NEW OBSERVATIONS ON THE RADIOCARBON CHRONOLOGY OF THE STARČEVO-CRIŞ AND KÖRÖS CULTURES

Paolo Biagi (Venice, Italy)[1] & Michela Spataro (London, United Kingdom)[2]

PREFACE

The scope of this paper is to update our knowledge of the radiocarbon chronology of the Starčevo-Criş and Körös Cultures, whose distributions cover a territory that includes Albania, Romania, Moldavia, Vojvodina, Serbia, Bosnia, Slavonia and part of Hungary. This problem has already been discussed in different ways by Gläser (1991), Horváth and Hertelendi (1994), Mantu (2000), Minichreiter (2001a), and more recently by Whittle *et al*. (2002), Tasić (2003) and Karmanski (2005).

The radiocarbon sequence of this culture is inaccurately known and the number of results so far obtained varies country by country. This contrasts with our knowledge of the territorial distribution of these cultural aspects and of the typological sequence of the vessel forms and decorations, a subject that has been treated by a few authors in great detail, region by region (Milojčić 1949; 1950; Anderlović - Garašanin 1954; Brukner 1968; Dimitrijević 1969; 1974; Srejović 1971; Lazarovici 1979; 1984; 1993; Ursulescu 1984; Minichreiter 1992; Tasić 2000). For example no radiocarbon date is currently available for Albania, where very important sites have been excavated, such as that of Kolshit (Korkuti 1983), close to the Kosovo border. Nor are there any radiocarbon results from Moldavia (Marinescu-Bîlcu 1993). Only twelve dates have been obtained from seven Romanian sites, three of which are considered unacceptable by C.M. Mantu (2000: 75). They are mainly from sites attributed to the phases III and IV of the Starčevo-Criş Culture, if we accept the typological subdivision proposed by G. Lazarovici (1984) for this country. Nevertheless these dates are very important because they provide us with a first preliminary chronological framework of the most recent phases of development of this culture.

The problem is more complicated if we take into consideration the earlier phases, which are presently undated, in Romania. Moving to Serbia, apart from the key site of Donja Branjevina in Vojvodina (Karmanski 2005), which, together with Magareci-Mlin (Tasić 1993) is the only radiocarbon-dated sequence where the earliest horizons of this culture are represented, twelve more sites have been dated (Tasić 2003), some quite recently (Whittle *et al*. 2002). Others, located along the right bank of the Danube in the Iron Gates region, are well known for their problematic cultural and chronological interpretation (Borić 2002). The only carbon-dated Starčevo site in Bosnia is Obre I (Gimbutas 1974), whose earliest occupation is attributed by this author to the late aspect of this culture. West of Vojvodina, a number of Starčevo sites are reported from Slavonia (Minichreiter 2001b), a few of which have been partly excavated and radiocarbon dated (Minichreiter 2001a).

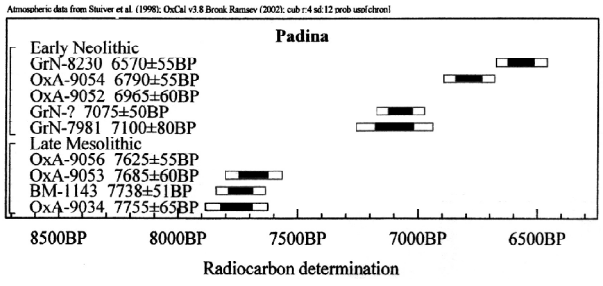
THE MONOCHROME OR PRE-CRIŞ PHASE (LAZAROVICI'S IA)

As mentioned above, this phase is still undated in Romania. Here the absolute dating of the monochrome wares would be of major importance for a better understanding of the chronology of the early Neolithization stages of the Central Balkans.

Perić (1998: 14) attributes some of the Serbian Iron Gates sites to this horizon. Among these, he mentions Lepenski Vir (Srejović 1969), Padina (Jovanović 1969) and Vlasac (Letica 1969), as well as the Vojvodinian site of Donja Branjevina. Monochrome pottery is probably recorded from Lepenski Vir (Whittle *et al*. 2002: 85) and Padina, although the radiocarbon dates from these two sites show different distribution patterns. The Padina diagram (fig. 1) indicates a gap of some 500 radiocarbon years between the Mesolithic phases of occupation and the beginning of the Early Neolithic, whose earliest stages are dated to 7100±80 BP (GrN-7981). In contrast, Lepenski Vir and Vlasac produced almost "continuous" sequences throughout the middle of the eighth and the middle of the seventh millennia BP (Nandris 1988: 7; Bonsall *et al*. 1997; Whittle *et al*. 2002: 67). Nevertheless the occurrence of Mesolithic horizons, referred to the ninth millennium BP is also attested (Borić 2002: 1031).

All the radiocarbon dates from the monochrome Neolithic layer Ia of Anza, in Macedonia, fall within the last three centuries of the eighth millennium BP, more precisely between 7270±140 BP (LJ-2181) and 7146±70 BP (LJ-3186) (Gimbutas 1976: 30) (fig. 2). Three

Fig. 1. Scatterplot of the radiocarbon dates from Padina (YU).



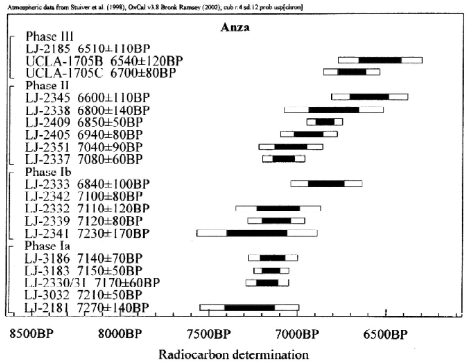


Fig. 2. Scatterplot of the radiocarbon dates from Anza (MK).

[1]Department of Science of Antiquities and the Near East, Cà Foscari University, Palazzo Bernardo, San Polo 1977, 30125 Venezia (I), Italy. E-mail: pavelius@unive.it

[2] Institute of Archaeology, UCL, 31-34 Gordon Square, London WC1H 0PY (UK). E-mail: m.spataro@ucl.ac.uk

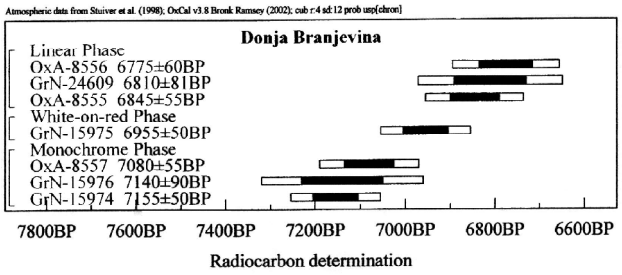


Fig. 3. Scatterplot of the radiocarbon dates from Donja Branjevina (YU).

more dates are known from Donja Branjevina, whose settlement III has been attributed to the monochrome phase by its excavator, S. Karmanski (2005). Two of the bone samples that have been dated come from trench V/1986-87, inside and outside pit-(dwelling) structures (7155±50 BP: GrN-15974 and 7140±90 BP: GrN-15976), and the third from trench 2/1987 (7080±55 BP: OxA-8557) (Karmanski 2005) (fig. 3). They should date this site to the last two centuries of the eight and the very beginning of the seventh millennium BP. All these results are similar to those from Anza and should point to the last (two-three) centuries of the eighth millennium BP for the emergence of the Starčevo-Criş Culture monochrome phase. From a geographic point of view, its distribution seems to be delimited, to the northwest, by the Timiş Plain, with the exception of Donja Branjevina, which lies at least 150 km west of the westernmost Romanian sites of this period.

THE "PROTO-STARČEVO" AND LINEAR PHASE (LAZAROVICI'S IB-IIA)

According to many authors, this phase is characterised by the appearance of *barbotino* and red-slipped ceramics decorated with white-painted geometric patterns in form of small dots, "wheat grain" and, more rarely (criss-cross) lines. Only a few Romanian sites have yielded fragments of this style of pottery, among which is Gura Baciului (Lazarovici and Maxim 1995), whose first horizons are presently undated. N.N. Tasić (2003), in his paper on the white painted wares of Serbia, reports that only 10 sites, out of more than 150 known in the country (80 of which have been partly excavated), have produced white painted pottery.

Three other sites, which are located out of this region, are those of Anza, in Macedonia (Gimbutas 1976), Szarvas 23 and Endrod 119, in Hungary. The latter two sites seem to delimit the northernmost spread of the white-on red painted wares. In his important paper on Szarvas 23, Makkay (1981: 100) points out the scarcity of this pottery within the Early Neolithic of Hungary, and suggests that it might "*have been imported from other (neighbouring or more southerly) sites of the early (or the earliest) phase of the Körös-Starčevo culture*". Szarvas 23 has been dated to 6855±55 BP (OxA-9375), while Bowman *et al*. (1990: 73) had previously published a slightly more recent result (BM-1866R: 6780±110 BP).

A good set of dates has recently been obtained from Endrod 119 (Makkay 1992), which range from 6915±45 BP (OxA-9587) to 6720±45 BP (OxA-9589) (Whittle *et al*. 2002: 110) (fig. 4); while Endrod 39 had already been dated between 6950±40 BP (BM-1963R) and 6830±120 BP (BM-1971R) (Horváth and Hertelendi 1994: 122). All these results are consistent with those so far available for the Körös Culture of Hungary, as will be discussed in the following paragraph.

The white-on-red decoration of the Anza vessels consists of motifs (Gimbutas 1976: 47) that are very similar, but not identical, to those of the above-mentioned sites. At Anza, *barbotino* wares make their first appearance during the II settlement phase, between 7080±60 BP (LJ-2337) and 6800±140 BP (LJ-2338), although one more recent date comes from the same horizon (LJ-2345: 6600±110 BP).

Only a few Serbian sites with white-on-red painted patterns have been radiocarbon-dated. They are those of Divostin (McPherron and Srejović 1988), Donja Branjevina (Karmanski 2005), Grivac (Bln-869: 7250±100BP) (Tasić 2003), Magareći Mlin (three dates in chrono-stratigraphic sequence, between GrN-15973: 7130±60 BP and GrN-15971: 6910±45 BP, the first of which dates the white painted pottery horizon) (Tasić 2003), Ludoš-Budžak (three dates between OxA-8554: 6875±55 BP and OxA-8553: 6705±55 BP) (Whittle *et al*. 2002: 109) and Biserna Obala-Nosa (OxA-8540: 6740±75 BP) (Whittle *et al*. 2002: 109).

The only site where at least three overimposed Starčevo-Criş (and Körös?) horizons are attested, is that of Donja Branjevina, on the left bank of the Danube, close to the present Croatian borderline. According to Karmanski (2005), the painted wares of layer II of this site are positioned above the monochrome phase, layer III. He attributes his layer II to the Proto-Starčevo phase (Pavúk 1993), from which only one radiocarbon date has been obtained, from a bone sample (GrN-24609: 6810±80 BP). The same author attributes its main occupation (layer I) to the Linear Starčevo Culture. Layer I lies just above layer II. It produced three radiocarbon assays, all from bone, which attribute it to a period between the end of the eighth and the first two-three centuries of the seventh millennium BP: 7080±55 BP (OxA-8557), 6845±55 BP (OxA-8555) and 6775±60 BP (OxA-8556). The key sequence of Donja Branjevina, which is the only date currently available for Serbia, helps understand the first appearance of the Neolithic in the region and follow the earliest stages of development of the Starčevo Culture in Central Balkans.

