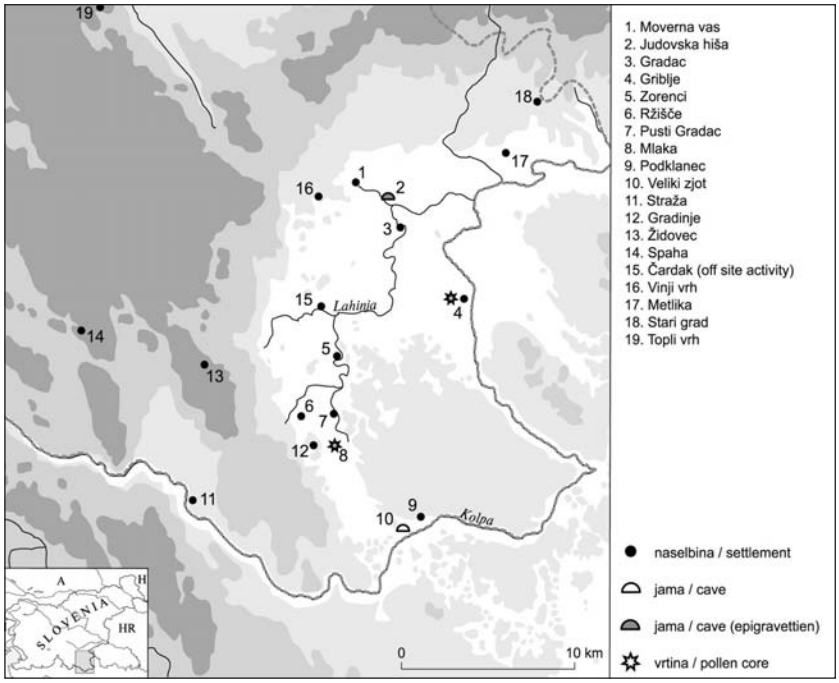

Fig. 3. Neolithic settlement sites in Bela krajina (prepared by Tamara Korošec).

It is possible that the Middle/Late Neolithic core settlements may have seen a seasonal element in their occupation throughout their use. The presence of midden deposits might be indicative of seasonal gatherings on the sites, which were otherwise occupied by smaller populations during the rest of the year. The presence of fine wares with burnt food deposits in the midden deposits are perhaps related to seasonal symbolic feasting, reintegrating an otherwise scattered population at a centre at certain times of the year.

Eneolithic settlement expansion (Fig. 4)

The settlement pattern changed in the 4th millennium BC. There is a visible expansion out from the Late Neolithic settlement centres into the drier karst hinterland through a process of secondary colonisation (*Budja 1989.93–98; Mason 1995.193–195*). This can best be seen in the original Moverna vas/Krupsko polje field survey and in more recent work. Similar expansion can be seen around the Pusti Gradac site (meander and first terrace) and Eneolithic activity is clearly present on core settlements at Gradac, Zorenci and Ržišča (*Budja 1992.102–109; Dular 1985.65; Mason 1995.191; 2008.21*). The most complete new evidence for a Neolithic/Eneolithic settlement pattern comes from the Griblje area and mirrors that of the Krupsko polje that is a Neolithic core settlement with later Eneolithic expansion into the drier hinterland (*Mason 2001.10*). However, it should be noted that seasonal ponds are present within the hinterland and probably formed foci for Eneolithic and possibly earlier Neolithic activity. Expansion was more likely to take place into the karst hinterlands and not laterally along the terrace – activity here was present in the form of satellite activity areas throughout the Neolithic and Eneolithic.

It has been hypothesised that this expansion was linked to increased population and was made possible by the increasing importance of the stock-raising element in the economy, which led to a more mobile lifestyle (*Budja 1989.93–98; Mason 1995.193–194*). This may be seen in the expansion of occupation of cave sites, such as Veliki zjot in the Kolpa valley (*Leben 1991.169–191; Turk 1991.189*). Enclosed upland sites, such as those at Spaha, Straža, Židovec, Topli vrh and potentially Metlika, also appear in the Lengyel and Lasinja phases (*Breščak 1992.255–256; Dular 2001.89–106*) and may be connected to increased competition in the area. They have also been tentatively connected to the appearance of transhumance (*Mason op. cit. 194*). However, it must be admitted that this hypothesis can only be tested against a large stratified faunal assemblage, which are unfortunately completely absent due to poor conditions for the preservation of animal bone in the area. The decline and disappearance of this settlement pattern in the second half of the 3rd millennium BC has been seen as a result of overexploitation, leading to environmental degradation (*Mason op. cit. 195*).

