Coll. Antropol. **33** (2009) 4: 1295–1301
Original scientific paper

Plant Remains from an Early Iron Age Well at Hajndl, Slovenia

Renata Šoštarić[1], Antun Alegro[1], Vladimir Hršak[1], Zvjezdana Stančić[2] and Hansjörg Küster[3]

[1] Department of Botany, Faculty of Science, University of Zagreb, Zagreb, Croatia
[2] Stjepana Radića 28, HR-49221 Bedekovčina, Croatia
[3] Institut für Geobotanik, Universität Hannover, Hannover, Germany

ABSTRACT

The archaeobotanical samples analysed derive from a well-preserved well dated to the Early Iron Age (Hallstatt) according to pottery found in the sampled layers and on a radiocarbon dating (720–520 cal B.C.) of the wooden construction of the well. Cultivated plants (Panicum miliaceum, Linum usitatissimum, Papaver somniferum and Camelina sativa) were recorded in relatively small numbers whereas primary cereals are lacking. Together with quite a large number of accompanied weeds they suggest agriculture activities, but a mixture of weeds and ruderal plants was probably also growing inside the relatively large settlement complex and could have been included in the assemblages just by chance. The plant species composition indicates local vegetation developed under strong anthropogenic influence and on mainly moist and nitrogen-rich soils. Grassland plants and an almost complete lacking of tree and shrub species characteristic for the climax vegetation (deciduous mesophilous mixed forests) of the region also indicate at least local human activity.

Key words: *plant macro-remains, cultivated plants, human influence, early Iron Age, Slovenia*

Introduction

Archaeological investigations into the Hajndl site (Figure 1) were started in the 1960s, when the Ptuj – Godenice Roman road was investigated. Simultaneously, remains of prehistoric ceramics and a prehistoric cultural layer were revealed for the first time.

Because of the construction of the Ormož roundabout way on the Ormož – Ptuj main road intensive archaeological research was carried out in 1999 and 2000. Remains of architecture and cultural layers dated to the Early Iron Age (Hallstatt) and Roman time were found.

Hajndl is located north and south of the Ormož – Ptuj main road, on a terrace gently inclined to the south and intersected with many ditches and drains that all collect in three main streams. On the western side, the terrace is bounded by the Lesnica brook, and on the southern and western side by steep foothills that descend to the ca 20 m lower Holocene Drava terrace. On the northern side the terrace rises and forms the lower part of the Slovene Hills (Slovenske gorice). The research area is today mostly planted with various crops (sugar beet, cereals, maize) or covered with grass, while the south west part of the terrace is wooded.

During most recent archaeological research, in 1999 and 2000, the about 250 m long remains of the Roman Ptuj (*Petovio*) – Martin na Muri (*Halicanum*) road were found north of the current Ormož – Ptuj road (Figure 2). From the Roman period, seven well-preserved limekilns were also found and they make a relatively large complex in which a large quantity of lime was obtained, probable for the major centres in the surrounding area.

There are two dwellings that originate from the Early Iron Age (Hallstatt) – both were built from horizontal beams and remnants of the roof-carrying posts were noticed. Several so called cultural pits and fireplaces have been discovered. The pits contained a large amount of ceramic vessels and several bronze fragments dating to the same period. Another type of dwelling that also originates from the Early Iron Age consists of dug out structures. More than 30 such dug out structures were discovered during the research. The floors in them were paved by entire or broken pebbles. Fragments of pottery for everyday use and grindstones were also discovered on the floors. In addition, there were some remaining bones, but due to the acidity of the soil they had been poorly preserved.

