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## THE NEOLITHIC IN CONTINENTAL SLOVENIA ACCORDING TO THE RADIOCARBON CHRONOLOGY: WHERE CAN IT BE PLACED?

### IL NEOLITICO DELLA SLOVENIA CONTINENTALE E LE DATAZIONI AL RADIOCARBONIO: LO STATO DELL'ARTE

**Riassunto breve** - Lo studio del Neolitico ed Eneolitico in Slovenia ha una lunga tradizione che risale alla fine del XIX secolo, ma possono essere ancora considerati periodi archeologici scarsamente studiati in questa nazione. Ci sono varie ragioni che giustificano questa situazione: fra queste il relativamente basso numero di siti neolitici identificati e studiati in maniera completa, la mancanza di prospezioni o ricerche sistematiche, di datazioni assolute e la carenza di pubblicazioni edite. Negli ultimi anni vi è stato un certo miglioramento dello stato delle conoscenze in questi settori. In questa nota vengono prese in considerazione le datazioni assolute relative a siti neolitici della Slovenia centrale. Sebbene la prima datazione assoluta (Resnikov prekop) fosse disponibile già oltre trent'anni fa, solo in quest'ultimo decennio è stato sviluppato un programma sistematico di datazione assoluta di alcuni dei siti neolitici oggetto di scavo consentendo così una significativa crescita della mole di datazioni disponibili.

**Parole chiave:** Neolitico, Slovenia continentale, Datazioni al radiocarbonio.

**Abstract** - *The study of the Neolithic and Eneolithic periods in central Slovenia has a long tradition, which began around the end of 19th century, although it is still to be considered a poorly studied archaeological period. This is due to several reasons, one of which is the relatively small number of discovered and excavated Neolithic sites, the absence of systematic surveys and researches, the low number of absolute dating programs and monographic publications. During last decades the situation has greatly improved from every point of view. The paper considers radiocarbon dates from several Neolithic sites, located in continental Slovenia. Although the first radiocarbon date from Resnikov prekop was obtained more than thirty years ago, only during the last decade programs of systematic radiocarbon dating from a few excavated sites improved considerably our knowledge of the absolute chronology of the Neolithic period in the study region.*

**Key words:** Neolithic, Continental Slovenia, Radiocarbon dates.

## Introduction

Neolithic and Eneolithic studies have a long tradition in Slovenia, from the end of 19th century onwards, although until recently we could consider both of the above-mentioned archaeological periods poorly studied. This is due to various reasons, among which are the relatively small number of discovered and excavated Neolithic sites, the absence of surveys and systematic research, the scarcity of absolute dating programs and the low number of monograph publications. During the last decades the situation has greatly improved.

This paper considers available data<sup>(1)</sup> on Neolithic period in continental Slovenia<sup>(2)</sup> with special regard to the

radiocarbon chronology. Although the first radiocarbon date from the Neolithic site Resnikov prekop, which was first excavated in the 1960s (KOROŠEC 1964), was obtained some thirty years ago, it is only during the last decade that systematic dating programs have been made in some regions where Neolithic research has been conducted (GUŠTIN 2005; ŽIBRAT GAŠPARIČ 2008). The results provided us with a more accurate absolute chronology of the earliest Neolithic farming populations in the territory of continental Slovenia.

## The Neolithic in central, southeast and north-east Slovenia according to the radiocarbon dates

The Archaeological interest in the Prehistory of central Slovenia started with the discovery of pile-dwellings in Ljubljana marshes in 1875 (KOROŠEC & KOROŠEC 1969: 11). Although interest in prehistory started as

1) This paper was finished in 2009. Since then some new data on radiocarbon dates in Slovenia has been published, however they are not considered in present paper.

2) The coastal region and the Karst area have not been considered in this paper, since they represent archaeologically and culturally completely different situation.

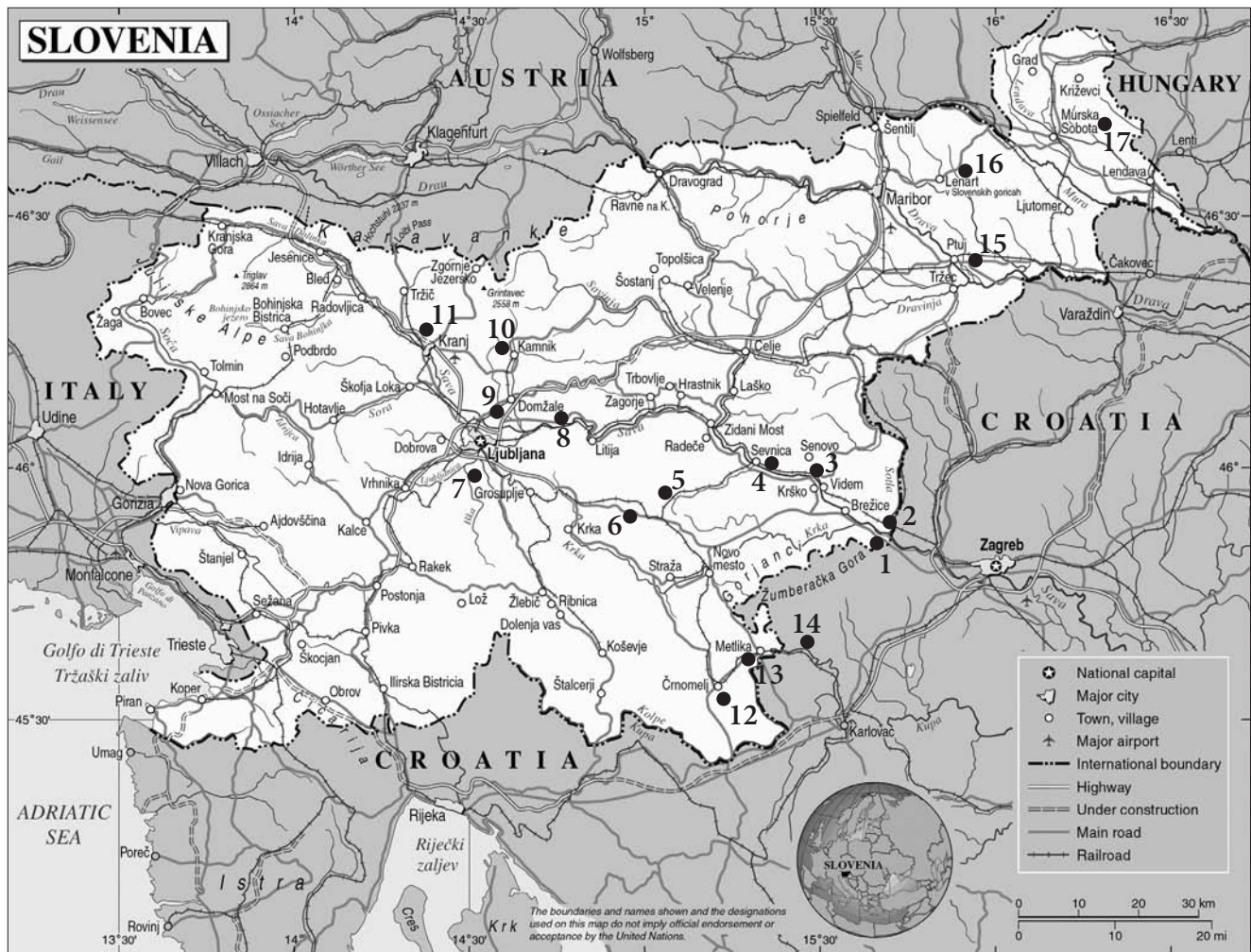


Fig. 1 - Distribution map of the most important Neolithic sites in continental Slovenia (map source: <http://www.un.org/Depts/Cartographic/map/profile/slovenia.pdf>). 1 - Čatež-Sredno polje, 2 - Col near Podgračeno, 3 - Ajdovska jama near Nemška vas, 4 - Sevnica, 5 - Gradec near Mirna, 6 - Ponikve near Trebnje, 7 - Resnikov prekop, 8 - Škovce near Dolsko, 9 - Dragomelj, 10 - Kamnik (Mali grad) and (Kratna above Kamnik), 11 - Drulovka near Kranj, 12 - Pusti gradec, 13 - Moverna vas, 14 - Ozalj - Stari grad (north Croatia), 15 - Ptuj - Ptujski grad and Ptuj - Srednješolski center, 16 - Andrenči, 17 - Bukovnica.