Early Linear Starčevo Culture settlements have been recently discovered in eastern Slavonia, for example at Zadubravlje and Slavonski Brod (Minichreiter 2001a; 2001b). Four radiocarbon dates come from the first of these sites, three of which date it to the first three centuries of the seventh millennium BP. They are: 6995±115 BP, 6835±110 BP and 6705±95 BP (all from Z- laboratory, number unpublished). According to the pottery typology from pit- (dwelling) 10, dated to 6995±115 BP, Zadubravlje can be assigned to the Linear A phase, because of the occurrence of vertical, parallel, brown-on-red painted narrow lines and triangular patterns on slightly carinated,

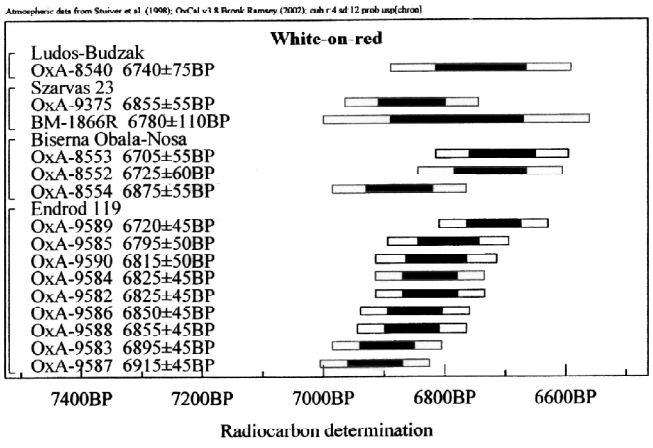


Fig. 4. Scatterplot of the radiocarbon dates of the white-on-red painted phase.

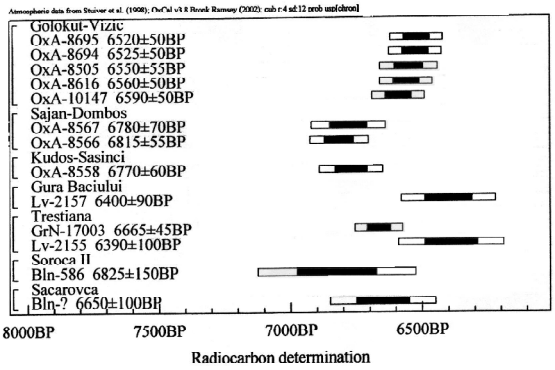


Fig. 5. Scatterplot of the radiocarbon dates of the Girlandoid and Spiraloid phases.

deep open bowls (Minichreiter 2001b: 16).

The Girlandoid and Spiraloid phase (Lazarovici's IIB-IIIB)

From this phase, which represents the classical Starčevo-Criş Culture, rich in *barbotino* pottery, flute-decorated globular forms, incised and pinched impressed wares as well as linear and spiral painted vessels, six dates are available from five Romanian sites. Among these is the third occupation layer of the key site of Gura Baciului, which yielded a result of 6400±90 BP (Lv-2157) (Mantu 2000: 98). All the other dates cover a time-span between 6825±150 (Bln-586) and 6390±100 BP (Lv-2155). Five almost identical dates, all around the middle of the seventh millennium BP (from OxA-10147: 6590±50 BP to OxA-8695: 6520±50 BP), have been obtained from the Serbian site of Golokut-Vizić (Whittle *et al*. 2002: 108); while the dates from Sajan-Domboš (OxA-8566: 6815±55 BP and OxA-8567: 6780±70 BP) and Kudoš-Šašinci (OxA-8558: 6770±60 BP), two sites which both produced potsherds with painted spiral motifs, are very similar (fig. 5). Those from pits 5A, 6 and 7 of Starčevo-Grad, all containing painted pottery with spiral decoration (Whittle *et al*. 2002: 68), range from 6920±45 BP (GrN-9036) to 6545±105 BP (GrN-6627) (Tasić 2003). Unfortunately no site of this phase has ever been dated in Slavonia. Period III of the Anza sequence produced four radiocarbon dates, which cover a time-span between 6700±80 BP (UCLA-1705c) and 6510±110 BP (LJ-2185).

THE FINAL PHASE (LAZAROVICI'S IV)

This last development phase of the culture already presents a series of Vinča elements, which are particularly clear in the variety of carinated pottery forms, mainly bowls of different size and shape and pedestalled vessels. Four dates from the Romanian site of Cârcea "Viaduct" (Nica 2000: 150) are attributed to this phase (Figs. 6&7). Three of them fall around the middle of the seventh millennium BP (from Bln-1981: 6540±60 BP to Bln-1983: 6395±60 BP), while the fourth has produced a far too recent result (Bln-2354: 5860±60 BP) (Mantu 2000: 98).

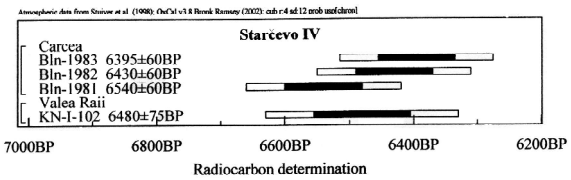


Fig. 6. Scatterplot of the radiocarbon dates of Starčevo IV.

PROBLEMS

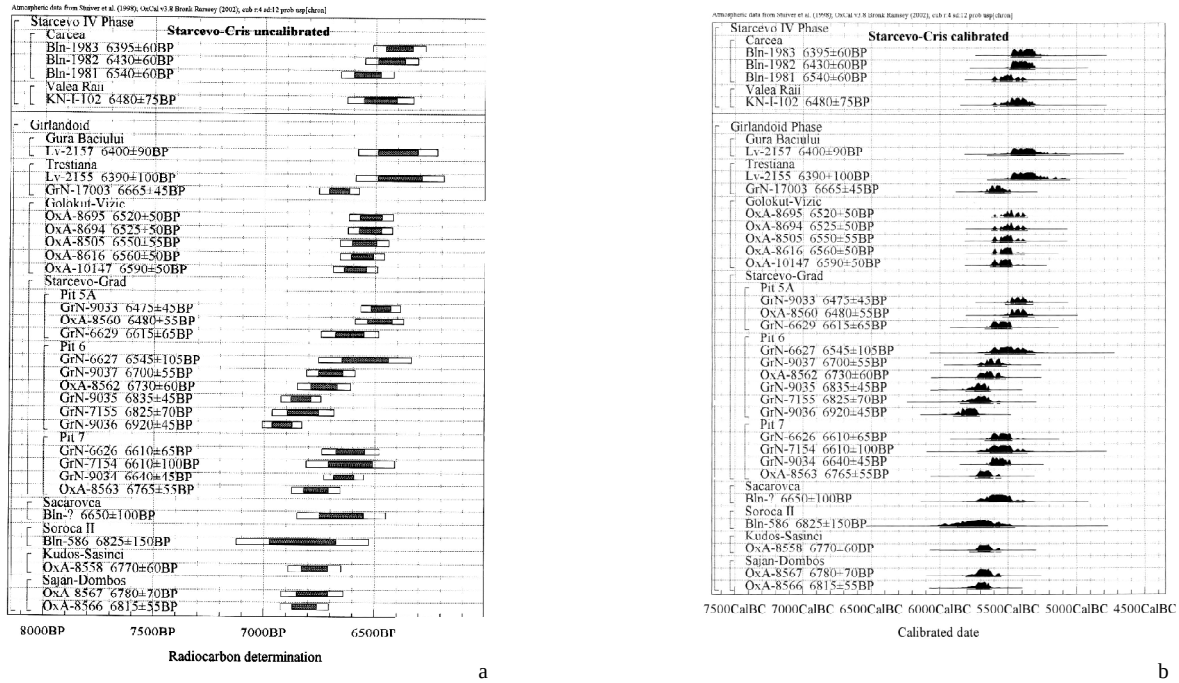
1. Although only few results are currently available for the Starčevo-Criş sites of Romania, our knowledge of the radiocarbon chronology of this culture is reinforced by a number of absolute dates obtained from the neighbouring sites of Serbia and, to a lesser extent, Slavonia. Nevertheless many chronological problems still remain open. They regard the absolute dating of the monochrome or Pre-Criş phase, which is known mainly from Romania, where it represents the first Neolithic of the country. In order to improve our knowledge on the chronology of this early stage, a number of new dates are necessary at least from some of the most important sites, such as Ocna Sibiului (Paul 1995) and Şeuşa (Ciută 1998) in the province of Alba Iulia. Apart from Romania, this phase has been radiocarbon-dated at the Vojvodinian settlement of Donja Branjevina. This site is supposed to mark the northernmost limit reached by this early aspect, whose spread is probably delimited by the course of the Danube where it flows between Vojvodina and Slavonia;

2. The dating and stratigraphic position of the white-on-red painted ware period, which has been called, by some authors, Proto-Starčevo. The problem, which is connected with the relative and absolute chronology of this phase, is mainly due to the scarcity of vertical stratigraphies and the low number of vessels painted in this style, which are found almost exclusively at Romanian and Serbian sites of the culture. These painted wares are documented as far as Transdanubia, although only two settlements of this region have yielded a few fragments of this characteristic pottery. It must be pointed out that sites of the earliest stages of the Hungarian Körös Culture, to which these potsherds are attributed, are dated to the beginning of the seventh millennium BP. The radiocarbon dates recently obtained from the Körös sites of Endrod 119 (Makkay 1992) and Ecsegfalva (Whittle *et al*. 2002: 110) date them to the first two-three centuries of the seventh millennium BP, a chronology which is very similar to that already known from the "classical" site of Starčevo-Grad in Serbia, although this latter seems to have lasted some two centuries longer. Another problem to be analysed in greater detail regards the chronological relationships between the Proto-Starčevo and the early Linear phase;

3. The radiocarbon dating of the Slavonian sites, located between the Drava and Sava Rivers. Although the typological subdivision elaborated by Dimitrijević (1974) seems to be confirmed by the results of recent excavations, at least as regards its earliest development phases (Minichreiter 2001a), the number of absolute dates of the Starčevo sites of this region is still largely insufficient;

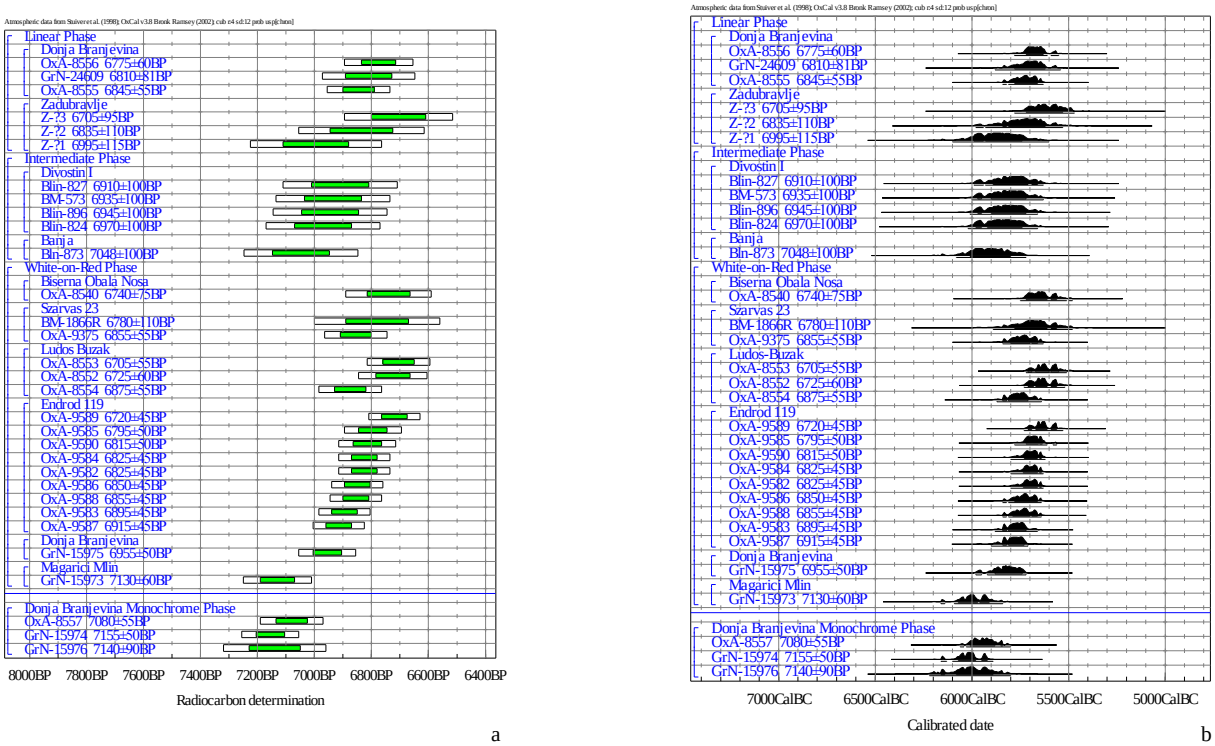
4. The results recently obtained from the Hungarian sites of the Körös Culture, which do not greatly improve the chronological scheme proposed by Gläser (1991), Horváth (1991) and Horváth and Hertelendi (1994) some ten years ago. It was mainly based on the results obtained from Maroslele-Pana, Endrod 39, Méhtelek-Nadas and Röszke-Lúdvár. Nevertheless the data available to date seem to demonstrate the inconsistency of the earlier Szatmár (Kalicz and Makkay 1972a), and later Medina phases (Kalicz and Makkay 1972b);