Recent excavations in some swallow holes have provided vital insights into the nature of Eneolithic occupation and/or environmental degradation in

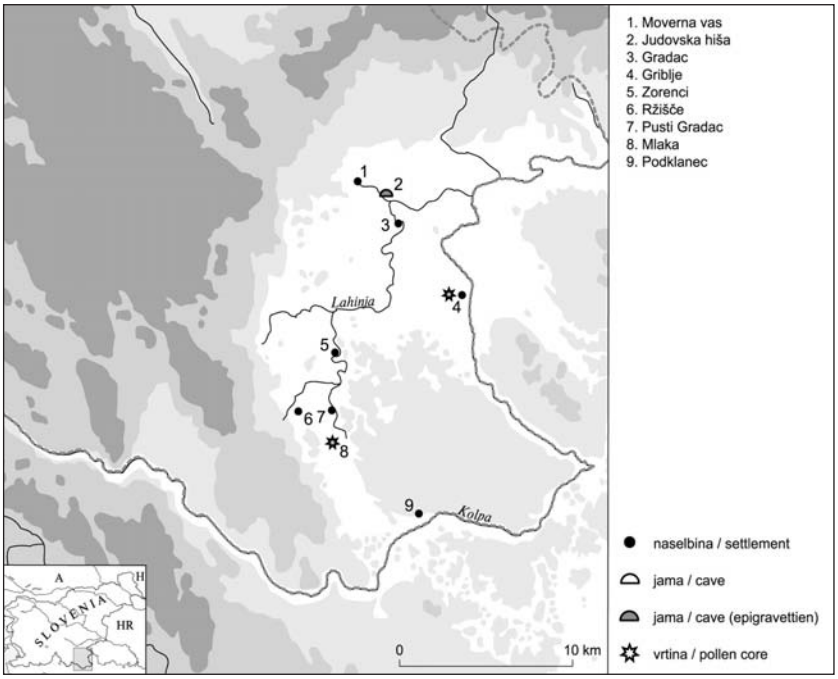

Fig. 4. Eneolithic settlement sites in Bela krajina (prepared by Tamara Korošec).

the karst hinterland. The site of Čardak II in the lowland karst on the edge of the valley of the river Dobličica has no direct evidence of Eneolithic settlement, but the charcoal in primary erosion deposit in the is dated to the mid to late 4th millennium BC (Beta–229151: calBC 3640–3420 (calBP 5460–5380), calBC 3380–3320 (calBP 5330–5270) calBC 3230–3110 (calBP 5180–5060) (*Mason 2008.21; Mason, Predan, Murko, Pintér 2006a.23–24; 2006b.24–26*) (Tab. 1). Eneolithic activity here would then fall within the Eneolithic expansion into the karst hinterland, but also within the phase of beech regeneration, noted at Mlaka.

The other karst hinterland site is that of Vinji vrh near Semič was subject to limited excavation in 2004 (*Mason, Britovšek, Pintér 2006.182–183*). It proved to be an late Eneolithic or Early Bronze Age settlement site, which at least partially lay within a swallow hole. The settlement was of low intensity without deep occupation layers and was later subject to intensive erosion. It has produced a range of ^{14}C dates, but the final date lies within in the second half of the 3rd millennium or at the beginning of the 2nd millennium BC (Beta–229158: calBC 2200–1880 (calBP 4150–3830) (*Mason 2008.22*) (Tab. 1). This is just outside the phase of more intensive human impact detected at Mlaka around 2500 calBC. It is clear that the intensity of human impact in the Eneolithic phase varied in space and time and was not a unitary phenomenon. The impact at Mlaka may be locally related to the Gradinje settlement site, which is without radiocarbon dates (*Mason, Tomažič, Novšak 2006. 95–96*). It should be also noted the final phase of occupation at Gradac terminated in a major erosion event, which is contemporary with Moverna vas phase 8 (*Mason 1995. 195*). It is now becoming increasingly clear that the main feature of the transition from the Eneolithic to the Early Bronze Age was the abandonment of the Neolithic/Eneolithic core settlements, but the continuation of the small-scale ephemeral settlements in their hinterland – indicative of an increasingly mobile way of life.

In conclusion, the evidence suggests that the existing model for Neolithic and Eneolithic settlement patterns in Bela krajina still offers the best means of interpreting the growing body of data for these periods. The model can now be extended with some confidence to the Kolpa valley and to other parts of the Lahinja catchment. What is now needed is the expansion of field survey work in these areas, particularly on sites that are incompletely defined, *e.g.* Podklanec. It is only then that the veracity of this model can be tested. The true nature of the Neolithic core settlements remains equally enigmatic, but as this can only be tested by large-scale excavation, it must remain so for the moment. On-going work in the spheres of palaeobotanical studies and off-site landscape studies may also be expected to provide vital results on the development of the Neolithic and Eneolithic landscape, particularly with regard to possible environmental degradation during and at the end of the Eneolithic, something which at the moment remains on the level of an intrasite phenomenon on the few excavated sites. It is also to be hoped that the tantalising palaeobotanical evidence for Mesolithic activity will be matched by archaeological evidence.

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