- I più importanti siti neolitici della Slovenia continentale (la mappa è tratta da: <http://www.un.org/Depts/Cartographic/map/profile/slovenia.pdf>). 1 - Čatež-Sredno polje, 2 - Col presso Podgračeno, 3 - Ajdovska jama presso Nemška vas, 4 - Sevnica, 5 - Gradec presso Mirna, 6 - Ponikve near Trebnje, 7 - Resnikov prekop, 8 - Škovce near Dolsko, 9 - Dragomelj, 10 - Kamnik (Mali grad) and (Kratna sopra Kamnik), 11 - Drulovka near Kranj, 12 - Pusti gradec, 13 - Moverna vas, 14 - Ozalj. Stari grad (Croazia settentrionale), 15 - Ptuj. Ptujski grad and Ptuj. Srednješolski center, 16 - Andrenči, 17 - Bukovnica.

early as mentioned above, the 1960s can be considered the most productive decade in the Neolithic studies of the last century.

The archaeological remains from Ajdovska jama near Nemška vas were studied and interpreted as Neolithic ones by Josip Korošec as early as in 1953. Resnikov prekop in Ljubljana basin, Drulovka in Gorenjska region and Ptujski grad in Podravje were discovered and excavated during the 1960s. J. Korošec excavated and published all three sites (Resnikov prekop (KOROŠEC 1964), Drulovka (KOROŠEC 1956, 1960), Ptujski grad (KOROŠEC 1965) and they were considered as the most important Neolithic sites in Slovenian territory for a long period of time. They were the key sites for the establishment of the cultural and chronological

framework of the Neolithic period in the continental part of Slovenia<sup>3)</sup>.

Neolithic studies in Slovenia were overwhelmed with debate of the cultural and chronological attribution of the archaeological finds (mostly ceramics) from these sites for several decades. The aforementioned debate regarded mainly two different views. According to Korošec, these finds were to be chronologically attributed to the late Neolithic, and culturally to the "so-called" Alpska facies lengyelske kulture (Alpine facies of the Lengyel Culture) (KOROŠEC 1960, 1964, 1965). The Slovenian authors in general followed Korošec's first

3) Ljubljana Basin, Gorenjska, Dolenjska and Štajerska with Podravje region.

interpretation, and took into consideration also some cultural influences from Dalmatia (BREGANT 1968, 1974; BATOVIĆ 1975; HAREJ 1986; TEŽAK-GREGL 2001). Quite opposite was, for example, Dimitrijević's opinion. He attributed all the Slovenian sites to the Eneolithic Lasinja Culture (DIMITRIJEVIĆ 1961, 1979a, 1979b), and saw most evident connections with the Pannonian plain. S. PAHIČ (1976) and F. LEBEN (1973, 1979) were of the same opinion, and ascribed the Slovenian sites to the Lasinja culture. Some foreign researchers attributed the archeological remains from the above-mentioned Slovenian sites to the so-called Eneolithic Horizon as well (PARZINGER 1984, 1993; KALICZ 1988, 2001).

In the late 1980s two important sites were excavated. M. Horvat opened new excavations in Ajdovska jama, a site that was already known (HORVAT 1989), while M. Budja excavated the Neolithic and Eneolithic site at Moverna in Bela Krajina (BUDJA 1988, 1990, 1992, 1993a, 1993b). Roughly during the same period the Archaeological Institute of Archaeology of Slovenian Academy of Science and Arts started systematic researches at fortified prehistoric settlements in the Dolenjska Region. As a consequence the first Neolithic hilltop settlements, among which is Gradec near Mirna, were discovered (DULAR et al. 1991; DULAR 2001).

New efforts in documenting and excavating Neolithic sites were made in the late 1990s and at the beginning of this century within the project Archaeology on Slovenian Motorways, when Dragomelj (TURK & SVETLIČIČ 2005), Čatež-Sredno polje (GUŠTIN et al. 2005a; TOMAŽ 2005, 2008) and Col 1 near Podgračeno (HORVAT 2005) were discovered and systematically excavated. Also important were the reviews of archaeological finds from the old excavations carried out at Drulovka (GUŠTIN et al. 2005b) and Ptujski grad (TOMANIČ-JEVREMOV et al. 2006), which offered some new insights into the Neolithic material culture.

During more than 130 years in the history of the research, quite numerous Neolithic sites were discovered and excavated; equally interesting and stimulating was the debate concerning their interpretation as already mentioned<sup>4)</sup>. The most recent proposal was made in 2005, when all the new data allowed M. Guštin to produce a new interpretation of the cultural attribution of the archaeological finds from the Neolithic sites of central and southeast Slovenia (GUŠTIN 2005). The evident concentration of Neolithic sites along the Sava river valley was a good argument to name this phenomenon the Sava Group of the Lengyel Culture. In 2008 and 2009 archeological finds from the excavations carried out at the Neolithic site at Škovce, near Dolsko (ŽORŽ 2008), and also from Ponikve, near Trebnje (unpublished),

allowed the excavators to attribute these settlements also to the Sava group of the Lengyel Culture.

The Sava group of the Lengyel Culture, according to M. GUŠTIN (2005), includes sites in the Sava river valley and its surrounding area; among these are Drulovka (KOROŠEC 1956, 1960; GUŠTIN et al. 2005b), Mali grad in Kamnik (SAGADIN 2005), Kratna above Kamnik (VELUŠČEK 2005), Dragomelj (TURK & SVETLIČIČ 2005), Resnikov prekop (KOROŠEC 1964; TOMAŽ 1999; TOMAŽ & VELUŠČEK 2005; VELUŠČEK 2006), Gradec near Mirna (DULAR et al. 1991), Čatež-Sredno polje (GUŠTIN et al. 2005a; TOMAŽ 2005, 2008), Ajdovska jama near Nemška vas (KOROŠEC 1953; HORVAT 1989), Col near Podgračeno (HORVAT 2005) and Sevnica (BUDJA 1991) (fig. 1, 5), to mention only the most important ones.

The material culture from all these sites has very similar characteristics both in the ceramic and stone tool-assemblages. The similarities are so close that they do validate their grouping into a single cultural phenomenon. Among the ceramic vessels, wide, opened bowls with or without foot as well as biconical pots of various dimensions are the most characteristic forms (fig. 2), while ladles with a quiver-shaped handle represent one of the most common features both in the Sava group sites and the others in Bela Krajina region or in east Slovenia. The Sava group pottery is also typified by a very distinct decoration technique. Some of the sites yielded more than 60% of the potsherds decorated with finger-impression patterns, while appliqués and incised decorations are less common (GUŠTIN 2005: 20; TOMAŽ 2005: 114). Besides shapes and decoration techniques it is also the production technology that ties the ceramics from the Sava group settlements. The technological characteristics of the pottery from all the above-mentioned sites are closely related, because they exhibit similar tempering techniques, surface treatments and firing methods (GUŠTIN 2005: 20; TOMAŽ 2005: 114-115). Considering the pottery technology, the ceramics from Čatež-Sredno polje and Dragomelj seem to have the most similar technological characteristics (TURK & SVETLIČIČ 2005; TOMAŽ 2005).

It is important to point out that in general, similar pottery can be found also outside the distribution territory of the Sava Group, mostly in northeast Slovenia and Bela Krajina. This is however not surprising, because the two regions fit well into the Lengyel Culture area of distribution as a whole (GUŠTIN 2005: 20). The pottery from the Neolithic sites of northeastern Slovenia, like Andrenci (PAHIČ 1976) and Bukovnica (ŠAVEL 1994), show some similarities in vessel forms; however their characteristics consist of decorations and forms with more "classic" Lengyel traits (fig. 3) (GUŠTIN 2005: 20). Another important site, showing similarities in pottery production with Sava group sites is located in Bela Krajina. The comparison between the archaeological assemblages shows close similarities,

4) For the overviews of the history of the Neolithic studies in Slovenia see LEBEN 1979; BUDJA 1983, 1993b; VELUŠČEK 1999; PETRU & BUDJA 2003.