Received for publication January 26, 2009

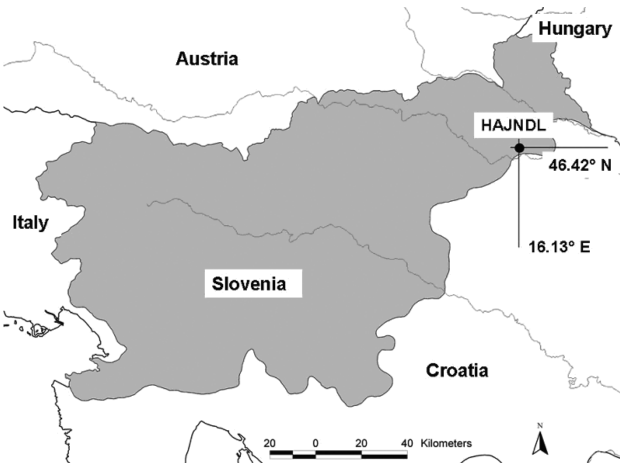

Fig. 1. Hajndl – geographical location of the investigated locality.

Fig. 3. Hajndl – the prehistoric well from Early Iron Age (Žižek 2000[1]).

Several wells were found, of which the best preserved was a square well with a wooden construction (Figure 3) situated in the central part of the complex excavated (Figure 2). The well was build from planks connected mutually with ruts. Wood from the construction of the well was dated by radiocarbon analysis to the Early Iron Age (Hallstatt, ca 2530 B.P., 720–520 cal B.C.; Institute »Ruđer Bošković«, Zagreb, Laboratory for Measurements of Low-level Radioactivity, Z-2975). Unfortunately, there was not enough material for dendrodates of the wood. The content of the well was excavated and after 4 m of empty clay layers, fragments of pottery dated to Early Iron Age were found. Remnants of the pottery were distributed in a 0.5 m thick layer (4–4.5 m depth) and archaeobotanical samples from those layers were taken. The excavation of the well was continued up to almost 7 m in depth, but there were no new findings (Žižek 2000[1], Žižek et al. 2001[2], Žižek – personal communication).

Wells very often provide a lot of excellent preserved and non-carbonised plant material (for example Knörzer 1989[3], Kooistra and Hessing 1988[4], Körber-Grohne 1979[5], Küster 1988[6], Wiethold 1992[7]). But they are a special source of plant remains (Jacomet and Kreuz 1999[8])

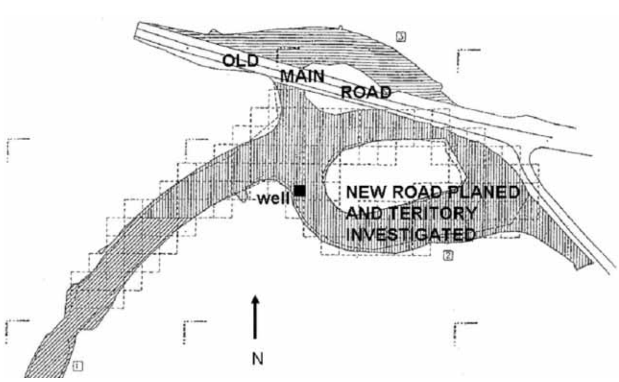

Fig. 2. Hajndl – plan of the excavated area and position of the investigated well (according to Žižek 2000[1]).

because containing secondary deposits and plant remains do not have to be obligatory from the same period as the well itself. Therefore it is necessary to date the investigated plant material directly independently from the dating of the well. In our case the cultural layer has been dated archaeologically by remnants of pottery only.

Material and Methods

During the excavation, five archaeobotanical samples from the prehistoric well were collected by archaeologists. Samples were taken as 10 cm thick slices of the 50 cm wide cultural layer containing pottery of the Early Iron Age.

Samples were left few days in water and periodically gently stirred, then wet-sieved with a stack of three sieves with mesh sizes of 2.5, 1 and 0.3 mm. The volume of the samples was around 1 litre of sediment. Since the analysis of the smallest fraction (0.3 mm) was very time consuming without notable benefit in number of new taxa, only about 1/3 of the smallest fraction was analysed.

The plant remains were identified with the aid of a reference collection and by relevant literature (Beijerinck 1947[9], Körber-Grohne 1987[10], Renfrew 1973[11], Schoch et al. 1988[12]). The nomenclature was adjusted to Martinčić et al. (1999[13]).