5. The seriation of the Serbian sites carbon-dated by Whittle *et al*. (2002). The dates from Vršac-At are most probably related, the first (OxA-8594) to the classical Starčevo occupation, the second to the more recent Vinča settlement (OxA-8595); those from Golokut-Vizićare are the only ones so far obtained, which are consistent with the local Spiraloid aspect of the Culture. They are all grouped around the middle of the seventh millennium BP and cover a time-span



a b

Fig. 7a-b. Scatterplot of the radiocarbon dates of the final phase in Romania (uncalibrated [a] and calibrated [b]).



a b

Fig. 8a-b. Scatterplot of the most important radiocarbon dates from Starčevo-Criş and Körös Cultures (uncalibraed [a] and calibrated [b]) .

between 6590±50 BP (OxA-10147) and 6520±50 BP (OxA-8695); in contrast the results obtained from Blagotin-Poljna, which should be related to a Starčevo IIa-IIb settlement on the basis of the pottery typology are very questionable (three dates between 7480±55 BP (OxA-8608) and 7230±50 BP (OxA-8760)) (Whittle *et al*. 2002: 66).

CONCLUSION

All the data presented in this paper indicate that a few specific parallels may be traced between the Central Balkans and Hungary as regards both absolute chronology and pottery typology of the Starčevo-Criş and Körös Cultures. This might be partly due to our limited knowledge of the internal sequence of the Körös Culture in Hungary, whose radiocarbon dates mainly fall within the first four centuries of the seventh millennium BP, with the only exception of Gyálarét-Szilágyi, from which comes a slightly older date (Bln-75: 7090±100 BP).

Quite a different picture is known from the Central Balkans, where the detailed pottery typological sequence proposed by G. Lazarovici (1984), necessitates of a good series of new dates to be fully accepted. Nevertheless, the few 14C sequences currently available from Macedonia, Romania and Vojvodina, seem to be acceptable, at least in a broad sense, and follow the above-mentioned detailed typological sequence. Nevertheless a systematic collection of samples for radiocarbon dating is of fundamental importance for the clarification of some critical points of the proposed sequence. They concern:

the chronology of the monochrome phase in the wider context of the late eighth millennium BP in the south-central Balkan Peninsula (Thissen 2000) (1);

the definition of the period of occurrence of the white-on-red painted wares, and of their presence/absence within the (monochrome and) Early Linear phase (2);

the detailed dating of the key sequence of Gura Baciului, in Transylvania, where all these phases are most probably attested on the basis of pottery typological analyses (3);

the relationships between the classical Linear and Girlandoid (and Spiraloid) phases with a special regard to Slavonia (4);

the chronological and territorial relationships with the Dalmatian Impressed Ware Culture, which have been revealed by the excavations carried out in Bosnia (Benac 1973) and Albania (Korkuti 1982) (5), and

the chronology of the first aspects of the Vinča and Linear Pottery Cultures in Banat (6).

ACKNOWLEDGEMENTS

The authors are very grateful to J. Meadows (Institute of Archaeology, UCL, UK) for developing the scatterplots of the figures presented in this paper and all the computer work.

REFERENCES

Anderlović-Garašanin D. 1954. *Starčevačka Kultura*. Ljubljana.

Benac A. 1973. Obre I. A Neolithic Settlement of the *Starčevo*-Impresso and Kakanj Cultures at Raskršče. *Wissenschaftliche Mitteilungen des Bosnisch-Herzegowinischen Landesmuseums*, III (A): 327-430. Sarajevo.

Bonsall C., Lennon R., McSweeney K, Stewart C., Harkness D., Boroneanţ V., Bartosiewicz L., Payton R. and Chapman J. 1997. Mesolithic and Early Neolithic in the Iron Gates: a Palaeodietary Perspective. *Journal of European Archaeology*, 5 (1): 50-92.

Borić D. 2002. The Lepenski Vir conundrum: Mesolithic and Neolithic sequences in the Danube Gorges. *Antiquity*, 76 (294): 1026-1039.

Bowman S.G.E., Ambers J. and Leese M.N. 1990. Re-evaluation of British Museum Radiocarbon Dates Issued Between 1980 and 1984. *Radiocarbon*, 25 (1): 39-58.

Brukner B. 1968. *Neolit u Vojvodini*. Dissertationes, V. Vojvodanski Muzej, Beograd-Novi Sad.

Ciută M. 1998. O locuinţă de suprafaţă aparinţând neoliticului timporiu descoperită la Şeuşa "La Cărarea Morii". *Apulum*, XXXV: 1-14. Alba Iulia.

Dimitrijević S. 1969. Starčevačka Cultura u Slavonsko-Srijemskom Prostoru i Problem Prijelaza Starijeg u Srednji Neolit u Srpskom i Hrvatskom Podunaviju. In *Neolit i Eneolit u Slavoniji*: 9-96. Vukovar.

Dimitrijević S. 1974. Problem stupnjevanja Starčevačke Kulture s posebnim na doprinos Južnopanonskih nazališta rešavanjuivih problemi. *Materijali*, X: 59-121. Beograd.

Gimbutas M. 1974. Chronology of Obre I and Obre II. *Wissenschaftliche Mitteilungen des Bosnisch-Heerzegovinischen Landesmuseums*, IV (A): 17-35. Sarajevo.

Gimbutas M. 1976. *Neolithic Macedonia*. Monumenta Archaeologica, 1. The University of California, Los Angeles.

Gläser R. 1991. Bemerkungen zur Absoluten Datierung des Beginns der Westlichen Linienbandkeramik. *Banatica*, 11: 53-64. Reşiţa.

Horváth F. 1991. Vinča Culture and its Connections with the South-East Hungarian Neolithic: a Comparison of Traditional 14C Chronology. *Banatica*, 11: 259-273. Reşiţa.

Horváth F. and Hertelendi E. 1994. Contribution to the 14C based chronology of the Early and Middle Neolithic Tisza region. *Á Nyíregyházi Jósa András Múzeum Évkönyve*, XXXVI: 111-133. Nyíregyháza.

Jovanović B. 1969. Chronological Frames of the Iron Gate Group of the Early Neolithic Period. *Archaeologia Jugoslavica*, X: 23-38. Beograd.

Kalicz N. and Makkay J. 1972a. Probleme des Frühen Neolithikum der Nördlichen Tiefebene. In Fitz J. and Makkay J. (eds.) *Die Aktuellen Fragen der Bandkeramik*: 77-92. Székesfehérvár.

Kalicz N. and Makkay J. 1972b. Südliche Einflüsse im Frühen und Mittleren Neolithikum Transdanubien. In Fitz J. and Makkay J. (eds.) *Die Aktuellen Fragen der Bandkeramik*: 93-105. Székesfehérvár.

Karmanski, S. 2005. *Donja Branjevina: a Neolithic Settlement near Deronje in the Vojvodina (Serbia)*. Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Quaderno 10. Trieste.

Korkuti M. 1982. Vashtëmia - një vendbanimi Neolitit të Hershëm. *Iliria*, 2: 91-146. Tirana.

Korkuti M. 1983. Vendbanimi Neolitik i Kolshit. *Iliria*, 2: 12-75. Tirana.

Lazarovici G. 1979. *Neoliticul Banatului*. Bibliotheca Musei Napocensis, IV. Cluj-Napoca.

Lazarovici G. 1984. Neoliticul Timporiu in România. *Acta Musei Porolissensis*, VIII: 49-104. Zalau.

Lazarovici G. 1993. Les Carpates Méridionales et la Transylvanie. In Kozlowski J. (ed.) *Atlas du Néolithique Européen*. ERAUL, 45: 243-284. Liège.

Lazarovici G. and Maxim Z. 1995. *Gura Baciului*. Biblioteca Musei Napocensis, XI. Cluj-Napoca.

Letica Z. 1969. Vlasac - nouvelle habitat de la Culture de Lepenski Vir à Djerdap. *Archaeologia Jugoslavica*, X : 7-12. Beograd.

Makkay J. 1981. Painted Pottery of the Körös-Starčevo culture from Szarvas, site NO. 23. *Acta Archaeologica Carpathica*, XXI: 95-103. Kraków.

Makkay J. 1992. Excavations at the Körös culture settlement of Endröd-Öregszolok 119 in 1986-1989. In Bökönyi S (ed.) *Cultural and Landscape*

Changes in South-East Hungary, I: 121-193. Archaeolingua, Budapest.

Mantu C.M. 2000. Relative and Absolute Chronology of the Romanian Neolithic. *Analele Banatului*, VII-VIII: 75-106. Cluj-Napoca.

Marinescu-Bîlcu, S. 1993. Les Carpates Orientales et la Moldavie. In Kozlowski J. (ed.) *Atlas du Néolithique Européen*. ERAUL, 45: 191-242. Liège.

McPherron A. and Srejović D. (eds.) 1988. *Divostin and the Neolithic of Central Serbia*. Pittsburgh.

Milojčić V. 1949. *Chronologie der Jüngeren Steinzei Mittel- und Südosteuropas*. Gerr. Mann, Berlin.

Milojčić V. 1950. Körös-Starčevo-Vinča. In *Reinecke Festschrift*: 108-120. Mainz.

Minichreiter K. 1992. *Starčkevačka Kultura u Sjevernoj Hrvatskoj*. Arheološki Zavod Filozofskog Kakulteta Sveucilišta u Zagrebu. Dissertationes et Monographiae, I. Zagreb.

Minichreiter K. 2001a. The architecture of Early and Middle Neolithic settlements of the Starčevo culture in Northern Croatia. *Documenta Praehistorica*, XXVIII: 199-214. Ljubljana.

Minichreiter K. 2001b. Tipološka klasifikacija keramike rane Starčkevačke kulture iz stambene zemunice 10 u Zadubravlju. *Prilozi Instituta za Arheologiju u Zagrebu*, 18: 5-20. Zagreb.

Nandris J.G. 1988. The R- and K-Strategy Society of Lepenski Vir in Early Neothermal Perspective. *Rivista di Archeologia*, XII: 5-13. Venezia.

Nica M. 2000. Die Mesolithischen und Neolithischen Kulturen Olteniens im Kontext des Mittel-und Südosteuropäischen Neolithikums. *Analele Banatului*, VII-VIII: 133-160. Timişoara.

Paul I. 1995. Aspekte des Karpatisch-Balkanisch-Donauländischen Neolithikums (Die Präcris Kultur). In *Vorgeschichtliche Untersuchungen in Siebenürgen*. Biblioteca Universitatis Apulensia, I: 28-68. Alba Iulia.

Pavúk J. 1993. Beitrag zur Definition der Protostarčevo-Kultur. *Anatolica*, XIX: 231-242.

Perić S. 1998. Mehrschichtige Neolitische Siedlungen und das Problem der Kulturstratigraphie des Neolithikums in Serbia. *Starinar*, XLIX: 11-38. Beograd.

Srejović D. 1969. The Roots of the Lepenski Vir Culture. *Archaeologia Jugoslavica*, X: 13-22. Beograd.