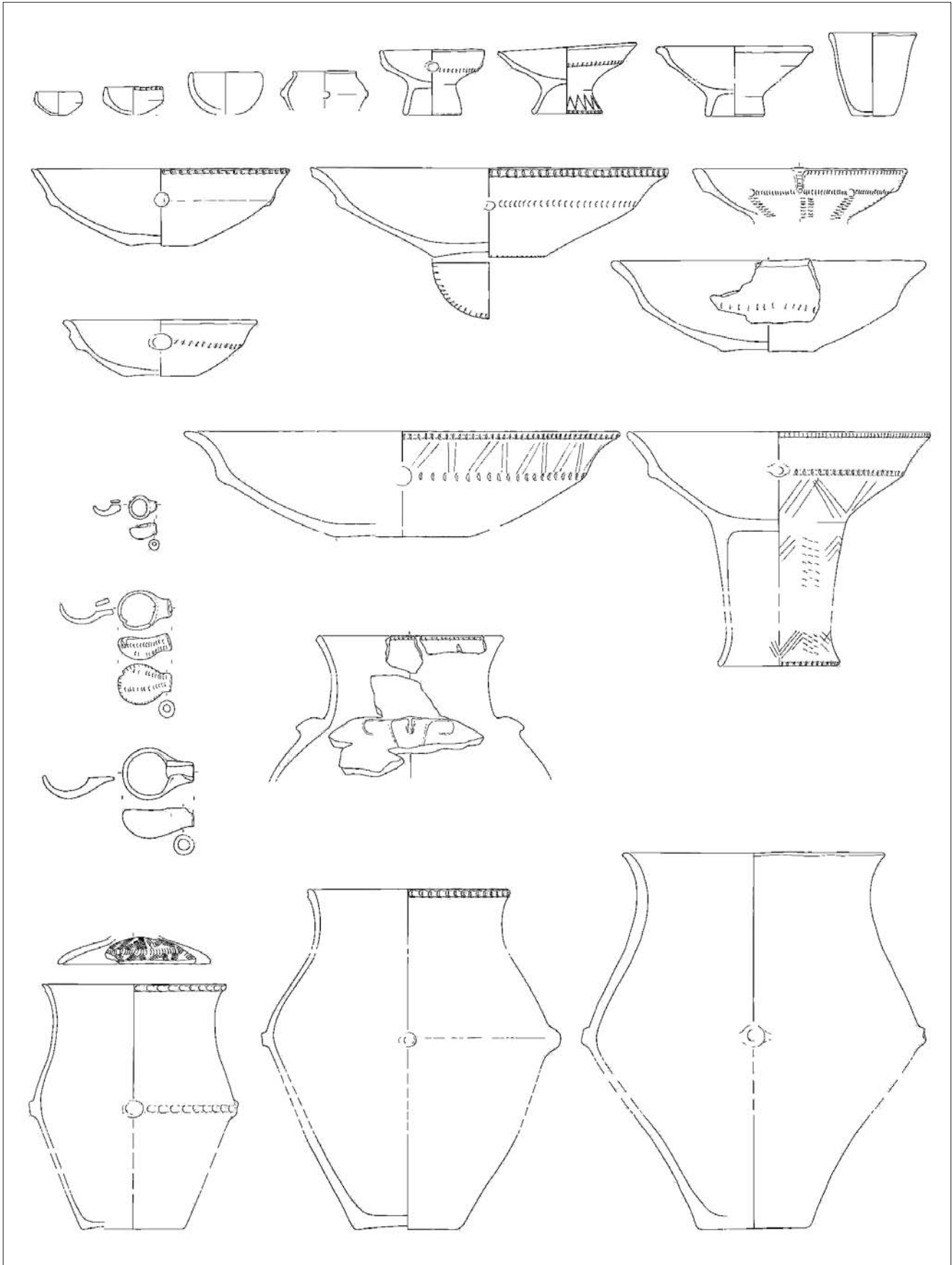


Fig. 2 - Characteristic vessel shapes of the Sava group of the Lengyel culture from Čatež-Sredno polje (south-eastern Slovenia; not in scale).  
 - *Ceramica caratteristica del Gruppo Sava della Cultura di Lengyel da Čatež-Sredno polje (Slovenia SW; non in scala).*

although differences can also be noticed. In Moverna vas similar vessel forms can be found as in Sava group sites, however the diversity of different vessel forms is much higher in Moverna vas (fig. 4). Between the two ceramic productions apparent differences can be observed also in the quality of manufacture and in applied decoration techniques (GUŠTIN 2005: 20). These differences might indicate a regionalisation of the Lengyel culture in the area, due to geographic reasons (GUŠTIN 2005: 21).

What do the radiocarbon dates tell us about the aforementioned archaeological records? In Slovenia only four sites have produced a sequence of radiocarbon dates (Čatež-Sredno polje, Moverna vas, Ajdovska jama near Nemška vas and Hardek) that belong to the 5th Millennium BC. All the others have only one or two available radiocarbon dates. This fact makes our attempt a bit more complicated; however some conclusions on radiocarbon chronology of Neolithic in continental Slovenia can be drawn.

So far the Neolithic settlement of Čatež-Sredno polje has the most complete list of radiocarbon dates (tab. I). A set of 21 radiocarbon dates, which cover a relatively short time-span, places Čatež-Sredno polje into a well-defined time frame. The oldest date so far obtained place the archaeological context PO 136 in Čatež-Sredno polje in 5992±36 BP (Lab. Number KIA 17864). Calibrated at 2σ<sup>(5)</sup> this would mean 4954-4776 cal. BC (prob. 94.4%) (tab. I). The youngest date obtained in Čatež-Sredno polje, not taking into consideration results from archeological structure PO 70, which appear to be too young in comparison with related archeological finds (tab. I)<sup>(6)</sup>, is archaeological context PO 90. Radiocarbon date for this archeological context is 5718±32 BP (Lab. Number KIA 17854), which would calibrated at 2σ mean time span 4620-4486 (prob. 80.9%) (tab. I). All the other dates from Čatež-Sredno polje range between these two time limits.

The consistency and chronological uniformity of the Sava group sites is attested also by one radiocarbon date from Dragomelj (TURK & SVETLIČIČ 2005: 69).

Radiocarbon date for charcoal sample from Dragomelj (Lab. Number Beta-162366) is 5730±50 BP. Calibrated in 2σ this would mean 4700-4460 cal. BC (prob. 95%) (tab. II). The date fits well into the group of the Čatež-Sredno polje dates.

Interesting also are the radiocarbon dates for Resnikov prekop (named also Resnikov Kanal), which at least partly correspond with those from Čatež-Sredno polje and Dragomelj. The first published date from Resnikov prekop, which was published in 1977 (SRDOČ et al. 1977: 472), at least according to its sample ID number (Lab. Number Z-354), places archeological remains in 5850±150 BP (SRDOČ et al. 1977: 472). For Resnikov prekop we are considering in this paper only the date published by SRDOČ et al. (1977), since in all other reports there are some inconsistencies regarding this date<sup>(7)</sup>.

In 1994 M. Budja introduced somewhat different date for Resnikov prekop, 5856±93 BP (BUDJA 1994: fig. 5)<sup>(8)</sup>. In 2006 Čufar and Korenčič published a new radiocarbon date for a wooden pile from Resnikov prekop, 5718±23 BP (Lab. Number Hd-24038), which calibrated at 2σ means 4675-4465 cal BC (tab. II; ČUFAR & KORENČIČ 2006: 124).

Both radiocarbon dates for Resnikov prekop were published also by MLEKUŽ, BUDJA & OGRINC (2006: tab. 1); however there seems to be some inconsistencies with quotation of sample ID number Z-345 (accurate: Lab. Number Z-354), the radiocarbon dates values seems to be substituted (accurate: for sample Lab. Number Hd-24038: 5718±23 BP and for sample Lab. Number Z-345 (Z-354): 5850±150 BP) and there is imprecise quotation of primary reference (accurate: SRDOČ et al. 1977: 472) (Radiocarbon journal checked). Budja and Mlekuž published the list of radiocarbon dates for Resnikov prekop also in 2008 (BUDJA & MLEKUŽ 2008: tab. 1), with some other inconsistencies. The sample ID Lab. Number Z-345 is inaccurate (accurate: Z-354)<sup>(9)</sup>, and there are some differences also in values of calibrated age at 2σ, at least in comparison with their quoted reference (ČUFAR & KORENČIČ 2006: 124)<sup>(10)</sup>.

5) All dates from Čatež-Sredno polje site have been calibrated with "CALIB rev 4.3, STUIVER et al., Radiocarbon 40 (1998) 1041-1083.

6) Finds from archaeological context PO 70 do not differ from finds, discovered in other Neolithic structures, which are dated to the first half of the 5th Milenium BC. According to pottery analysis, finds from structure PO 70 and other structures are homogenous in terms of vessel shapes, applied decorative techniques as well as in technological characteristics. However, a charcoal sample from context PO 70 (Lab. Number KIA 17851) produced a date, which places it in 5309±45 BP; calibrated at 2σ this would mean 4249-4037 (prob. 87.8%). In comparison to the oldest date from PO 136, this would mean that finds from PO 70 are cca. 700 years younger than the oldest finds at Čatež-Sredno polje or ca. 400 years younger than finds from PO 90. Although ceramic finds from Čatež-Sredno polje exhibit great deal of uniformity throughout the duration of the settlement, radiocarbon date for PO 70 appears to be in our opinion very questionable.