The plant remains are kept at the Department of Botany, Faculty of Science, University of Zagreb.

Results and Discussion

In the five analysed archaeobotanical samples from the prehistoric well at the Hajndl locality, a total of 4299 plant macrofossils were found, and 75 plant taxa were identified, most of them to the species level (Table 1). All the plant remains found were non-carbonised and preserved in a quite good, water-logged condition.

TABLE 1
HAJNDL, THE LIST OF TAXA FOUND IN SAMPLES

Taxa:/Depth of cultural layers (cm):	0–10	10–20	20–30	30–40	40–50	Σ
Agrostemma githago L., seed; W			3	1		4
Ajuga reptans L., nutlet; G, SH		1				1
Anagallis arvensis L., seed; W	2				3	5
Anthemis arvensis L., achene; W			2			2
Anthemis tinctoria L., achene; G			2			2
Apiaceae, mericarp		1			5	6
Atriplex patula L./*A. prostrata* Bouch. ex DC., seed; W		3	5	4		12
Bellis perennis L., achene; G			5	5	3	13
Bidens tripartita L., achene; N			17			17
Brassicaceae, seed			5			5
Bryophyta (moss), stem with leaves			7	10	4	21
Camelina sativa (L.) Crantz s.l., seed; C, W	2	6	5			13
Carex sp., nutlet	2		3		1	6
Cerastium sp., seed	2	3	5		6	16
Chenopodium album L., seed; W	12	39	91	70	36	248
Circaea lutetiana L., nutlet; SH	2			1		3
Conium maculatum L., mericarp; W	2	4	14	6	10	36
Corylus avellana L., nut shell (fragm.); F, SH			2	3		5
Daucus carota L. s.l., mericarp; G		1	1		2	4
Fallopia convolvulus (L.) A.Löve, nutlet; W			1			1
Fragaria sp., achene; F		3		5		8
Galeopsis sp., nutlet			1	1		2
Hyoscyamus niger L., seed; W		3				3
Hypericum sp., seed	6	6	15	20	21	68
Lamiaceae, nutlet	4				6	10
Lamium orvala L., nutlet; SH			1			1
Leonurus marrubiastrum L., nutlet; N		3	1	5		9
Linum usitatissimum L., seed; C			1			1
Linum cf. *usitatissimum*, seed; C					3	3
Lycopus europaeus L., nutlet; N	1		30			31
Malus / *Pyrus* sp., seed; F		1		1	8	10
Malva sylvestris L., capsule (fragm.); W			1			1
Malva sp., capsule (fragm.)					3	3
Mentha sp., nutlet	2			5		7
Myosoton aquaticum (L.) Moench, seed; N		6			3	9
Origanum vulgare L., nutlet; SH	8	9	10		6	33
Panicum miliaceum L., caryopsis and glume; C	14	116	266	264	231	891
Papaver dubium L./*P. rhoeas* L., seed; W	8	6		10		24
Papaver somniferum L., seed; C		3	25	5		33
Physalis alkekengi L., seed; F, N	1					1
Plantago major L./*P. media* L., seed; G	6				6	12
Poa annua L., caryopsis; W		3	10	5		18
Poaceae, caryopsis	2	8	20	1		31
Polygonum aviculare L., nutlet; W	17	20	164	80	21	302
Polygonum hydropiper L., nutlet; N	50	226	361	144	83	864
Polygonum lapathifolium L., nutlet; N		2	3	2	1	8
Polygonum persicaria L., nutlet; W	1		1			2