Srejović D. 1971. Die Lepenski Vir-Kultur und der Beginn der Jungstein zeit in der mittleren Donau. In Schwabedissen H. (ed.) *Die Anfänge des Neolithikums vom Orient bis Nordeuropa*. Fundamenta A/3: 1-17. Köln-Wien.

Tasić N.N. 1993. Nekoliko novih radiokarbon datuma sa lokaliteta Deronje i Magerici Mlin. *Glasnik SAD*, 9: 99-102. Beograd.

Tasić N.N. 2000. Salt Use in the Early and Middle Neolithic of the Balkan Peninsula. In Nikolova L. (ed.) *Technology, Style and Society. Contributions to the Innovations betwen the Alps and the Black Seain Pre history*. BAR. Oxford. BAR International Series 854: 35-40.

Tasić N.N. 2003. The White Painted Ornament of the Early and Middle Neolithic of the Central Balkans. In Nikolova L. (ed.) *Early Symbolic Systems for Communication in Southeast Europe*. BAR. Oxford. BAR International Series, 1139, 181-191 .

Thissen L. 2000. A Chronological Framework for the Neolithisation of the Southern Balkans. In Hiller S. and Nikolov V. (eds.) *Karanovo III. Beiträge zum Neolithikum in Südosteuropa*: 193-212. Phoibos Verlag, Wien.

Ursulescu N. 1984. *Evoluţia Culturii Starčevo-Criş pe Teritoriul Moldovei*. Muzeul Judeţean Suceava, Suceava.

Whittle A., Bartosiewicz L., Borić D., Petitt P. and Richards M. 2002. In the beginning: new radiocarbon dates for the Early Neolithic in northern Serbia and south-east Hungary. *Antaeus*, 25: 65-118. Budapest.

RAPID RIVERS AND SLOW SEAS?
NEW DATA FOR THE RADIOCARBON CHRONOLOGY OF THE BALKAN PENINSULA

Paolo Biagi (Venice, Italy)[1], Stephen Shennan & Michela Spataro (London, United Kingdom)[2]

1. INTRODUCTION

The scope of this paper is twofold: 1) to present and discuss the results of a new series of absolute dates obtained from the Starčevo-Criş sites of Romania and Vojvodina, in order to establish a first radiocarbon chronology of the Early Neolithic of the region, and correlate them with the pottery typological sequence already known for the same period; and 2) to use these results to infer the rate of spread of the first farmers across the central Balkans, and suggest the main routes they followed.

An increasing number of archaeologists has shown interest in the radiocarbon dating of the first Neolithic settlements of the Balkan Peninsula, which are distributed both in the continental regions of the interior (Bojadžjev, 1995; 2000; Görsdorf and Bojadžjev, 1996; Nikolova, 1998; Borić, 1999; Thiessen, 2000a; 2000b), and along the Dalmatian coast of the Adriatic Sea (Müller, 1991; Forenbaher, 1999; Bass, 2003).

Several recently published summary papers have provided us with a complete picture of present-day knowledge, at both regional and large scales (Horváth, 1991; Whittle *et al*., 2002; Tasić , 2003; Biagi and Spataro, 2005). They revealed a clear gap in the radiocarbon chronology of the earliest Neolithic of the Central Balkans, particularly in present-day Romania. Despite our detailed knowledge of the ceramic typological phases of this long-lasting culture (Lazarovici, 1984; 1993), until recently only 12 radiocarbon dates were available, from seven sites, the majority of which are attributed to later phases in the development of the Criş Culture (Criş III and IV) (László, 1998; Mantu, 1998; 2000).

For this reason, it became clear to the authors that a programme of radiocarbon dating of Starčevo-Criş Culture sites had to be an essential part of their research project devoted to the scientific analysis of Early Neolithic pottery production and circulation in the area.

2. THE EMERGING PICTURE OF THE BALKAN CHRONOLOGY

2.1. Sampling Methods and the New Results

Between 2003 and 2004, twenty-five samples were collected for radiocarbon dating from some of the most important Early Neolithic settlements of Banat and Transylvania (Romania) as well as from other sites in Vojvodina (Serbia) and Slavonia (Croatia) (fig. 1). The sites sampled, and the results so far obtained, are shown in table 1 and figs. 2a and 2b.

The samples selected for radiocarbon dating are mainly long bones of large mammals, such as aurochs (*Bos primigenius*) and red deer (*Cervus elaphus*). More rarely, *Bos* astragali, heels and ribs have been used, as well as two red deer antler samples. Most dates are conventional, although two long bone fragments and one fragment of a bone tool were dated by AMS. All the bone samples were identified to species level before being processed. Two samples of previously identified charcoal were also dated (table 1: Material).

All the samples were provided by the sites' excavators. They came from well-defined features (such as habitation structures, or pits, or fireplaces), contexts or archaeological layers, which did not show any visible trace of contamination from earlier or later intersecting structures or horizons. In the case of sites with long sequences, samples were collected from different, superimposed layers or, whenever possible, features, in order to confirm (or reject) the relative chronology of the pottery typological sequences already defined by the excavators. Particular attention was paid to the sampling of the (supposed) earliest Neolithic Criş Culture sites of Transylvania (namely Pre-Criş or Criş IA-IB); in this case, the samples were selected with great care, given the importance of dating organic specimens from the lowermost occupation layers of these sites.

With the exception of GrN-28455, which is older than expected, the dates so far obtained show a continuous trend, which covers a

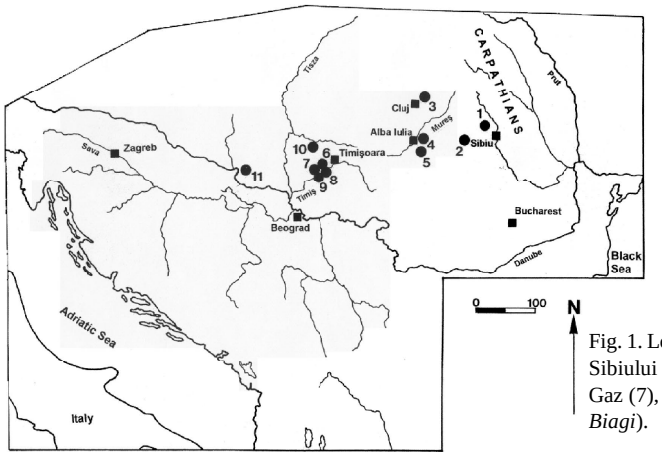


Fig. 1. Location of the sites sampled for radiocarbon dating. Ocna Sibiului(1), Miercurea Sibiului (2), Gura Baciului (3), Şeuşa (4), Limba Bordane (5), Foeni-Sălaş (6), Foeni-Gaz (7), Parța (8), Giulvaz (9), Dudeşti Vechii (10) and Mostonga (11) (*drawing by P. Biagi*).

[1]Department of Science of Antiquities and the Near East, Cà Foscari University, Palazzo Bernardo, San Polo 1977, 30125 Venezia (I), Italy.
E-mail: pavelius@unive.it
[2] Institute of Archaeology, UCL, 31-34 Gordon Square, London WC1H 0PY (UK). E-mails: s.shennan@ucl.ac.uk; m.spataro@ucl.ac.uk

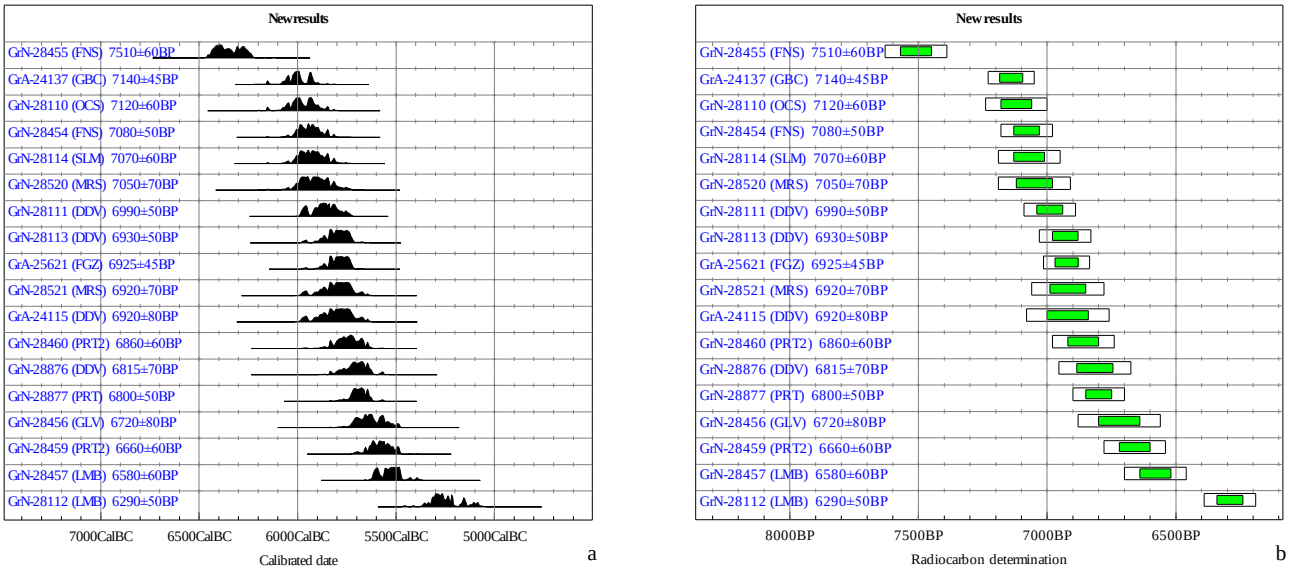


Fig. 2. Graph of the new radiocarbon dates from Romania (cal [a] and uncal [b] dates).

time-span from the last two centuries of the eighth to the middle of the seventh millennium BP (last century of the seventh to the middle of the sixth millennium Cal BC) (figs. 3a and 3b).

If we consider the sites with Pre-Criş (Paul, 1995) and/or Criş IA-IB (Lazarovici, 1993) horizons (Ocna Sibiului [Paul, 1995], Şeuşa [Ciută , 2000], Gura Baciului [Lazarovici and Maxim, 1995] and Miercurea Sibiului [Luca, 2002], all the radiocarbon dates fall within a well-defined time-span, which covers some one hundred years of the last two centuries of the eighth millennium BP (last fifty years of the seventh to the first two centuries of the sixth millennium Cal BC). The second main pottery typological phase (Criş IIA and IIB) is dated by the results from Miercurea Sibiului, Foeni-Sălaş (Greenfield and Drasovean, 1994; Spataro 2003b), Dudeştii Vechi (El Susi, 2001), and Foeni-Gaz (Spataro, 2003a), to the very end of the eighth millennium and the beginning of the seventh millennium BP (the first and the second century of the sixth millennium Cal BC).

The third block, which is based on the Criş IIIA and B typological subdivision, includes dates between the end of the first century of the seventh millennium BP and the middle of the same millennium (second century of the sixth millennium and the middle of the same millennium Cal BC). Dates for this phase published by Mantu (2000: 98), from sites in Transylvania (Gura Baciului) and Oltenia, are less precise and may cover a longer time span[3].

Phase IV is represented by only one date (GrN-28112), which falls in the second half of the seventh millennium BP (second half of the sixth millennium Cal BC). Other dates from this phase have already been published by Mantu (2000: 98). They were obtained mainly from the site of Cârcea "Viaduct" in Oltenia (Nica, 2000), with the exception of KN-I 102, which is from Valea Raii "Copăcelu". The radiocarbon dates from these settlements fall within the middle of the seventh millennium BP (middle of the sixth millennium Cal BC)[4].

2.2. A Fluvial Route for the Spread of the Neolithic

One important point to note is that, although all the dates of the first block come from sites distributed along the tributaries of the Olt[5], which flows southwards straight into the Danube, and the Mureş River in Transylvania. The second block includes only one date from this region, and four from the Banat Plain, from sites located along the Timiş and Mureş Rivers, which join the Danube at (the Timiş), or not too far (the Mureş), from Belgrade.