7) The date for Resnikov prekop has been also reported by S. Dimitrijević (Lab. Number Zgb-354) in Praistorija Jugoslavenskih zemalja (DIMITRIJEVIĆ 1979b: 179); but Dimitrijević dates for Resnikov prekop are 3874±150 (Lab. Number Zgb-354) and 3906 (Zgb) (DIMITRIJEVIĆ 1979b: 179). So, from these early years, we have two papers, two site names, one sample number from the Rudjer Bošković Institute in Zagreb and three different dates.

8) The radiocarbon date is published with no Sample ID number, thus making it hard to correlate with original data.

9) Also the original publication of this date is in SRDOČ et al. 1977, 472 (Radiocarbon journal checked).

10) Namely Čufar's and Korenčič's values of calibration at 2σ places their date between 4675-4465 cal. BC (no percentage offered) (ČUFAR & KORENČIČ 2006: 124), while Budja's and Mlekuž's calibration at 2σ produced two different time spans 4678-4619 cal. BC (no percentage offered) and 6627-6437 cal. BC (no percentage offered) using CALIB version 5.10 (REIMER et al. 2004) (BUDJA & MLEKUŽ 2008: 50, tab.1).

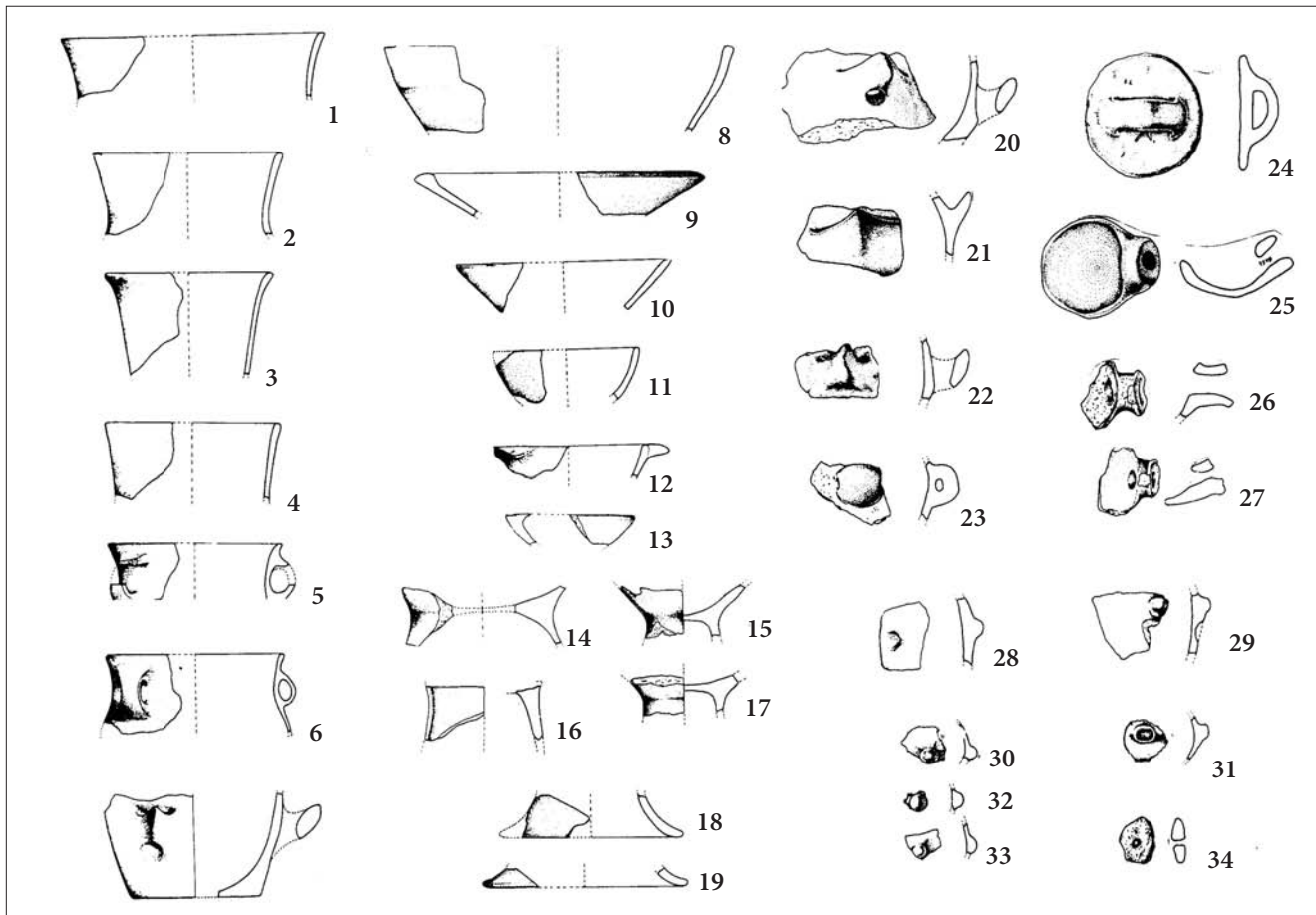


Fig. 3 - Characteristic vessel shapes from Bukovnica in northeast Slovenia (after ŠAVEL 1994, Priloga 18)  
 - *Ceramica caratteristica di Bukovnica in Slovenia nord-orientale (da ŠAVEL 1994, Priloga 18).*

According to M. Andrič, five radiocarbon dates were produced for Resnikov prekop as a part of palynological analysis (ANDRIČ 2006: 108, tab. 2). They established that palaeoecological sedimentary sequence at Resnikov Prekop is incomplete, because section dated between ca. 6000-200 cal. BC was according to author presumably removed from the sequence by running water (ANDRIČ 2006: 108, 113). Available dates do not provide us with more information about the cultural layer, which is of a special interest to us; nevertheless they gave valuable information about vegetation and palaeoenvironment in two separate periods before ca. 6000 cal BC and after ca. 200 cal. BC (ANDRIČ 2006: 108, 113).

Another important, radiocarbon-dated site is a cave site Ajdovska jama near Nemška vas (tab. II; SRDOČ et al. 1984, 1987; see also OGRINC 1999: 197, 198, tab. 1, 2<sup>(11)</sup>). It is the only known Neolithic site in Slovenia, where human

burials have been discovered. Archaeological sequence in Ajdovska jama was dated for the first time as early as in 1984 (SRDOČ et al. 1984) and since then quite a few radiocarbon dates have been produced, mainly in Zagreb laboratory (tab. II, with references)<sup>(12)</sup>. According to Radiocarbon journal, the oldest date derives from Grave 1 and place it in 5620±130 BP (Lab. Number Z-1044) (SRDOČ et al. 1984, 451) and the youngest date came from charcoal 4410±70 BP (Lab. Number Z-2301) (OBELIĆ et al. 1994, 308), excluding sample Lab. Number Z-1603, which is clearly too divergent (SRDOČ et al. 1987: 139) to be considered. Majority of these dates are old and with large standard deviation. In addition inconsistent publication and reinterpretation of the original dates resulted in very imprecise determination of a time periods, when cave has been used as a burial-ground and periods, when cave has been used used for other purposes. According to Velušček, who compared and reinterpreted available radiocarbon dates for Ajdovska jama, the timeframe of

11) Dates, published by OGRINC (1999: tab. 1, 2), differ from ones, published in Radiocarbon (SRDOČ et al. 1984, 1987) or by HORVAT (1984, 1989) or by CULIBERG, HORVAT & ŠERCELJ (1992). These dates have been published without sample ID number, so it is not possible to correlate them with original data. Dated samples derived primarily from animal and human bones and they cover period 5300 BP and 6000 BP (OGRINC 1999: tab. 1, 2). Due to these reasons, these dates were not considered in present paper.

12) Radiocarbon dates from Ajdovska jama were reported by different authors in several instances, besides the original publications in Radiocarbon journal (SRDOČ et al. 1984, 1987, 1992; OBELIĆ et al. 1994), and their reinterpretations of the original dates differ considerably (compare HORVAT 1984, 1989; or by CULIBERG, HORVAT & ŠERCELJ 1992).