Polygonum sp., nutlet	4	6	21	8	19	58
Potentilla sp., achene				5	6	11
Prunella vulgaris L., nutlet; G			37	20	15	72
Ranunculus acris L., achene; G		5	12	19	6	42
Ranunculus repens L., achene; N	1	1	2			4
Ranunculus sardous Crantz, achene; G			1	4	2	7
Ranunculus sp., achene	1	2			3	6
Rubus fruticosus L. agg., pip; F, SH	1	1	1	1	2	6
Rubus idaeus L., pip; F, SH			2	1	3	6
Rubus sp., pip; F		1	2	1	10	14
Rumex acetosella L., nutlet				5		5
Rumex obtusifolius L./*R. pulcher* L., nutlet; N	2		1	1		4
Rumex sp., nutlet			2	1	1	4
Sambucus ebulus L., pip; N			1	1		2
Sambucus nigra L., pip; F, SH	6	3	37	14	6	66
Sambucus racemosa L., pip; F, SH			26	11		37
Sambucus sp., pip	7	9	17	22	19	74
Solanum nigrum L., seed; W	11	10	45	46	31	143
Sonchus sp., achene		1				1
Spergula arvensis L., seed; W			4			4
Stellaria graminea L./*S. palustris* Retz., seed; G			5		9	14
Stellaria media (L.) Vill., seed; W	2	3	11	5		21
Urtica dioica L., nutlet; N	56	63	312	185	81	697
Urtica urens L., nutlet; W			2			2
Valerianella dentata (L.) Poll., achene; W					1	1
Verbena officinalis L., nutlet; W	10	22	25	35	21	113
Xanthium strumarium L., fruit; W			10			10
Xanthium sp., fruit				1	1	2
INDET.	5	6		29	29	69
Total number of plant remains found in layers:	250	606	1653	1063	727	4299
Total number of taxa (incl. indet.) identified in layers:	32	38	54	43	40	76
Percentage of different taxa presented in layers:	42.1%	50.0%	71.0%	56.5%	52.6%	

C – cultivated plants, F – locally growing fruits, W – weed and ruderal plants, N – nitrophilous herb plants of open soils and moist habitats, G – grassland plants, SH – shrub and herb forest plants

The plant taxa identified are given in the table in alphabetical order and presented according to the samples from which they derive (Table 1).

The plant remains constitute a mixture of introduced cultivated and indigenous species that derive from various biotopes (building up a »thanatocoenosis«, e.g. Behre and Jacomet 1991[14]). A relatively small number of cultivated plant species was found. Remains of millet (*Panicum miliaceum*) were preserved in quite large quantities and in all samples (Table 1), but the other crops – flax (*Linum usitatissimum*), poppy (*Papaver somniferum*) and false flax (*Camelina sativa*) were present in much smaller amounts. Together with crops, quite a large number of weeds that accompany the different crops were found too. Deposits of wells are always of secondary origin filled in after the use as water source, mostly with any kind of waste. The large number of weeds may indicate agricultural activities (Jones 1985[15], 1987[16]; van der Veen 1988[17]). According to the archaeological findings the settlement-complex was quite large and the mixture of weeds and ruderal plants could have been grown in the immediate catchment of the well and the houses.

As well as cultivated plants, a large part of the food of the population of the prehistoric settlement consisted of gathered fruits of wild plants of the surroundings. The fruits of hazel (*Corylus avellana*), wild strawberries (*Fragaria* sp.), apple/pear (*Malus*/*Pyrus* sp.), winter cherry (*Physalis alkekengi*), blackberry (*Rubus fruticosus*), raspberry (*R. idaeus*), common elder (*Sambucus nigra*) and red elder (*S. racemosa*) were part of the forest and forest edge vegetation of the area.

Red elder (*Sambucus racemosa*) probably did not grow in the immediate surrounding of the settlement, rather the fruits were gathered in the forests of the Slovene Hills (Slovenske gorice), which lie north of the site. It is possible that the fruits were washed down by the watercourses into the lower areas. The fruits of the red elder are not edible in a fresh state, and have a sharp and yet insipid taste, and can cause vomiting, nausea and diarrhoea because of the glycoside amygdaline that is found in the pips. In food they can be used after boiling in syrup, jam and so on, but it is still best to take out the pips (Hegi 1918[18]). It is possible that they were used in food, but it cannot be ruled out that because of the coral-red colour they also had ritual importance.