As we have seen, the first Neolithic communities of Romania made their appearance during the last two centuries of the eighth millennium BP (last fifty years of the seventh – first two centuries of the sixth millennium Cal BC) in central-eastern Transylvania, a region that, so far has yielded no trace of Mesolithic occupation (Păunescu, 2001). Thanks to its fluvial network, it is closely connected with the Stara Planina of Bulgaria. This latter territory is crossed, from south to north, by the River Iskur, which joins the Danube a few kilometres west of its junction with the Olt (Bailey and Panayotov, 1995: 5).

Earlier dates for the Early Neolithic of the same part of Bulgaria have been obtained at Gulubnik (Gălăbnik) (Pavuk and Cohadžiev, 1984), along the course of the Strymon (Struma), which flows southwards into the Aegean from close to the source of the Iskur. According to Todorova (1995: 83), together with the Vardar and the Nišava, this is supposed to be the most important fluvial route followed by the first farming communities, because of the great number of Neolithic sites located along the banks of this watercourse and its tributaries (Nikolov, 2002).

[3] The dates are: Lv-2157 (6400±90 BP: Gura Baciului), GrN-17003 (6665±45 BP: Trestiana), Lv-2155 (6390±100 BP: Trestiana), Bln-586 (6825±150 BP: Soroca II "Trifauti) and Bln-? (6650±100 BP: Sacarovca I).

[4] The dates are: KN-I 102 (6480±75 BP), Bln-1918 (6540±60 BP), Bln-1982 (6430±60 BP), Bln-1983 (6395±60 BP) and Bln-2354 (5860±60 BP), which is considered to be too young than expected.

[5] It is important to point out that the transhumance routes currently followed by the shepherds to reach Transylvania from Oltenia is through the Poiana Rusca or the Parang-Lotru-Cindrel Mountains and not the course of the Olt River (Luca, pers. comm. 2004).

3. CERAMICS AS A KEY INDICATOR OF THE NEOLITHISATION PROCESS

3.1. Pottery Typology and Its Relative Chronology

It is now generally believed that Starčevo-Criş is the culture responsible for the Neolithisation of Romania. Moving from the south towards Transylvania, with the exception of Maramureş and Dobrogea (Vlassa, 1972; Lazarovici, 1998; Ignat, 2001: 70), this phenomenon is supposed to have occurred in three successive stages. The data currently available would indicate that its epicentres are Cîrcea, near Craiova in Oltenia, Ocna Sibiului, near Sibiu, and Gura Baciului, near Cluj, in Transylvania (Lazarovici, 1993: 243). According to this hypothesis, the earliest sites, where the oldest pottery traditions are represented, should be those of Transylvania.

From a typological point of view, the oldest phase, called IA by Lazarovici (1993: table 1), or Pre-Criş by Paul (1995), is characterised by well-burnished, translucent, red or pink-painted wares, sometimes with simple patterns of white-painted dots and small ovals. The vessel shapes are hemispherical, globular, or more rarely cylindrical. This horizon is also present at Donja Branjevina in Vojvodina (Karmanski, 2005). A few sherds of characteristic red-surfaced pottery with white-painted dots are known from further north, at the southern limit of the Great Hungarian Plain (Makkay, 1981).

From a chronological point of view, the radiocarbon dates show a continuous trend. Following the pottery typological subdivision, the Pre-Criş (IA-IB) phase apparently began around 7200-7100 BP (6000 Cal BC), and lasted about one century (figs. 4a and 4b). The transition (?) from Pre-Criş (IA-IC) to Criş II most probably took place around 7000 BP (5900 to 5800 Cal BC).

According to Draşovean (2001: 35), the second main phase of development of the Starčevo-Criş Culture is the Criş IIA-IIB, which is found throughout Romania (e.g. Gura Baciului layer 3, in Transylvania) and, in particular, in Banat. Indeed, as shown in table 1 (Cultural phases), phase II is represented at both Foeni-Sălaş and Foeni-Gaz (Spataro, 2003a; 2003b). According to Lazarovici (1979: 43), this phase is attested at Donja Branjevina, Lepenski Vir, Nosa, Cîrcea II, Karanovo, Gura Baciului II, and other sites.

Phase II ceramic forms represent an evolution of preceding shapes and motifs. The ceramics are characterised by troncoconical open bowls, sometimes on a ring-shaped or squared low pedestal, globular shapes decorated with geometrical, linear and triangular painted patterns and deep, open bowls with a slightly outstanding rim. Zigzag decorated "altars" are also typical of this sub-phase (Lazarovici, 1979a: fig. 2; 1984: figs. 3 and 4). Phase IIA is characterised by a white, red or yellow slip, with white-painted linear patterns, curves, spirals or combined and channelled motifs (see Lazarovici, 1993: table 3). Lazarovici, (1998: 13) introduced the term "*solid style*" to describe the typical vessel shapes of this sub-phase, which, according to this author, are characterized by surfaces with wide white-slipped or painted panels[6].

Phase IIB[7] is characterised by open bowls, sometimes decorated with red-painted triangles below the rim, characteristic hemispherical, low-pedestalled bowls, with vertical painted decorations and "Girlandoid" (garland-like) types, globular shapes, including flasks, sometimes with pinched, impressed, vertical motifs. The decorative patterns also consist of instrumental, finger and fingernail impressions (see Lazarovici, 1993: table 4). On the basis of the new radiocarbon results, phase II also seems to have lasted some one hundred and fifty years or so.

Phase III has been subdivided into two main sub-phases. The vessel shapes of IIIA are very similar to those of the preceding one and include hemispherical and troncoconical bowls and necked jars (Lazarovici, 1979: 37, fig. 2A: 5 and 6). The surface treatment is also similar: monochrome, burnished, *barbotino* wares and channelled surfaces are abundantly represented as are red-painted spiral and triangular motifs, but the number of finger impressed and fingernail motifs starts to decrease (see Lazarovici, 1993: table 5). New vessel forms, mainly carinated shapes, including undecorated bowls and plates of variable size and depth, make their appearance during sub-phase IIIB, together with a few biconical shapes, which recall Vinča proto-types (Lazarovici, 1984: fig. 6). The open conical, low-pedestalled bowls continue to be a common feature as are deep, globular jars, rarely with four horizontal ring handles, sometimes necked, decorated with pinched impressed, fingernail and incised zigzag patterns. The channelled surface seems to be less common. During the same period the red and black painted decorative patterns are very rich, even on carinated and pedestalled vessels, with triangle, zigzag, linear, meander and spiral motifs (see Lazarovici, 1993: table 6)[8].

Again, there does not appear to have been a chronological gap between phase II and phase III, which began circa 6900 to 6800 BP (5800 to 5700 Cal BC) (figs. 4a and 4b**).** Bearing in mind that we have only two dates (GrN-28460 and GrN-28876), sub-phase A seems to have occurred between 6900 to 6700 BP (5800 and 5600 Cal BC), whereas sub-phase IIIB can be dated to 6800 to 6500 BP (5700 to 5500 Cal BC).

We should bear in mind, however, that we have only two phase IV dates, both of which are from sites in Oltenia, where the situation is different to that in Transylvania (Nica, 2000). During phase IV the frequency of carinated vessels increases and the red or black-painted decorative patterns become more articulated, with the appearance of beautiful spiral ornamentations on pedestalled bowls and complex geometrical cruciform motifs on the upper part of deep conical bowls[9].

The vessel shapes include troncoconical, bitroncoconic, globular, pedestalled, tripod-like, oval-shaped handled flasks, and necked jar types (see Lazarovici, 1993: tables 7 and 8). The surface treatment is

[6] Lazarovici (1998: 24) points out the appearance of channelled pots and polished ornaments during the development of the Karanovo I and Karanovo II Culture, Anzabegovo II, Protoseskl0, Preseselo-Mogoulita and at Starčevo-Criş sites in Southern Banat (e.g. Cuina Turcului III, Padina II, etc.).

[7] According to Lazarovici, Phase IIB corresponds to the Linear B phase of Dimitrijević (1969; 1974). This subphase is known. This sub-phase is known from the finds of Gornea-Locurile Lungi, Gornea-Caunita de Sus (Lazarovici, 1979b), Dubova-Cuina Turcului, Cîrcea, Cuina Turcului II, Gabrovac, Starčevo, Zsoldos, Lepenski Vir IIA, Schela Cladovei, etc. (Lazarovici, 1979a: 44-45).

[8] Phase IIIA corresponds to the "Girlandoid" (garland-like) phase of Dimitrijević (Lazarovici, 1979a: 45). The fingernail impressions are organised in simple syntaxes, groups, sometimes are paired. The sites that characterize this phase are those of "*Beşenova, Cenad, Dubova-Peştera lui Maovaţ , Giulvăz, Gornea, Ostrovu Golu, layer 1*" (Lazarovici, 1979: 48). Sub-phase IIIB corresponds to the Spiraloid A of Dimitrijević. It has been recognized at Giulvăz, Gornea-Locurile Lungi, Ostrovu Golu, Gornea-Căunita de Sus, Schela Cladovei, etc. (Lazarovici, 1979a: 48).

[9] This phase is regarded as contemporary with Vinča A by Milojčić . Lazarovici (1984) stressed its contemporaneity with the Balkan Anatolian Chalcolithic, Karanovo II-III, and Veselinovo-Dudeşti.

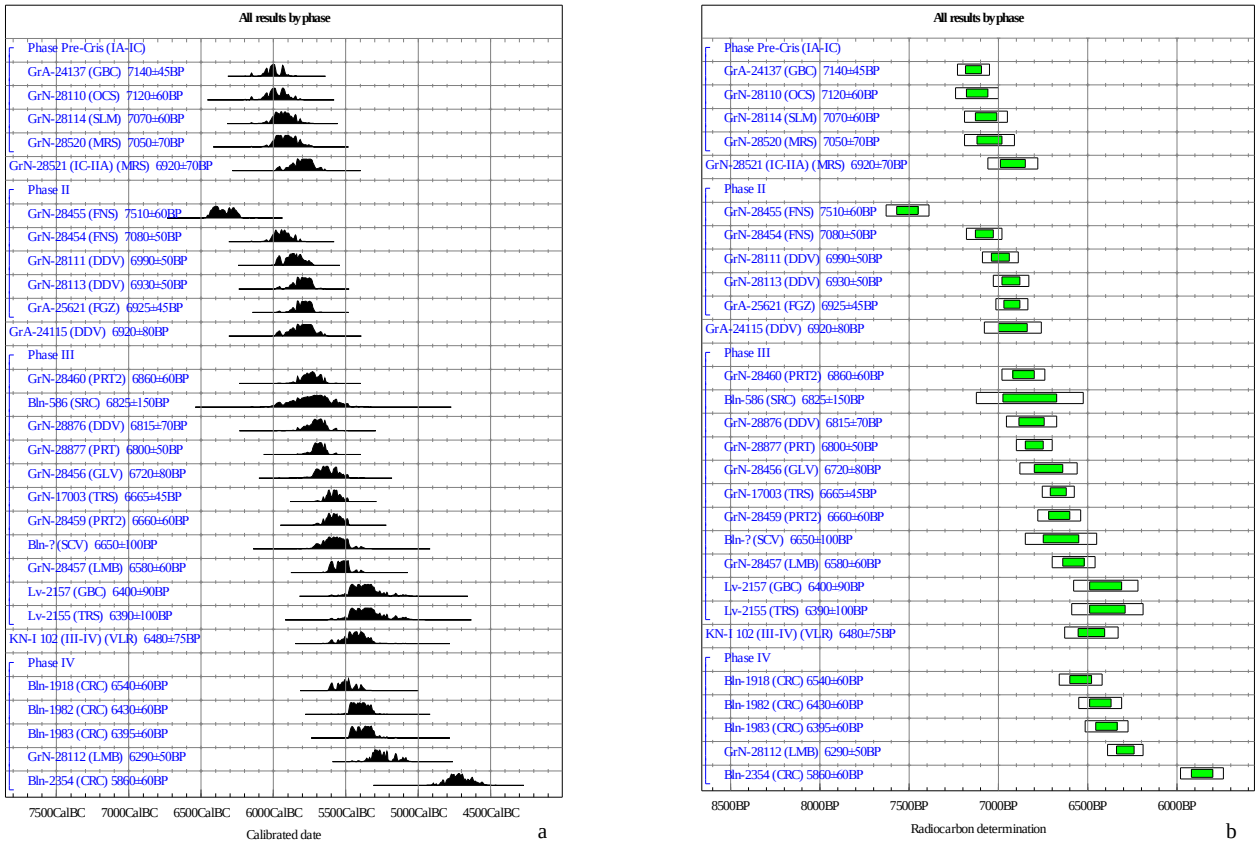


Fig. 3. Graph of all the Early Neolithic radiocarbon dates from Romania, including old dates (cal [a] and uncal [b]).