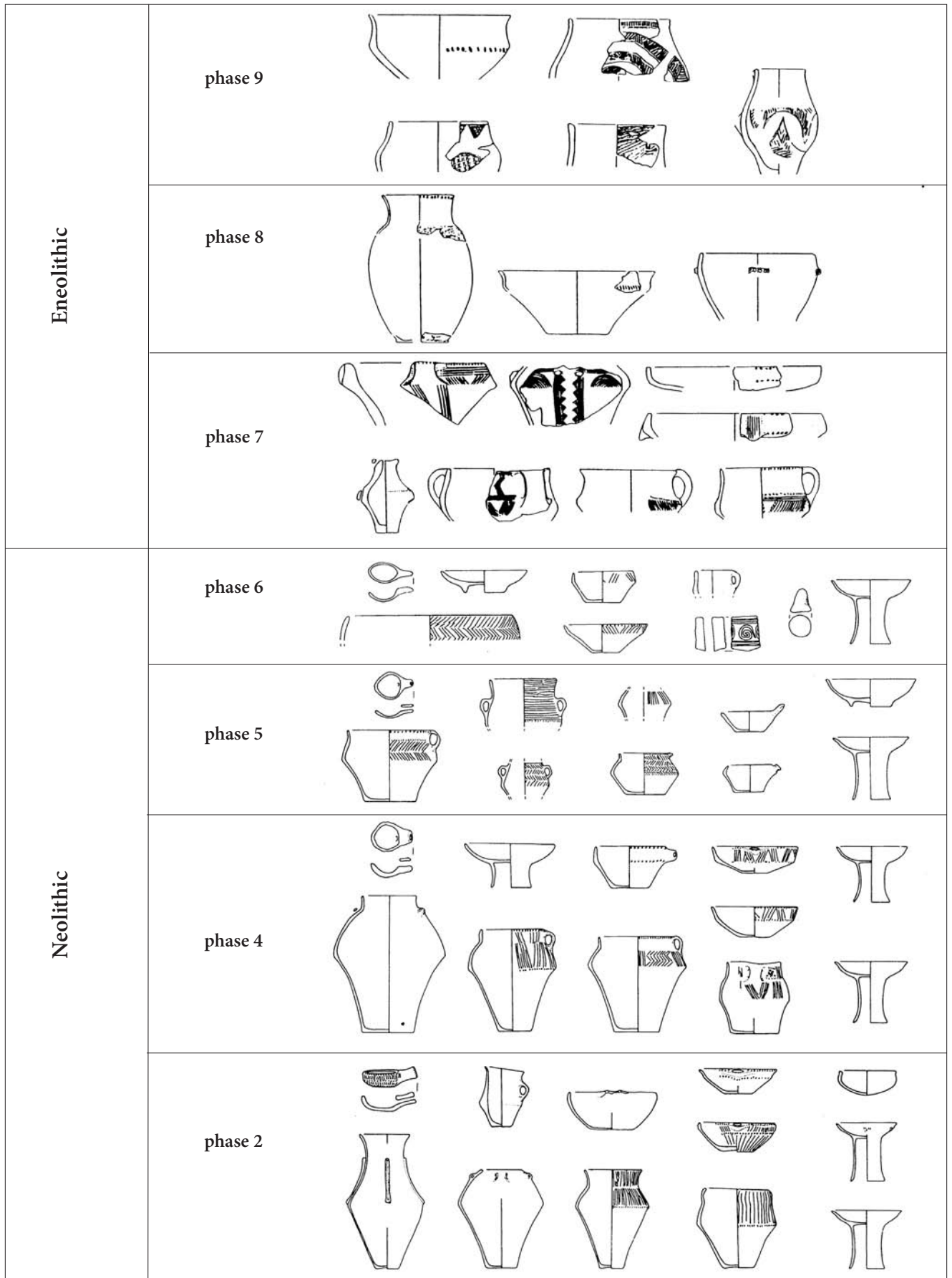


Fig. 4 - Characteristic vessel shapes from Moverna vas in Bela Krajina Region (after BUDJA 1, fig. 4)  
 - Ceramica caratteristica da Moverna vas nella regione di Bela Krajina (da BUDJA 1, fig. 4)

Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1 $\sigma$ -range)* (prob. 68,3%)	Cal. BC (2 $\sigma$ -range) (prob. 95,4%)	Reference
KIA17864	PO 136	charcoal	BP 5992 $\pm$ 36	4935-4935 (prob. 0.7%), 4919-4870 (prob. 36.2%), 4858-4830 (prob. 18.4%), 4823-4805 (prob. 13.0%)	4954-4776 (prob. 94.4%), 4747-4742 (prob. 1.0%)	Guštin 2005, fig. 2
KIA17848	PO 62B	charcoal	BP 5935 $\pm$ 31	4845-4819 (prob. 23.0%), 4810-4774 (prob. 31.8%), 4748-4732 (prob. 13.5%)	4902-4888 (prob. 4.8%), 4882-4873 (prob. 2.9%), 4854-4767 (prob. 65.8%), 4761-4720 (prob. 21.9%)	Guštin 2005, fig. 2
KIA17857	PO 96	charcoal	BP 5888 $\pm$ 36	4795-4713 (prob. 68.3%)	4846-4819 (prob. 6.7%), 4811-4687 (prob. 87.8%), 4631-4622 (prob. 1%)	Guštin 2005, fig. 2
KIA17866	PO 150	charcoal	BP 5839 $\pm$ 30	4773-4749 (prob. 19.1%), 4727-4686 (prob. 41.7%), 4634-4621 (prob. 7.5%)	4795-4785 (prob. 1.9%), 4782-4745 (prob. 22.7%), 4743-4665 (prob. 52.0%), 4664-4646 (prob. 4.7%), 4644-4693 (prob. 14.2%)	Guštin 2005, fig. 2
KIA17860	PO 108	charcoal	BP 5828 $\pm$ 36	4771-4752 (prob. 11.6%), 4723-4671 (prob. 39.6%), 4659-4651 (prob. 4.1%), 4640-4618 (prob. 13.0%)	4781-4745 (prob. 15.4%), 4741-4582 (prob. 78.1%), 4567-4552 (prob. 1.9%)	Guštin 2005, fig. 2
KIA17861	PO 110	charcoal	BP 5820 $\pm$ 30	4768-4755 (prob. 7.5%), 4718-4671 (prob. 41.0%), 4659-4651 (prob. 4.1%), 4639-4618 (prob. 15.7%)	4774-4748 (prob. 11.4%), 4729-4584 (prob. 82.0%), 4565-4553 (prob. 1.9%)	Guštin 2005, fig. 2
KIA17850	PO 55	charcoal	BP 5811 $\pm$ 30	4766-4761 (prob. 2.0%), 4717-4667 (prob. 34.8%), 4663-4646 (prob. 10.2%), 4644-4615 (prob. 19.1%), 4609-4605 (prob. 2.0%)	4773-4750 (prob. 8.6%), 4725-4550 (prob. 68.8%)	Guštin 2005, fig. 2
KIA17856	PO 93	charcoal	BP 5806 $\pm$ 42	4765-4764 (prob. 0.7%), 4716-4600 (prob. 67.6%)	4775-4747 (prob. 7.6%), 4732-4544 (prob. 87.8%)	Guštin 2005, fig. 2
KIA17862	PO 129	charcoal	BP 5797 $\pm$ 40	4712-4598 (prob. 67.6%), 4555-4555 (prob. 0.7%)	4772-4750 (prob. 5.7%), 4724-4542 (prob. 89.7%)	Guštin 2005, fig. 2
KIA17863	PO 135	charcoal	BP 5791 $\pm$ 37	4709-4699 (prob. 4.8%), 4693-4596 (prob. 61.5%), 4559-4554 (prob. 2.0%)	4769-4753 (prob. 3.8%), 4720-4544 (prob. 91.6%)	Guštin 2005, fig. 2
KIA17865	PO 146	charcoal	BP 5787 $\pm$ 33	4706-4703 (prob. 2.0%), 4692-4596 (prob. 63.5%), 4560-4554 (prob. 2.7%)	4766-4756 (prob. 1.9%), 4715-4547 (prob. 93.5%)	Guštin 2005, fig. 2
KIA17858	PO 105	charcoal	BP 5782 $\pm$ 30	4690-4596 (prob. 64.9%), 4561-4554 (prob. 3.4%)	4765-4761 (prob. 1.0%), 4713-4546 (prob. 94.4%)	Guštin 2005, fig. 2
KIA17846	PO 42	charcoal	BP 5804 $\pm$ 30	4713-4667 (prob. 34.2%), 4663-4646 (prob. 11.6%), 4644-4615 (prob. 21.9%), 4607-4605 (prob. 0.7%)	4770-4753 (prob. 5.7%), 4720-4578 (prob. 84.1%), 4572-4551 (prob. 5.7%)	Guštin 2005, fig. 2
KIA17852	PO 83	charcoal	BP 5758 $\pm$ 33	4673-4657 (prob. 9.6%), 4654-4637 (prob. 10.9%), 4620-4549 (prob. 47.8%)	4708-4701 (prob. 1.0%), 4692-4520 (prob. 92.5%), 4511-4502 (prob. 1.9%)	Guštin 2005, fig. 2
KIA17849	PO 62	charcoal	BP 5751 $\pm$ 33	4672-4657 (prob. 8.9%), 4652-4638 (prob. 8.9%), 4619-4545 (prob. 50.5%)	4691-4516 (prob. 92.5%), 4514-4500 (prob. 2.9%)	Guštin 2005, fig. 2
KIA17859	PO 106	charcoal	BP 5752 $\pm$ 30	4671-4658 (prob. 8.2%), 4651-4639 (prob. 8.2%), 4618-4546 (prob. 51.9%)	4690-4519 (prob. 93.5%), 4511-4501 (prob. 1.9%)	Guštin 2005, fig. 2
KIA17855	PO 91	charcoal	BP 5750 $\pm$ 31	4672-4658 (prob. 8.3%), 4652-4638 (prob. 7.6%), 4619-4545 (prob. 52.4%)	4689-4518 (prob. 92.5%), 4512-4501 (prob. 2.9%)	Guštin 2005, fig. 2
KIA17847	PO 42cII	charcoal	BP 5747 $\pm$ 32	4672-4658 (prob. 7.5%), 4652-4639 (prob. 7.5%), 4619-4542 (prob. 53.3%)	4689-4516 (prob. 91.6%), 4514-4500 (prob. 3.8%)	Guštin 2005, fig. 2
KIA17867	PO 152	charcoal	BP 5737 $\pm$ 39	4669-4661 (prob. 4.8%), 4648-4642 (prob. 3.4%), 4617-4536 (prob. 59.3%), 4507-4504 (prob. 0.7%)	4686-4631 (prob. 20.0%), 4623-4498 (prob. 75.4%)	Guštin 2005, fig. 2
KIA17854	PO 90	charcoal	BP 5718 $\pm$ 32	4598-4556 (prob. 25.3%), 4555-4498 (prob. 43.0%)	4675-4656 (prob. 4.8%), 4654-4636 (prob. 3.9%), 4620-4486 (prob. 80.9%), 4482-4460 (prob. 5.8%)	Guštin 2005, fig. 2
KIA17851	PO 70	charcoal	BP 5309 $\pm$ 45	4222-4216 (prob. 3.4%), 4204-4186 (prob. 8.1%), 4165-4137 (prob. 12.8%), 4135-4115 (prob. 9.5%), 4115-4044 (prob. 34.5%)	4315-4302 (prob. 1.9%), 4249-4037 (prob. 87.8%), 4022-3996 (prob. 5.7%)	Guštin 2005, fig. 2