There are three kind of wild strawberries (*Fragaria moschata* Duchesne, *F. vesca* L. and *F. viridis* Duchesne) that cannot be distinguished by their nutlets only The most common and best loved is the wood strawberry (*F. vesca),* and the plant remains found most likely belonged to this species.

Local vegetation

Species composition was analysed in order to reconstruct or to get an impression of the former vegetation and landscape respectively (Figure 4). Each species is assigned to a vegetation type for which it is characteristic or in which it frequently occurs in present day Central-European vegetation. For this purpose the system of characteristic species proposed by Simon et al. (1992[19]) was mainly followed, extended by further standard phytosociological and ecological works (e.g. Ellenberg et al., 1991[20]; Oberdorfer, 1992[21], 1993[22], 2001[23]; Merz 2000[24]). Because the plant communities in prehistoric times differed from those of today, particularly weed communities, they have been reconstructed only to ecological groups representing the ecological conditions at a given habitat.

The analysis has shown that the vast majority of species belongs to the group of weed and ruderal plants – 33% and 22% of the total plant remains (Figure 4) – being members of present day segetal weeds (class *Secalietea cerealis*) and of mostly annual and biennial weeds (class *Chenopodietea*). They comprise ephemeral, ruderal communities of open, nitrophilous soils, developed in vicinity of human settlings and on arable land and, of course, species that can occur in both mentioned classes. A similar character have communities of the class *Bidentetea tripartitae* and the alliance *Convolvulion* comprising nitrophilous plants of open soils and moist habitats, especially river and brook banks, ditches, dikes and similar places in the vicinity of settlements. This »nitrophilous« group is represented with 18% of the species and 42% of the total number of plant remains.

Species characteristic for meadows of the class *Molinio-Arrhenatheretea* are represented by 15% and 4% of total plant remains. This group could indicate meadow communities developed on moist soils and inundate areas along rivers and brooks, as result of local forest clearance for cattle pasture and agriculture (Pott, 1995[25]), but those species could also appear on open soils between houses inside the settlements.

Herb and shrub species of forested areas are also represented by 15% and 4% of the total plant remains, belonging to the class *Querco-Fagetea* (Central-European deciduous woodlands). Hazel (*Corylus avellana),* blackberry (*Rubus fruticosus*), raspberry (*R. idaeus*)*,* common elder (*Sambucus nigra*)*,* red elder (*S. racemosa*), found in the samples, naturally grow at the edges of forests, in small forest clearings, as well as herb species – enchanter's nightshade (*Circaea lutetiana*)*,* wild strawberries (*Fragaria* sp.)*,* giant dead-nettle (*Lamium orvala*) and winter cherry (*Physalis alkekengi*). No tree species have been recorded.

Cocklebur (*Xanthium strumarium* L., Figure 5) has often given rise to discussion as to whether it belongs to the archaeophytes or is indigenous (Brande, 1976[26], Brinkkemper and Kuijper, 1993[27], Opravil, 1983[28], Otte and Mattonet, 2001[29]). Macro-fossils of *Xanthium* from the Hajndl site are among the oldest finds of this type in Europe (Bouby and Marinval, 2002[30], Dálnoki and Jacomet, 2002[31], Wiethold, 2001[32]).

As the plant remains were dated only indirectly, it is not quite clear if the well has lost its function and was artificially filled by man already in early Iron Age or later. Palynological study of this locality was not made. Pollen analysis of the neighbouring areas (for example Culiberg

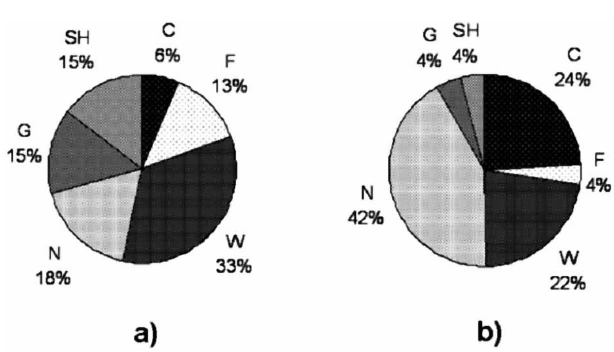

Fig. 4. The identified plant species grouped in ecological categories: a) according to number of different plant species; b) according to total number of plant remains. C – cultivated plants, F – locally growing fruits, W – weed and ruderal plants, N – nitrophilous herb plants of open soils and moist habitats, G – grassland plants, SH – shrub and herb forest plants.