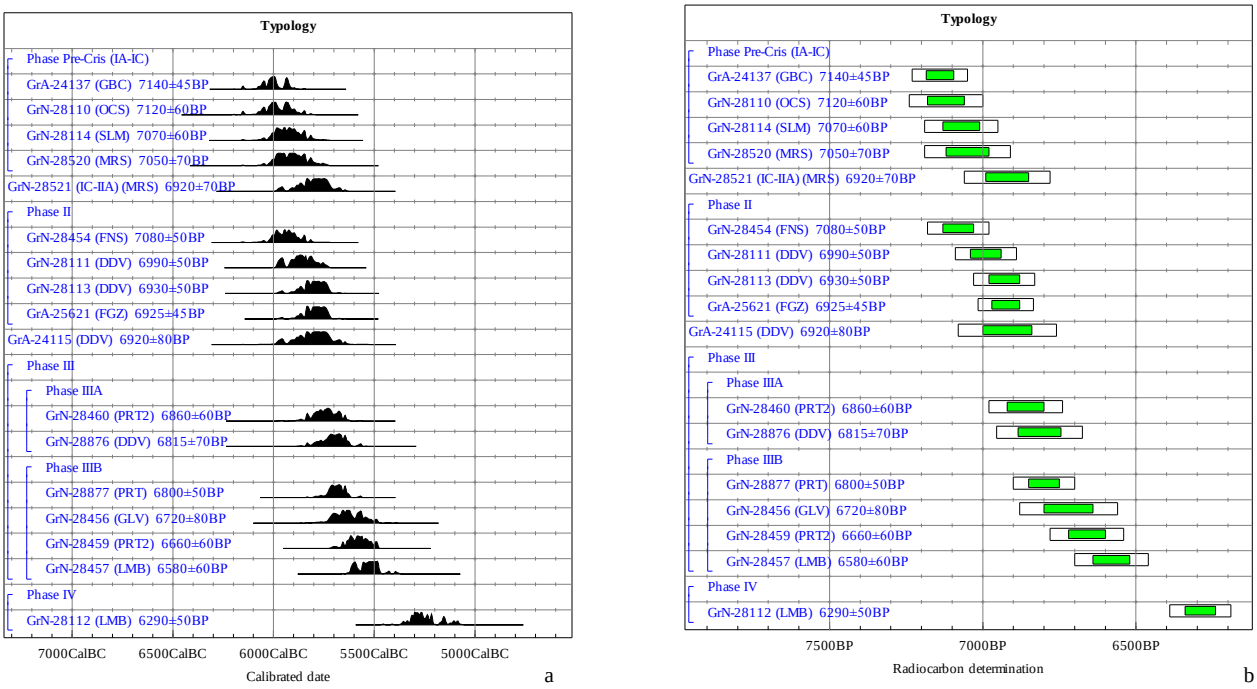


Fig. 4. Typology graph with calibrated (a) and uncalibrated (b) dates.

often of *barbotino* character. In Transylvania at least 50 Neolithic settlements can be attributed to this phase, among which are Cipău, Homorodul de Sus, Iernut-Bideşcutul Mare, Leţ, etc. (Lazarovici, 1979a: 53).

Sub-phase IVB corresponds to the Starčevo-final of Dimitrijević (Lazarovici, 1979a: 54). The shapes of the ceramic assemblage are mainly carinated, often with short, vertical or slightly outstanding rim (see Lazarovici, 1993: table 9). Painted wares are less frequent as are finger impressed and incised vessels (Lazarovici, 1984: fig. 12).

3.2. Technology Vs Typology: Chronological Continuity

Despite its typological development, Starčevo-Criş pottery is rather homogeneous technologically. Potsherds from several Starčevo-Criş Culture sites in Romania, Vojvodina and Slavonia have been analysed in thin section[10] (Spataro, 2003a; 2003b). The results of the scientific analyses show an interesting and uniform picture: the Early Neolithic potters of Transylvania, Banat and Vojvodina produced their ceramics using a common "formula" (Spataro, 2004).

They exploited micaceous and non-micritic (non-calcareous) clay sources, which contained alluvial sand. The latter was composed of quartz, muscovite mica, polycrystalline quartz, feldspar, plagioclase, and pyroxene, and in most cases, it has been heavily tempered with organic matter. The clay was heavily tempered with cereal chaff, including barley awns.

Eighty potsherds have been analysed from four different phases (Criş IB/IC to Criş IV) at the Transylvanian site of Gura Baciului, in the Cluj district (Lazarovici and Maxim, 1995). The choice of raw material and temper (non-micritic and micaceous clays tempered with organics) is always the same, regardless of the typological phase, vessel form, or decorative technique. For instance, the white-on-red painted wares have identical fabrics to sherds characterised by *barbotino* surfaces.

4. DISCUSSION

4.1. The Spread of the Neolithic in the Central Balkans: a Rapid Fluvial Phenomenon

The oldest radiocarbon dates, obtained from the Early Neolithic sites in Transylvania, reinforce the general impression that the neolithisation of the Balkan Peninsula took place very rapidly, and without any apparent obstacle. The almost contemporaneous dates (recently obtained, from south-east to north-west) from Gulubnik in Bulgaria (Bojadžjev, 1996: 122), the first habitation layers of Anza in Macedonia, along a tributary of the Vardar[11], the oldest above-mentioned Transylvanian sites, Padina at the Iron Gates (Jovanović, 1969)[12], Donja Branjevina in Vojvodina (Karmanski, 2005)[13], and the south Hungarian Körös sites (Starnini, 2002: 180), show that a very wide territory was rapidly crossed by the first farmers, during the last two centuries of the eighth millennium BP (last two centuries of the seventh – first century of the sixth millennium Cal BC) (figs. 5a and 5b).

There is little doubt that the capillarity of the fluvial network that characterises the region played a fundamental role in this diffusion process, as already observed for some contiguous regions (Nandris, 1970a). On the basis of the results described above, it seems possible to suggest that the first farmers took some 150 years to cross a territory of at least 550 kilometres, as the crow flies, from the upper Strymon Valley in Bulgaria, to the south, to the course of the Tisza, in the southern fringes of the Great Hungarian Plain, to the north (Fig. 6). Apart from the radiocarbon evidence, some characteristic traits of the pottery typology seem to confirm this pattern, as for instance the distribution of the red-slipped wares with white-painted dots (Makkay, 1981; Pavúk, 1993), and the systematic occurrence of some specific objects such as some types of stamp-seals (Makkay, 1984), labrets (Nandris, 1970b) and bone spoons (Nandris, 1972).

This speed with which farming spread from the southern to the northern Balkans contrasts with the apparent length of time it took for it to spread initially beyond Thessaly, where the earliest Neolithic is dated from Sesklo just before the middle of the eighth millennium BP (middle of the seventh millennium Cal BC) (Perlès, 2001: 100).

4.2. The Spread of the Neolithic Along the Adriatic and the Mediterranean Basin

It appears that this observation of varying speeds can be generalised. Indeed, Guilaine (2003: 199) has proposed a "*Modèle Arithmique*" for the diffusion of the first agricultural societies in Europe. Thus, recent research on the radiocarbon chronology of Impressed Ware sites on the two coasts of the Adriatic has shown that the diffusion of the Neolithic took place at two different rates of speed. Even though the radiocarbon dates so far available from the Impressed Ware sites of the Dalmatian coast are few, from the Province of Dubrovnik[14], to the south, to Medulin[15], the southernmost point of the Istria Peninsula, to the north, the general impression is that this process took place in some 300 years (Forenbaher, 1999: 527), during which a coastal strip of some 450 km of was covered. Unfortunately the standard deviation of some of the available dates is rather high, which makes any calculation rather imprecise (Bass, 2003: 54).

In contrast, along the Italian coast of the same basin, this phenomenon took at least 1000 years, during which a route of at least 700 km was covered, from Apulia, to the south, to Romagna, to the north, between the last two centuries of the eighth millennium uncal BP and the last two centuries of the seventh millennium BP (Skeates, 1994: 65). It is well known that the Dalmatian and Italian Impressed Wares are different, and that the Cardial aspect of this culture shows a well-defined, almost elliptical, distribution map, which covers, to a certain extent, both the above-mentioned costal zones (Müller, 1991: 312). Nevertheless, analysis of the material culture assemblages has demonstrated that, although some contacts between the two opposite shores undoubtedly took place, as demonstrated by the distribution of Liparian obsidian and probably Tavoliere flint, scientific analysis of pottery produced no evidence that it was exchanged across the Adriatic (Spataro, 2002). This is despite the fact that the crossing of the Straits of Otranto, was undoubtedly possible, thanks to the

[10] The sites analysed are those of Gura Baciului, Ocna Sibiului, Şeuşa La-cărarea morii, Foeni-Gaz, Foeni-Sălaş, Dudeşti Vechii, Donja Branjevina, Mostonga, Vinkovci and Ždralovi.
[11] From 7270±140 BP (LJ-2181) to 6840±100 BP (LJ-2333) (Gimbutas, 1976: 30).
[12] 7100±80 BP (GrN-8230), 7075±50 BP (GrN-7981) and 6570±55 BP (GrN-8229) all from charcoal (Deenen, pers. comm. 2004)
[13] 7155±50 BP (GrN-15974), 7140±90 BP (GrN-15976) and 7080±55 BP (OxA-8557).
[14] Gudnja Pećina: 7170±70 BP (GrN-10315).
[15] 6850±180 BP (HD-12093).

Signature	**Site name**	**Material**	**Lab. Number**	**Date BP**
FS2	Foeni-Salas (RO)	*Bos Primigenius*, calcaneum	GrN-28455	7510+/-60
GB1	Gura Baciului (RO)	Long bone flake	GrA-24137	7140+/-45
CNS1	Ocna Sibiului (RO)	*Bos* sp., radius dx	GrN-28110	7120+/-60
FS1	Foeni-Salas (RO)	*Bos* sp., radius	GrN-28454	7080+/-50
SS1	Seusa (RO)	*Bos* sp., humerus sx	GrN-28114	7070+/-60
MS1	Miercurea Sibiului (RO)	*Bos* sp., astragalus	GrN-28520	7050+/-70
DDV1	Dudesti Vechii (RO)	*Cervus elaphus*, humerus dx	GrN-28111	6990+/-50
DDV2	Dudesti Vechii (RO)	*Bos* sp., astragalus	GrN-28113	6930+/-50
FG1	Foeni-Gaz (RO)	Long bone flake	GrA-25621	6925+/-45
DDV3	Dudesti Vechi (RO)	Bone perforator	GrA-24115	6920+/-80
MS2	Miercurea Sibiului (RO)	*Bos*, long bone fragment	GrN-28521	6920+/-70
PT2	Parta 2 (RO)	*Cervus elaphus*, metatarsal	GrN-28460	6860+/-60
DDV5	Dudesti Vechii (RO)	*Quercus* and *Ulmus*	GrN-28876	6815+/-70
PT3	Parta 2 (RO)	*Quercus, Fraxinus* and *Ulmus*	GrN-28877	6800+/-50
MST1	Mostonga III (YU)	*Cervus elaphus*, antler	GrA-24117	6750+/-50
GLV1	Giulvaz (RO)	*Cervus elaphus*, antler	GrN-28456	6720+/-80
PT1	Parta 2 (RO)	*Bos* sp., ulna	GrN-28459	6660+/-60
LB2	Limba Bordane (RO)	*Bos* sp., radius	GrN-28457	6580+/-60
LB1	Limba Bordane (RO)	*Bos* sp., rib	GrN-28112	6290+/-50

Table 1. List of the new radiocarbon-dated samples.