Tab. I - List of published the radiocarbon dates from Čatež-Sredno polje site (\*Calibrated with "CALIB rev 4.3, STUIVER et al., 1998).

- Date al radiocarbonio dal sito di Čatež-Sredno polje (\*Calibrazione con "CALIB rev 4.3, STUIVER et al., 1998).



Ajdovska jama						
Sample ID	Context	Sample material	Radiocarbon Age		Cal. BC	Reference
Z-1178	cave entrance	charcoal	BP 5400±150			SRDOČ et al. 1987, 139
Z-1179	grave	charcoal	BP 4700±200			SRDOČ et al. 1987, 139
Z-1554	Central cave	charcoal	BP 4700±120			SRDOČ et al. 1987, 139
Z-1602	68/85, fireplace	charcoal	BP 4850±130			SRDOČ et al. 1987, 139
Z-1603	charcoal	charcoal	BP 2900±130			SRDOČ et al. 1987, 139
Z-2043	34/87	charcoal	BP 4820±100			SRDOČ et al. 1992, 156
Z-2042	41/87	charcoal	BP 5230±110			SRDOČ et al. 1992, 156
Z-2044	18/87	charcoal	BP 4900±100			SRDOČ et al. 1992, 156
Z-2123	42	charcoal	BP 5360±130			SRDOČ et al. 1992, 156
Z-2197	19	charcoal	BP 5160±130			SRDOČ et al. 1992, 156
Z-2300	79/90	charcoal	BP 4400±70			OBELIČ et al. 1994, 307
Z-2301	20/90	charcoal	BP 4410±70			OBELIČ et al. 1994, 308
Z-1042	Grave 1	wheat	BP 5120±130			SRDOČ et al. 1984, 451
Z-1043	Grave 2	wheat	BP 5180±150			SRDOČ et al. 1984, 451
Z-1044	Grave 1	wheat	BP 5620±130			SRDOČ et al. 1984, 451
Z-1045	hearth	charcoal	BP 5340±120			SRDOČ et al. 1984, 451
Moverna vas						
Sample ID	Context	Sample material	Radiocarbon Age		Cal. BC (prob. 94,5%)	Reference
Z-1474	Layer 7	charcoal	BP 5400±140			SRDOČ et al. 1987, 139
Z-1475	Layer 6	charcoal	BP 4900±130			SRDOČ et al. 1987, 139
Z-1476	Layer 5	charcoal	BP 4050±120			SRDOČ et al. 1987, 139
Z-1685	Layer 5	charcoal	BP 3900±100			SRDOČ et al. 1987, 139
Poz-21396	053.1	animal fat ?	BP 5750±40		4710-4490 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21398	050.2	tree resin	BP 5550±40		4460-4330 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21399	050.1	tree resin	BP 5630±40		4540-4360 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21400	022.1	tree resin	BP 5610±40		4520-4350 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21402	050.1	tree resin	BP 5620±40		4530-4360 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21402	050.2	tree resin, beewax (?)	BP 5990±40		5000-4780 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21403	gl. 323-332	vegetable fat	BP 5800±40		4770-4540 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21419	056		BP 5940±40		4940-4720 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21404	031.4	tree resin	BP 5670±40		4610-4440 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Poz-21404	050.2	tree resin	BP 5550±40		4460-4330 (prob. 94.5%)	ŽIBRAT GAŠPARIČ 2008, pri. 9.2.6
Dragomelj						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1σ-range)	Cal. BC (2σ-range)	Reference
Beta-162366	1037	charcoal	BP 5730±50	4660-4500 (prob. 68%)	4700-4460 (prob. 95%)	TURK & SVETLIČIČ 2005, 69
Resnikov prekop (Resnik Kanal)						
Sample ID	Context	Sample material	Radiocarbon Age			Reference
Z-354		wood	BP 5850±150			SRDOČ et al. 1977, 472
Hd-24038		wood	BP 5718±23	4580-4505 Cal. BC (1σ-range)	4675-4465 Cal. BC (2σ-range)	ČUFAR & KORENČIČ 2006, 124
Col 1 near Podgračeno						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1σ-range) (prob. 68.3%)	Cal. BC (2σ-range) (prob. 95.4%)	Reference
KIA21323	02/1/1	wood ?	BP 5165±35	4036-4023 (prob. 12.3%)* 3993-3956 (prob. 56.0%)	4005-3938 (prob. 68.0%)* 4041-4005 (prob. 17.9%)* 3858-3812 (prob. 0.4%)*	GUŠTIN 2005, fig. 3
Gradišče nad Dešnom						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1σ-range) (prob. 68.3%)	Cal. BC (2σ-range) (prob. 95.4%)	Reference
KIA21331	04	charcoal	BP 5303±29	4221-4216 (prob. 2.7%)* 4204-4194 (prob. 5.5%)* 4162-4154 (prob. 4.8%)* 4154-4146 (prob. 3.4%)* 4144-4137 (prob. 4.1%)* 4134-4119 (prob. 10.2%)* 4112-4059 (prob. 32.1%)* 4054-4045 (prob. 5.5%)*	4224-4178 (prob. 21.0%)* 4172-4040 (prob. 71.6%)* 4016-4002 (prob. 2.9%)	GUŠTIN 2005, fig. 3

Tab. II - List of published radiocarbon dates from other Neolithic and some Eneolithic sites in central and southeast Slovenia, (\*Calibrated with "CALIB rev 4.3, STUIVER et al., 1998).

- Date al radiocarbonio dal sito di Čatež-Sredno polje (\*Calibrazione con "CALIB rev 4.3, STUIVER et al., 1998).