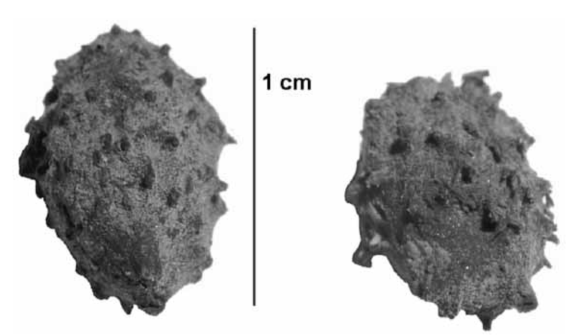

*Fig. 5. Fruits of the cocklebur (*Xanthium strumarium*) found at Hajndl.*

and Šercelj, 1996[33], Gardner, 1997[34]) show the general and well known facts that the forest clearing took place since Neolithic, with undoubtedly visible sharp oscillations of the ratios of arboreal to non-arboreal pollen with a tendency towards a rise in the *Poaceae-Cyperaceae* group and a diminution of *Abies-Fagus* forests during the first millennium B.C. The plant remains show a strong local anthropogenic influence on the natural vegetation, which is deciduous woodland for this region, and local forest clearance probable took place not only for the settlement but also for crop fields and possibly for the grazing of cattle. But without local palynological study it is not possible to define largeness of the forest clearance.

According to available literature there are few localities from Iron Age in Slovenia with carbonised plant remain findings (Culiberg and Šercelj, 1995[35], 1995[36], Jeraj et al., 2009[37]). They are different type of locality, comparing with Hajndl, but have usual archaeobotanical similarities: composition of the samples is also mostly presented with mixture of cultivated and weed species, and millet (*Panicum miliaceum*) also occurs often in quite large quantities, what is very often case in archaeobotanical studies since the Neolithic.

Conclusions

Archaeobotanical study of plant remains, mostly fruits and seeds, from an Early Iron Age well (720–520 cal B.C.) at Hajndl indicate local vegetation developed under strong anthropogenic influence and on mainly moist and nitrogen-rich soils. Botanical evidence of locally intensive human influence are the high proportion of annual weed, ruderal and nitrophilous plant species which in natural, anthropogenic uninfluenced plant communities cannot persist in concurrence with perennial plant species. Furher evidence of intensive human activity are grassland plants and almost complete lack of tree and shrub species characteristic for the climax vegetation (deciduous woodland).

Remnants of millet (*Panicum miliaceum*) were preserved in quite large quantities and it seemed that millet was a very important crop. Together with other founded crops (*Linum usitatissimum, Papaver somniferum* and *Camelina sativa*) and with quite a large number of accompanied weeds it gives evidence for agriculture activities, but a mixture of nitrophilous weeds and ruderal plants was very probable also grown inside the settlement complex.

Acknowledgements

Many thanks to Ivan Žižek (Regional museum Ptuj, Slovenia) and other archaeologists for collecting archaeobotanical samples and providing archaeological data. The laboratory work on Hajndl samples was done at the Institute of Geobotany, University of Hannover, Germany. Financial support came from German Academic Exchange Service (DAAD), Bonn, Germany. Many thanks to Sven Jelaska for making the map of geographical location of Hajndl locality and to Manfred Rösch, Julian Wiethold and Almuth Alsleben for fruitful discussion and advices. Special thanks to Stefanie Jacomet for comments on previous version and providing useful literature information and Felix Bittmann for comments and corrections on final version of the article.