Date BC 1 sigma	**Date BC 2 sigmas**	**Excavation context**	**Cultural phase**
6440-6340 (44.7%)	6450-6240 (95.4%)	Pit-house, square 5, cut 0.5, locus 41	Criş IIA-IIB
6320-5260 (23.5%)			
6060-6040 (9.6%)	6160-6140 (2.9%)	Structure in trench E-D, square 8	Criş IB-IC
6030-5980 (41.6%)	6090-5890 (92.5%)		
5959-5920 (17.0%)			
6060-6040 (6.3%)	6160-5140 (2.3%)	Layer VIII	Pre-Criş
6030-5970 (35.2%)	6090-5840 (93.1%)		
5960-5890 (26.6%)			
6010-5890 (68.2%)	6030-5810 (95.4%)	Pit-house, square 5, level 7, locus 23	Cris IIA-IIB
6000-5880 (63.2%)	6060-6040 (1.9%)	Unique layer	Pre-Criş
5860-5840 (5.0%)	6030-5790 (93.5%)		
5990-5840 (68.2%)	6030-5740 (95.4%)	Pit-house 10	Criş IB
5980-5950 (10.0%)	5990-5940 (15.5%)	Neolithic ditch, trench 1, sector E4-5	Criş IIB
5920-5800 (58.2%)	5930-5730 (79.9%)		
5840-5730 (68.2%)	5980-5950 (2.4%)	Trench 3, sector A2, cm 165	Criş IIB
	5920-5710 (93.0%)		
5840-5820 (11.5%)	5900-5710 (95.4%)	Pit-house 1, cm 125	Criş IIB
5810-5730 (56.7%)			
5870-5720 (68.2%)	5980-5940 (4.8%)	Trench 3, sector A1, cm 75-80	Criş IIIA
	5920-5660 (90.6%)		
5890-5720 (68.2%)	5990-5940 (6.1%)	Pit-house 4a	Criş IC-IIA
	5930-5660 (89.3%)		
5800-5700 (56.8%)	5850-5630 (95.4%)	Pit-house 1, trench II, square 7-5, cm 380	Criş IIIA
5690-5660 (11.4%)			
5770-5760 (0.9%)	5840-5610 (82.9%)	Trench 1, sector C, Square 1 and 2, Oven	Criş IIIA
5750-5630 (67.3%)	5590-5560 (2.5%)		
5725-5655 (60.0%)	5790-5620 (95.4%)	Trench 2, Square 6, cm 210	Criş IIIB
5650-5640 (8.2%)			
5715-5675 (25.2%)	5730-5610 (85.7%)	Unique layer	Starčevo
5670-5620 (43.9%)	5590-5550 (9.7%)		
5720-5610 (52.8%)	5740-5480 (95.4%)	Trench 2, cm 60-80	Criş IIIB
5590-5550 (15.4%)			
5640-5520 (68.2%)	5710-5690 (1.1%)	Trench II, square 5, cm 290	Criş IIIB
	5670-5470 (94.3%)		
5610-5590 (10.5%)	5630-5460 (90.9%)	Section X 1998, square 6, cm 180-200	Criş IIIB
5560-5480 (57.7%)	5450-5420 (2.8%)		
	5400-5380 (1.8%)		
5320-5200 (62.2%)	5370-5200 (74.9%)	L3 house, square 6-8, cm 110-130	Criş IV
5170-5140 (6.0%)	5180-5070 (20.5%)		

Table 1. List of the new radiocarbon-dated samples (continued).

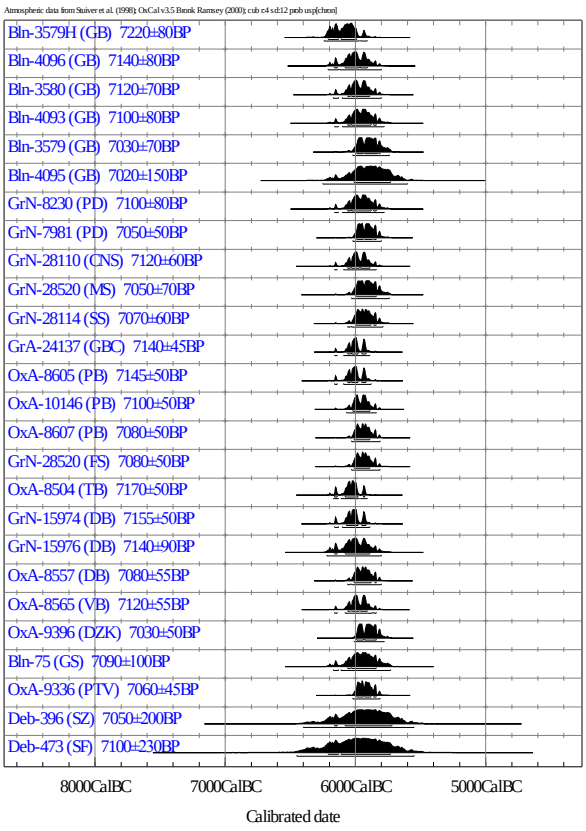


Fig. 5. Plot of the radiocarbon dates of the last two centuries of the eight millennium BP in geographical order from the south (top) to the north (bottom). The sites are those of Gulubnik (GB), Padina (PD), Miercurea Sibiului (MS), Ocna Sibiului (CSN), Şeuşa (SS), Gura Baciului (GBC), Foeni-Sălaş (FS), Perlez-Batka (PB), Vinogradi-Bečej (VB), Topole-Bać (TB), Donja Branjevina (DB), Deszk (DSZ), Pitvaros (PTV), Szarvas 56 (SZ), Gyálarét-Szilágyi (GS) and Szaiol-Felsöföld (SF).

numerous islands dotting the Adriatic Sea in those straits, as both personal observations (Bass, 1998) and nautical archaeological experiments (Tichý, 2000) have shown.

The slow speed of spread on both coasts of the Adriatic contrasts not only with the rapid north-south spread at a similar latitude in the continental Balkans, but also with the fast east-west spread through the Mediterranean that Zilhão (2003: 217) sees in terms of "pioneer colonisation". It is paralleled in turn by the delay of c. 400 years in the northern Balkans before the emergence and extremely rapid spread of the LBK, and at a later date in north-west Europe, where the agricultural frontier seems to have remained static for c. 1000 years before farming spread to Britain and southern Scandinavia (Bogucki, 2003: 268).

In spatial terms it is increasingly clear that the van Andel and Runnels (1995) modification of Ammerman and Cavalli Sforza's (1971) wave of advance model accounts for the patterns we see in the spread of farming in many areas. As population expanded, pioneer farmers moved from one favourable "island" of agriculturally suitable land to another. This did not depend on existing farming areas becoming saturated with population but on the benefits of being first colonisers of new patches as opposed to having to take available spaces in existing ones. This process led to a very rapid expansion, apparently to the limits of particular farming adaptations, as in the rapid spread to Romania, then subsequent infilling until demographic expansion levelled off as a result of density dependent checks. What is harder to explain than the phases of rapid expansion is the checks, which occurred at various times and places and led to Guilaine's (2003) proposed "*Modéle Arithmique*". In northwest Europe it may have been existing hunter-gatherer populations with relatively high population densities that led to the delay of the LBK frontier (Price, 2003: 280; Gronenborn, 2004: 19). In the northern Balkans it may have been the result of the time needed for new agricultural adaptations to Central European climates to be developed before the LBK expansion could begin, although so far this is more a standard assumption than a demonstrated fact. However the contrasting rates of spread of the two sides of the Adriatic (Skeates, 1994: 65; Bass, 2003: 54), both of them slower than that through the Balkans, are not obviously explicable by either of these mechanisms and raise important issues that need to be resolved.

Within the northern Balkans themselves the significance of the new dates, apart from demonstrating the rapidity of the spread, is that they show a continuous process of typo-chronological evolution in the pottery which sits uneasily with the traditional view that the phases of the Starčevo-Criş represent a series of incursions from regions to the south-east, but fits entirely with the initial results of the fabric and technology analyses of the pottery which have been carried out and indicate long-standing continuity (Spataro, 2004).

Aknowledgements

The authors are very grateful to Professor F. Draşovean (Timişoara Museum - RO), Professor G. Lazarovici (Reşiţa University - RO), S. Luca (Sibiu University - RO) and I. Paul (Alba Iulia University - RO), and Dr. M. Ciută (Alba Iulia University - RO) and Dr. D.L. Ciobotaru (Timişoara Archaeological Service - RO), who provided samples for dating from their excavations. Special thanks are due to Dr. M. Bon (Venice Natural History Museum - I) and R. Nisbet (Torre Pellice, Turin - I) respectively, for the identification of the bone and charcoal samples to be dated.

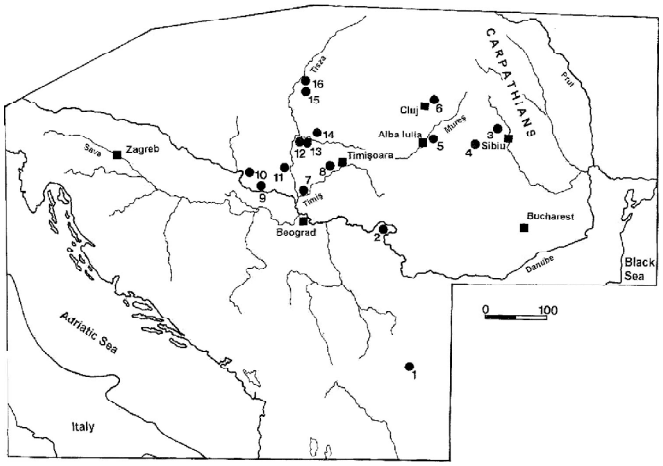


Fig. 6. Location of the sites of the last two centuries of the eighth millennium BP in the study region. Gulubnik (1), Padina (2), Ocna Sibiului (3), Miercurea Sibiului (4), Şeuşa (5), Gura Baciului (6), Perlez-Batka (7), Foeni-Sălaş (8), Topole-Bać (9), Donja Branjevina (10), Vinogradi-Bečej (11), Deszk (12), Gyálarét-Szilágyi (13), Pitvaros (14), Szarvas 56 (15), Szaiol-Felsöföld (16) (sources: Bognár-Kutzian and Csongor,1987; Horváth and Hertelendi, 1994; Whittle *et al*., 2002; Biagi and Spataro, 2004) (*drawing by P. Biagi*).

This work has been possible thanks to the financial support of the The Leverhulme Trust Project "*The early Neolithic in the Balkans: ceramic analysis and cultural processes*".

References

Ammerman, A.J. and Cavalli Sforza, L.L. 1971 - Measuring the Rate of Spread of Early Farming in Europe. *Man,* 6: 674-688. London.

Bailey, D.W. and Panayotov, I. 1995 - Introduction. In Bailey, D.W. and Panayotov, I. (eds.) *Prehistoric Bulgaria*. Monographs in World Archaeology, 22: 1-8. Prehistory Press, Madison.

Bass, B. 1998 - Early Neolithic offshore accounts: remote islands, maritime exploitations, and the trans-Adriatic cultural network. *Journal of Mediterranean Archaeology*, 11 (2): 165-190. Sheffield.

Bass, B. 2003 - The maritime expansion of Early Neolithic agro-pastoralism in the Eastern Adriatic Sea. *Atti della Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia*, XIV: 45-60. Trieste.

Biagi, P. and Spataro, M. 2004 - New Radiocarbon Dates from the Criș Culture Settlements of Banat and Transylvania. *Patrimonium Banaticum,* III: 7-20. Timișoara.