Murska Sobota–Nova Tabla						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1 $\sigma$ -range)	Cal. BC (2 $\sigma$ -range)	Reference
KIA16407	PO 056?	charcoal	BP 5566±99	4494-4470,* 4463-4334	4666-4664,* 4604-4225, 4177-4173	GUŠTIN 2005, fig. 3
Sodolek						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1 $\sigma$ -range) (prob. 68.3%)	Cal. BC (2 $\sigma$ -range) (prob. 95.4%)	Reference
KIA26992	PO 134	charcoal	BP 5524±37	4446-4421 (prob. 21.4%)*, 4397-4383 (prob. 9.7%), 4365-4336 (prob. 37.3%)	4454-4415 (prob. 27.0%)*, 4412-4328 (prob. 64.6%), 4275-4259 (prob. 3.9%)	GUŠTIN 2005, fig. 3
Malečnik						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1 $\sigma$ -range) (prob. 68.3%)	Cal. BC (2 $\sigma$ -range) (prob. 95.4%)	Reference
KIA22920	021	charcoal	BP 5505±38	4439-4422 (prob. 10.2%)*, 4364-4327 (prob. 45.8%), 4276-4258 (prob. 12.3%)	4451-4418 (prob. 15.3%)*, 4402-4320 (prob. 60.1%), 4294-4352 (prob. 20.0%)	GUŠTIN 2005, fig. 3
Bukovnica						
Sample ID	Context	Sample material	Radiocarbon Age			Reference
Z-2114	021	charcoal	BP 5650±110			SRDOČ et al. 1992, 157
Šafarsko						
Sample ID	Context	Sample material	Radiocarbon Age			Reference
Z-983	hearth	Wooden particles	BP 5050±190			SRDOČ et al. 1992, 157
Ptuj, šolsko parkirišče - Volkmerjeva Ulica						
Sample ID	Context	Sample material	Radiocarbon Age			Reference
Z-3015	pit 10- object 2	charcoal	BP 5870±130			OBELIĆ et al. 2002, 626
Ormož - Hardek						
Sample ID	Context	Sample material	Radiocarbon Age	Cal. BC (1 $\sigma$ -range) (prob. 65%)	Cal. BC (2 $\sigma$ -range) (prob. 95%)	Reference
Z-2742	258/XIV	charcoal	BP 5200±130			OBELIĆ et al. 2002, 626
Z-2933	Kv. 5a, pit 2	charcoal	BP 5290±110			OBELIĆ et al. 2002, 626
Z-2721		wood	24300±1100			ŽIŽEK 2006, fig. 2
Z-2429		charcoal	4140±160			ŽIŽEK 2006, fig. 2
Z-2742		charcoal	5200±120			ŽIŽEK 2006, fig. 2
Beta-112115		charcoal	5380±50	4340-4215		
				4185-4160	4340-4070	ŽIŽEK 2006, fig. 2
Beta-112117		charcoal	5480±40	4350-4325	4370-4250	ŽIŽEK 2006, fig. 2
Beta-112118		charcoal	5300±50	4225-4035	4250-3985	ŽIŽEK 2006, fig. 2
Beta-112119		sediment	6900±50	5760-5685	5835-5635	ŽIŽEK 2006, fig. 2
Beta-112120		charcoal	5530±50	4485-4335	4475-4255	ŽIŽEK 2006, fig. 2
Beta-112121		charcoal	6020±170	5195-5180		
				5085-4735	5280-4505	ŽIŽEK 2006, fig. 2
Beta-112122		charcoal	5410±50	4330-4230	4350-4140	ŽIŽEK 2006, fig. 2

Tab. III - List of published radiocarbon dates from other Neolithic and some Eneolithic sites in northeast Slovenia (\*Calibrated with "CALIB rev 4.3, STUIVER et al., 1998).

- *Date al radiocarbonio da siti neolitici ed eneolitici del nord est Slovenia (\*Calibrazione con "CALIB rev 4.3, STUIVER et al., 1998).*

so called "cemetery horizon", defined by Milena Horvat, is presumably far to long-lived than one should expect (VELUŠEK 2006: 62). In his opinion, the 29 individuals from Ajdovska jama could not be buried in such long time-span (VELUŠEK 2006: 62).

Another interesting observation is surprising. The dates from Ajdovska jama deviate considerably from those from Neolithic dates, which have been mentioned before. This is much intriguing given that archeological finds, especially ceramics, are not so different from above-mentioned sites. However, in our opinion

reinterpretation and recalibration of original data as well as their interpretation is needed for Ajdovska jama as well as for other Slovenian Neolithic sites to solve questions, which concern its absolute and relative position regarding other sites in Slovenia.

Equally intriguing is the site Col 1 near Podgračeno, because the radiocarbon date for this site is 5165±35 BP (Lab. Number KIA21323)(tab. II)<sup>(13)</sup>, although the

13) Calibrated at 2 $\sigma$  this would mean 4005-3938 (prob. 68.0%) (tab. II).

ceramics shows similarities with ceramic finds from other sites of the Sava group (see HORVAT 2005; GUŠTIN 2005). Ajdovska jama as well as Col 1 near Podgračeno produced radiocarbon dates which are more similar with dates from sites in central, northeast and east Slovenia, which are culturally ascribed to Eneolithic "Lasinja Culture". In central Slovenia Gradišče nad Dešnom is such a site with typical lasinja elements in pottery production and with radiocarbon date  $5303 \pm 29$  BP (obtained from charcoal; Lab. Number KIA21331; tab. II). Calibrated at  $2\sigma$  this would mean 4172-4040 (prob. 71.6%) (tab. II).

Beside the sites of Čatež-Sredno polje and Ajdovska jama near Nemška vas, extensive research at Movernava in Bela Krajina yielded a reasonable large sequence of radiocarbon dates (tab. II). According to the excavator M. Budja's in Movernava was archeological remains from Neolithic and Eneolithic periods were discovered. Although Movernava is perhaps most thoroughly analysed Neolithic and Eneolithic site, a complete monographic publication is still missing. Archeological remains and settlement layers in Movernava have been detected in seven successive settlement phases (fig. 4). At the beginning, four dates have been obtained from Rudjer Bošković Laboratory in Zagreb, for Layer 7 (Lab. Number Z-1474:  $5400 \pm 140$  BP), Layer 6 (Lab. Number Z-1475  $4900 \pm 130$  BP), and two for Layer 5 (Lab. Number Z-1476:  $4050 \pm 120$  BP; Lab. Number Z-1685  $3900 \pm 100$  BP) (tab. II; SRDOČ et al. 1987)<sup>(14)</sup>.

For Neolithic settlement phases (2, 4, 5 and 6) a program of direct dating of organic material from ceramic vessels has been implemented in 2008 (tab. II; ŽIBRAT GAŠPARIČ 2008, chapter 9.2.6). The dated sample from the earliest settlement phase place it in  $5940 \pm 40$  BP (Lab. Number Poz-21419) (tab. II; ŽIBRAT GAŠPARIČ 2008: chapter 9.2.6), in calibrated terms this would mean time span 4940-4720 cal. BC (prob. 94.5%). For Movernava 4 phase several dates were obtained. Sample of tree resin or bee wax (Lab. Number Poz-21402) produced the oldest date for this settlement phase:  $5990 \pm 40$  BP, which in calibrated terms this would mean time span 5000-4780 cal. BC (prob. 94.5%), while another sample of tree resin (Lab. Number Poz-21398) produced the youngest date for this phase:  $5550 \pm 40$  BP, which in calibrated terms this would mean time span 4460-4330 cal. BC (prob. 94.5%) (tab. II; ŽIBRAT GAŠPARIČ 2008: chapter 9.2.6). Movernava 5 phase has been dated with a sample of tree resin (Lab. Number Poz-21400) in  $5610 \pm 40$  BP, which in calibrated terms means 4520-4350 cal. BC (prob. 94.5%). Movernava 6 phase is dated with sample of tree resin (Lab. Number Poz-21404) to  $5670 \pm 40$  BP which in calibrated terms means 4610-4440 cal. BC (prob. 94.5%) (tab. II; ŽIBRAT GAŠPARIČ 2008: chapter 9.2.6).

14) However these dates do not match with dates for settlement phases in Movernava, published by BUDJA (1992: fig. 2).

According to these dates all four Neolithic settlement phases of Movernava fit well into the first half of the 5th Millennium cal. BC and are contemporaneous throughout with settlement sequence in Čatež-Sredno polje and partially with sites at Resnikov prekop and Dragomelj<sup>(15)</sup>. This observation raises a question concerning cultural affiliation of archeological finds from these sites, since sites in Bela Krajina and all others in central and southeast Slovenia exhibit apparent variability in their pottery production. Although sites in both regions can be regarded as an integral part of an extensive Complex of Lengyel Culture, some level of inner regionalisation can be witnessed according to these facts.