REFERENCES

1. ŽIŽEK I, Zaščitna arheološka izkopavanja Hajndl 1999/2000 – izvještaj (Pokrajinski muzej Ptuj, Ptuj, 2000). — 2. ŽIŽEK I, OLIČ S, KRAJŠEK J, TOPOLOVEC V, FARIČ B, KERMAN B, URŠIĆ-JESENIK N, Pod cestoj, Zaščitna arheološka izkopavanja Hajndl 1999/2000, Rezstavna brošura – Avla občine Ormož, 02.03.–31.03.2001 (Pokrajinski muzej Ptuj, Ptuj, 2001). — 3. KNÖRZER KH, Bonner Jahrbücher, 189 (1989) 252. — 4. KOOISTRA LI, HESSING WAM, Berichten ROB, 38 (1988) 207. — 5. KÖRBER-GROHNE U, Einige allgemeine Bemerkungen zu einer Pflanzensociologischen Zuordnung subfossiler Floren des Postglazials. In: TÜXEN R (Ed) Werden und Vergehen von Pflanzengesellschaften. Berchte der Internationalen Symposien der Internationalen Vereinigung für Vegetationskunde, Rinteln, 20.–23. März 1978 (Cramer, Vaduz, 1979). — 6. KÜSTER H, Vortr Niederbay Archäologentag, A 6/1 (1988) 175. — 7. WIETHOLD J, Archäologische Nachrichten aus Schleswig-Holstein, 3 (1992) 47. — 8. JACOMET S, KREUZ A, Archäobotanik (Ulmer, Stuttgart, 1999). — 9. BEIJERINCK W, Zadenatlas der nederlandsche flora (Veenman & Zonen, Wageningen, 1947). — 10. KÖRBER-GROHNE U, Nutzpflanzen in Deutschland, Kulturgeschichte und Biologie (Theiss, Stuttgart, 1987). — 11. RENFREW JM, Palaeoethnobotany, The prehistoric food plants of the Near East and Europe (Methuen, London, 1973). — 12. SCHOCH WH, PAWLIK B, SCHWEINGRUBER FH, Botanische Makroreste (Haupt, Bern 1988). — 13. MARTINČIĆ A, WRABER T, JOGAN N, RAVNIK V, PODOBNIK A, TURK B, VREŠ B (Eds) Mala flora Slovenije, Ključ za določanje praprotnic in semenk, Ed 3 (Tehniška založba Slovenije, Ljubljana, 1999). — 14. BEHRE K-E, JACOMET S, The ecological interpretation of archaeobotanical data. In: ZEIST W VAN, WASYLIKOWA K, BEHRE K-E (Eds) Progress in Old World Palaeoethnobotany (Balkema, Rotterdam, 1991). — 15. JONES M, Archaeobotany beyond subsistance reconstruction. In: BARKER GW, GAMBLE C (Eds) Beyond Domestication in Prehistoric Europe. (Academic Press, London, 1985). — 16. JONES G, J Archaeol Sci, 14 (1987) 311. — 17. VAN DER VEEN M, BAR International Series, 401 (1988) 99. — 18. HEGI G, Illustrierte Flora von Mittel-Europa VI/1 (Sambucus) (München, 1918). — 19. SIMON T, HORÁNSZKY A, DOBLOYI K, SZERDAHELYI T, HORVÁTH F, A magyar edényes flóra értékelő táblázata. In: SIMON T (Ed) A Magyarországi edényes flóra határozója (Nemzeti Tankönyvkiadó, Budapest, 1992). — 20. ELLENBERG H, WEBER HE, DÜLL R, WIRTH V, WERNER W, PAULIßEN D, Scripta Geobotanica, 18 (1991) 1. — 21. OBERDORFER E, Süddeutsche Pflanzengesellschaften, Teil IV: Wälder und Gebüsche. 2. Aufl. (Fischer, Jena, 1992). — 22. OBERDORFER E, Süddeutsche Pflanzengesellschaften, Teil III: Wirtschaftwiesen und Unkrautgesellschaften, 3. Aufl. (Fischer, Jena, 1993). — 23. OBERDORFER E, Pflanzensoziologische Exkursionsflora für Deutschland und Angrenzende Gebiete (Ulmer, Stuttgart, 2001). — 24. MERZ P, Pflanzengesellschaften Mitteleuropas und der Alpen (Ecomed, Landsberg/Lech, 2000). — 25. POTT R, Fitosociologia, 29 (1995) 7. — 26. BRANDE A, Bot Jahrb Syst, 95 (1976) 406. — 27. BRINKKEMPER O, KUIJPER WJ, Archaeo-Physika, 13 (1993) 81. — 28. OPRAVIL E, Flora, 173 (1983) 71. — 29. OTTE A, MATTONET B, Braunschweiger Geobot Arbeiten, 8 (2001) 221. — 30. BOUBY L, MARINVAL P, Les données encore partielles sur l'alimentation à Vieille-Toulouse. In: PAILLER JM (Ed) Tolosa, Nouvelles recherches sur Toulouse et son territoire dans l'Antiquité École Franç Rome (Ecole française de Rome, Rome, 2002). — 31. DÁLNOKI O, JACOMET S, Veget Hist Archaeobot, 11 (2002) 9. — 32. WIETHOLD J, Recherches archéobotaniques en Frane Centre-Est. Campagne 2001. Rapport annuel d'activité 2001 du Centre archéologique européen du Mont Beuvray (Bibracte, Glux-en-