In northeast and east Slovenia, situation concerning the evidence of earliest Neolithic settlement is somewhat different, in terms of paucity of available data as well as in actual data itself. In northeast Slovenia several sites have produced radiocarbon dates for Neolithic/Eneolithic settlement in the region, however only Hardek near Ormož actually have produced a sequence of several radiocarbon dates (tab. III). All other sites have only one radiocarbon date available so far (Sodolek, Malečnik, Bukovnica, Šafarsko, Ptuj-šolsko parkirišče-Volkmerjeva ulica, Murska Sobota-Nova tabla). Two of the oldest dates are known from Hardek, one coming from a sediment (Lab. Number: Beta-112119):  $6900 \pm 50$  BP, which in calibrated at  $2\sigma$  means time-span 5835-5635 cal. BC (prob. 95%) (ŽIŽEK 2006: fig. 2). The charcoal sample (Lab. Number Beta-112121) produced slightly younger date:  $6020 \pm 170$  BP, which in calibrated at  $2\sigma$  means time-span 5280-4505 cal. BC (prob. 95%) (ŽIŽEK 2006, fig. 2)<sup>(16)</sup>. Other dates, coming from charcoal samples from Hardek, analysed in Beta Laboratory in Miami, produced relatively homogenous set of dates:  $5530 \pm 150$  BP (Lab. Number Beta-112120),  $5480 \pm 40$  BP (Lab. Number Beta-112117),  $5410 \pm 170$  BP (Lab. Number: Beta-112122)  $5380 \pm 50$  BP (Lab. Number: Beta-112115),  $5300 \pm 50$  BP (Lab. Number Beta-112118). Calibrated at  $2\sigma$  (prob. 95 %) they would altogether cover

15) A bit more complicated is an interpretation of an evident time overlapping between all four Neolithic phases in Movernava, thus asking as to proceed with dating program. Only through substantial quantity of reliable radiocarbon dates more solid clarification of the problem will be possible. According to archaeological evidence in Movernava, there is a clear interruption between Neolithic and Eneolithic settlement phases attested through different settlement pattern, modified characteristic of pottery production as well as in variability of stone tools assemblages (TOMAŽ 1999; also ŽIBRAT GAŠPARIČ 2008).

16) The problem with radiocarbon dates from Hardek is that some of them have produced quite a big standard deviation, thus covering wide time-span. The other problem is their archeological context, since we don't know in detail what is their relation to discovered archeological finds. Taking into consideration the pottery characteristics, the assemblage from Hardek is ascribed to Lasinja Culture.



Fig. 5 - Some of the described Neolithic sites.  
 a, b: Čatež-Sredno polje (foto D. Snoj);  
 c: Drulovka (foto J. Tratnik);  
 d: Ajdovska jama (www.zavod.svibna.si);  
 e: Bukovnica (after ŠAVEL 2006).

- Alcuni dei siti neolitici descritti. a, b: Čatež-Sredno polje (foto D. Snoj); c: Drulovka (foto J. Tratnik); d: Ajdovska jama (www.zavod.svibna.si); e: Bukovnica (after ŠAVEL 2006).

a period between 4470 and 3985 cal. BC (tab. III). This is in general also a rough time-frame for Lasinja culture at other radiocarbon-dated sites in northeastern Slovenia (see tab. III). Charcoal sample from Sodolek has been dated in  $5524 \pm 37$  BP (Lab. Number KIA26992), which calibrated at  $2\sigma$  means time-span between 4412-4328 cal. BC (prob. 64.6%) (GUŠTIN 2005: fig. 3). Charcoal sample from Malečnik has been dated in  $5505 \pm 38$  BP (Lab. Number KIA22920), which calibrated at  $2\sigma$  means time-span between 4402-4320 cal. BC (prob. 60.1%) (GUŠTIN 2005: fig. 3) and charcoal sample from Murska Sobota-Nova tabla has been dated in  $5566 \pm 99$  BP (Lab. Number KIA22920), which calibrated at  $2\sigma$  means time-span between 4604-4225 cal. BC (prob. 60.1%) (GUŠTIN 2005: fig. 3). From sites Bukovnica, Šafarsko and Ptuj, šolsko parkirišče-Volkmerjeva ulica three dates are known from Laboratory Rudje Bošković in Zagreb, however also in these cases there is no clear correlation between archeological finds and these dates. Charcoal sample from Bukovnica has been dated in  $5650 \pm 110$  BP (Lab. Number Z-2114) (SRDOČ et al. 1992: 157), Wooden particles from Šafarsko have been dated in  $5050 \pm 190$  BP (Lab. Number Z-983) (SRDOČ et al. 1992: 157) and charcoal from Ptuj, šolsko parkirišče-Volkmerjeva ulica has been dated in  $5650 \pm 110$  BP (Lab. Number Z-3015) (OBELIĆ et al. 2002, 626) (tab. III).

Dates from sites Bukovnica and Ptuj, šolsko parkirišče-Volkmerjeva ulica the oldest in northeast Slovenia so far, not taking into consideration two dates from Hardek (Lab. Number Beta-112119 and Beta-112121), which clearly diverge greatly from other Hardek radiocarbon dates. Although precise correlation between the date and archeological finds is not known in these two cases, there are in Bukovnica as well as in Ptuj some ceramic finds, that exhibit typical Lengyel pottery characteristics, thus placing them possibly at the end of late Neolithic period. Archeological finds from other radiocarbon-dated sites belong to Eneolithic Lasinja.

## Conclusions

During the history of research several questions regarding Neolithic in continental Slovenia have been addressed. At the beginning questions of cultural and chronological determination of discovered archeological finds were of main concern in Neolithic studies in Slovenia, only in recent years also radiocarbon chronology became important as well. Although the first radiocarbon date has been published as early as 1977 (SRDOČ et al. 1977) and many sites have been dated as well along the history of research, only in last decade programs of systematic radiocarbon-dating at several sites produced some rewarding results.

According to available radiocarbon dates, as shown in this short communication, continental part of Slovenia

has been inhabited by agricultural communities at the beginning or in the first half of the 5th Millennium BC. Dates for earliest known Neolithic sites in central and southeast Slovenia, obtained so far, appears to be quite young, taking into consideration the neighbouring regions, where Neolithic way of living appears much earlier. In Croatia, in eastern Slavonia for example, the earliest Neolithic occupation is connected with Starčevo culture sites, which can be dated at the end of 7th Millennium BC and in 6th Millennium BC (BIAGI & SPATARO 2005; MINICHREITER & KRAJCAR BRONIĆ 2007). In eastern part of Slovenia, as seen above, the first widespread settlement pattern, attested also through radiocarbon dates, appears as late as at the beginning of Eneolithic period in the second half of the 5th Millennium BC. If we look at the neighbouring regions in West Hungary at Zala County, which is just across the border with Slovenia, and in Balaton region, the situation is completely different. First agricultural settlements are connected with Starčevo communities, settling there in the mid 6th Millennium BC (BANNFY 2006: 130). In our opinion, acknowledged absence of early Neolithic sites in continental part of Slovenia, especially in most eastern part in Prekmurje, is merely a consequence of a lack of systematic research, focusing on detection of Neolithic settlement in the area.

Some interesting questions have been raised also concerning relation between radiocarbon dates and cultural attribution of archeological finds from different sites. On one hand we have confirmed contemporaneous sites with divergent material culture (for example relation Čatež-Sredno polje and Moverna vas). Traditionally these divergence would have been most probably interpreted in terms of time discrepancy. New insight into radiocarbon chronology proved this to be inaccurate; more probable is divergent in cultural traits of both communities resulting in cultural regionalisation. Similar problem can be detected in the case of Ajdovska jama and Col 1 near Podgračeno, which both have produced relatively young dates as already stated. These dates are closer to the dates from east Slovenia, however archeological finds are tied based on pottery characteristics to Neolithic traditions in the case of Ajdovska jama, while at sites in east Slovenia, archeological finds are connected with Lasinja culture and Eneolithic traditions. To clarify their relation, detailed analysis of material culture in relation to the more advanced sequence of radiocarbon dates should be performed in the future.

Nevertheless, there are also some entirely practical problems, which we have to overcome in the future. The main problem concerning radiocarbon dates of Neolithic sites in continental Slovenia appears to be inconsistency in reporting and interpreting the original data, resulting in somewhat confusing overview concerning radiocarbon chronology of Neolithic period in Slovenia. Reinterpretation and recalibration

of existing dates would be an asset and would probably helped in clarifying this picture. Another problem is the sampling method applied so far in radiocarbon dating. The majority of dates came from long-lived samples such as charcoal. In the future, dating of short-lived samples should be a priority, resulting in more accurate results. Radiocarbon-dating programs should become an integral part of each archeological research, being of scientific or of preventive nature.

*Manuscript received on 1.IX.2009, accepted on 14.XII.2009.*

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