-Glenne, 2001). — 33. CULIBERG M, ŠERCELJ A, 20. Slovenia. In: BERGLUND BE, BIRKS HJB, RALSKA-JASIEWICZOWA M, WRIGHT HE (Eds) Palaeoecological Events During the Last 15000 Years: Regional Syntheses of Palaeoecological Studies of Lakes and Mires in Europe (Wiley, Chichester, 1996). — 34. GARDNER A, Poročilo o raziskovanju paleolita, neolita in eneolita v Sloveniji, 24 (1997) 63. — 35. CULIBERG M, ŠERCELJ A, Archeološki vestnik, 46 (1995) 169. — 36. CULIBERG M, ŠERCELJ A, Opera Inst Archeol Sloveniae, 1 (1995) 195. — 37. JERAJ M, VELUŠČEK A, JACOMET S, Veget Hist Archaeobot, 18 (2009) 75.

R. Šoštarić

University of Zagreb, Faculty of Science, Department of Botany, Marulićev trg 20/2, 10000 Zagreb, Croatia, e-mail: renata@botanic.hr

BILJNI OSTACI IZ BUNARA U HAJNDLU, SLOVENIJA, IZ RANOG ŽELJEZNOG DOBA

S A Ž E T A K

Analizirani arheobotanički uzorci potječu iz dobro očuvanog bunara iz razdoblja ranog željeznog doba (Hallstatt). Starost nađenih biljnih ostataka datirana je na temelju keramike nađene u istim slojevima iz kojih potječu uzorci, a starost bunara (720–520 pr. Kr.) određena je analizom njegove drvene konstrukcije metodom radioaktivnog ugljika. Kultivirane biljke (*Panicum miliaceum, Linum usitatissimum, Papaver somniferum i Camelina sativa*) zabilježene su u relativno malom broju, dok primarne žitarice uopće nisu nađene. Nalazi kultiviranih biljaka, zajedno s velikim brojem pratećih korova, sugeriraju poljodjelsku aktivnost, ali mješavina korova i ruderalnih biljaka vrlo je vjerojatno rasla i unutar relativno velikog kompleksa naselja i mogla je sasvim slučajno dospjeti u analizirane slojeve. Sastav nađenih biljnih svojti pokazuje da se lokalna vegetacija razvijala pod jakim utjecajem čovjeka te uglavnom na vlažnom i dušikom bogatom tlu. Travnjačke biljke i potpuno odsustvo drvenastih vrsta karakterističnih za vegetacijski klimaks istraživanog područja (listopadne mezofilne miješane šume) također ukazuju na jak, barem lokalni, antropogeni utjecaj.