Biagi, P. and Spataro, M. 2005 - New Observations on the Radiocarbon Chronology of the Starčevo-Criș and Körös Cultures. *In:* Nikolova, L. and Higgins, J. (eds.), *Prehistoric Archaeology & Anthropological Theory and Education.* Reports of Prehistoric Research Projects 6-7. Salt Lake City & Karlovo (this volume).

Bognár-Kutzian, I. and Csongor, É. 1987 - New Results of Radiocarbon Dating of Archaeological Finds in Hungary. In Pécsi, M and Kordos, L. (eds.) *Holocene Environment in Hungary*. Theory-Methodology-Practice, 41: 131-140. Geographical Research Institute, Hungarian Academy of Sciences, Budapest.

Bogucki, P. 2003 - Neolithic Dispersal in Riverine Interior Central Europe. In Ammerman, A.J. and Biagi, P. (eds.) *The Widening Harvest. The Neolithic Transition in Europe: Looking Back, Looking Forward*: 249-272. Collo quia and Conference Papers, 6. The Archaeological Institute of America, Boston.

Bojadžjev, J. 1995 - Chronology of Prehistoric Cultures in Bulgaria. In Bailey, D.W. and Panayotov, I. (eds.) *Prehistoric Bulgaria*. Monographs in World Archaeology, 22: 149-192. Prehistory Press, Madison.

Bojadžjev, J. 2000 - Entwicklung der frühneolithischen bemalten Keramik in Bulgarien. In Hiller, S. and Nikolov, V. (eds.) *Karanovo III. Beiträge zum Neolithikums in Südosteuropa*: 327-341. Phoibos Verlag, Wien.

Borić, D. 1999 - Places that created time in the Danube Gorge and beyond, c. 9000-5500 BC. *Documenta Praehistorica*, XXVI: 41-70. Ljubljana.

Ciută , M. 2000 - Contribuții la conoașterea celui mai vechi orizont al neoliticului timporiu din România: Cultura Precriș. Descoperirile arheologice de la Șeușa-La cărarea morii. *Apulum* XXXVII (1): 52-101. Alba Iulia.

Dimitrijević, S. 1969 - Starčevačka Cultura u Slavonsko-Srijemskom prostoru im problem prijelaza starijeg u srednji neolit u Sprskom i Hrvatskom podunavlju. In *Neolit i Eneolit u Slavoniji*: 9-96. Vukovar.

Dimitrijević, S. 1974 - Problem stupnjevanja Starčevačke Kulture s posebnim obzirom na doprinos Južnopanonskih nazališta rešavanju ivih problemi. *Materijali,* X: 59-121. Belgrade.

Draşovean, F. 2001 - Early neolithic settlement at Timişoara-Fratelia. In Draşovean, F. (ed.) *Festschrift für Gheorghe Lazarovici. Zum 60 Geburtstag*: 33-40. Editura Mirton, Timişoara.

El Susi. G. 2001 - Archaeozoological researches in Starčevo-Criș sites of the Banat Plain. Fauna from Foeni-Sălaș and Dudeștii Vechi (Timiș County). *Analele Banatului*, IX: 15-40. Timișoara.

Forenbaher, S. 1999 - The Earliest Islanders of the Eastern Adriatic. *Collegium Anthropologicum*, 23 (2): 521-539.

Gimbutas, M. 1976 - *Neolithic Macedonia As reflected by the Excavations at Anza, Southeast Yugoslavia*. Monumenta Archaeologica, 1. The Institute of Archaeology, The University of California, Los Angeles.

Görsdorf, J. and Bojadžjev, J. 1996 - Zur absoluten Chronologie der bulgarischen Urgeschichte. Berliner 14C-Datierungen von bulgarischen archäologischen Fundplätzen. *Eurasia Antiqua*, 2: 105-174. Berlin.

Greenfield, H. and Draşovean, F. 1994 - Preliminary report on the 1992 excavations at Foeni-Salas: an Early Neolithic Starčevo-Criș settlement in the Romanian Banat. *Analele Banatului*, III: 45-85. Timișoara.

Gronenborn, D. 2004 - Comparing contact-period archaeologies: the expansion of farming and pastoralist societies to continental temperate Europe and southern Africa. *Before Farming*, 2004 (3): 1-35.

Guilaine, J. 2003 - Aspects de la Néolithisation en Méditerranée et en France. In Ammerman, A.J. and Biagi, P. (eds.) *The Widening Harvest. The Neolithic Transition in Europe: Looking Back, Looking Forward*: 189-206. Colloquia and Conference Papers, 6. The Archaeological Institute of America, Boston.

Horváth, F. 1991 - Vinča Culture and its Connections with the South-East Hungarian Neolithic: a Comparison of Traditional 14C Chronology. *Banatica*, 11: 259-273. Reșița.

Horváth, F. and Hertelendi, E. 1994 - Contribution to the 14C based absolute chronology of the Early and Middle Neolithic in the Tisza region. *Jósa András Múzeum Évkönyve*, XXXVI: 111-134. Nyíregyháza.

Ignat, D. 2001 - The early Neolithic in north-west of Romania. In Draşovean F. (ed.) *Festschrift für Gheorghe Lazarovici. Zum 60 Geburtstag*: 69-89. Editura Mirton, Timişoara.

Jovanovic, B. 1969 - Chronological Frames of the Iron Gate Group of the Early Neolithic Period. *Archaeologia Jugoslavica*, X: 23-38. Belgrade.

Karmanski, S. 2005 - *Donja Branjevina: a Neolithic Settlement near Deronje in the Vojvodina (Serbia)*. Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Quaderno 10. Trieste.

László, A. 1998 - Sur Le début du Néolithique de la Roumanie: quelques considérations concernant la période "Proto-Starčevo". In Otte, M. (ed.) *Préhistoire d'Anatolie. Genèse de deux mondes*, I. ERAUL, 85 : 175-192. Liège.

Lazarovici, G. 1979a - *Neoliticul Banatului*. Muzeul de Istorie al Transilvaniei. Bibliotheca Musei Napocensis, IV. Cluj-Napoca.

Lazarovici, G. 1979b - *Gornea. Prehistorie*. Banatica, 5. Reșița.

Lazarovici, G. 1984 - Neoliticul Timporiu in România. *Acta Musei Porolissensis*, VIII: 49-104. Zalau.

Lazarovici, G. 1993 - Les Carpates Méridionales et la Transylvanie. In Kozlowski, J. (ed.) *Atlas du Néolithique Européen, L'Europe Orientale 1*. ERAUL, 45: 243-284. Liège.

Lazarovici, G. 1998 - About the Neolithisation process of the second migration of the Early Neolithic. In Draşovean, F. (ed.) *The Late Neolithic of the Middle Danube Region. International Symposium on the problems of the transition from Middle to Late Neolithic in the Middle Danube Region*: 7-37. The Museum of Banat. Editura Eurobit, Timişoara.

Lazarovici, G. and Maxim, Z. 1995 - *Gura Baciului*. Biblioteca Musei Napocensis, XI. Cluj-Napoca.

Luca, S.A. 2004 - Eine Zoomorphe Statuette aus der Jungsteinzeitlische Siedlung von Reussmarkt (Miercurea Sibiului) Szertdahely-Petriș. *Cultura și Civilizatie la Dunărea de Jos*, 19: 96-106. Călărași.

Makkay, J. 1981 - Painted Pottery from the Körös- Starčevo Culture from Szarvas site NO. 23. *Acta Archaeologica Carpathica*, XXI: 95-103. Krakow.

Makkay, J. 1984 - *Stamp seals in south-east Europe*. Akadémiai Kiádo, Budapest.

Mantu, C.M. 1998 - Absolute chronology of Neolithic cultures in Romania and relations with the Aegeo-Anatolian world. In Otte M. (ed.) *Préhistoire*

d'Anatolie. Genèse de deux mondes, I. ERAUL, 85 : 159-174. Liège.

MANTU, C.M. 2000 - Relative and Absolute Chronology of the Romanian Neolithic: *Analele Banatului*, VII-VIII: 75-106. Timişoara.

MÜLLER, J. 1991 - Die Ostadriatische Impresso-Kultur. Zeitliche Gliederung und Kulturelle Einbindung. *Germania*, 69 (2): 311-358.

NANDRIS, J. 1970a - Ground water as a factor in the First Temperate Neolithic settlement of the Körös region. *Zbornik Narodnog Muzeja u Beogradu*, VI: 59-71. Belgrade.

NANDRIS, J. 1970b - The development and relationships of the earlier Greek Neolithic. *Man*, 5 (2): 192-213. London.

NANDRIS, J. 1972 - *Bos primigenius* and the bone spoon. *Bulletin of the Institute of Archaeology*, 10: 63-82. London.

NICA, M. 2000 - Die Mesolithischen und Neolithischen Kulturen Olteniens im Kontext des Mittel- und Südosteuropäischen Neolithikum. *Analele Banatului*, VII-VIII: 133-160. Timişoara.

NIKOLOV, V. 2002 - *Frühneolithische Bemalte Ornamentik*. Sofia.

NIKOLOVA, L. 1998 - Neolithic Sequence: The Upper Stryama Valley in Western Thrace (with Appendix: Radiocarbon Dating of the Balkan Neolithic). *Documenta Praehistorica* XXV, 99-131.

PAUL, I. 1995 - Aspekte des Karpatisch-Balkanisch-Donauländischen Neolithikums (die Präcriş Kultur). In *Vorgeschichtliche Untersuchungen in Siebenbürgen*. Biblioteca Universitatis Apulensis, I: 28-68. Alba Iulia.

PĂUNESCU, A. 2001 - *Paleoliticul şi Mezoliticul din Spaţiul Transilvan*. AGIR, Bucarest.

PAVÚK, J. 1993 - Beitrag zur Definition der Protostarčevo-Kultur. *Anatolica*, XIX: 231-242. Leiden.

PAVÚK, J. and ČOHADŽIEV, M. 1984 - Neolithische Tellsiedlung bei Gâlâbnik in Westbulgarien. *Slovenská Archeologia*, XXXII (1): 195-228. Nitra.

PRICE, T.D. 2003 - The Arrival of Agriculture in Europe as Seen from the North. In AMMERMAN, A.J. and BIAGI, P. (eds.) *The Widening Harvest. The Neolithic Transition in Europe: Looking Back, Looking Forward*: 273-296. Colloquia and Conference Papers, 6. The Archaeological Institute of America, Boston.

SKEATES, R.1994 - Towards an absolute chronology for the Neolithic in Central Italy. In SKEATES, R. and WHITEHOUSE, R. (eds.) *Radiocarbon Dating and Italian Prehistory*. Accordia Special Studies on Italy, 3: 61-72. London.

SPATARO, M. 2002 - *The First Farming Communities of the Adriatic: Pottery Production and Circulation in the Early and Middle Neolithic*. Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Quaderno 9. Trieste.

SPATARO, M. 2003a - Scientific study of ancient pottery production: a case-study from the early Neolithic site of Foeni-Gaz (Timiş County, Romania). *Patrimonium Banaticum*, II: 7-26. Timişoara.

SPATARO, M. 2003b - Early Neolithic pottery production in the Balkans: minero-petrographic analysis of the ceramics from the Starčevo-Criş site of Foeni-Sălaş (Banat, Romania). *Atti della Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia*, XIV: 25-43. Trieste.

SPATARO, M. 2004 - Early Neolithic pottery production in Romania: the scientific analysis of the ceramics from Gura Baciului and Şeuşa La-cărarea morii (Transylvania). In BAILEY, D.W., WHITTLE, A. and CUMMINGS, V. (eds.) *(Un)settling the Neolithic*. Routledge, London (in press).

STARNINI, E. 2002 - La transizione Mesolitico-Neolitico in Ungheria: uno sguardo critico sullo stato della ricerca. In *Omaggio a Santo Tiné. Miscellanea di studi di Archeologia preistorica e protostorica*: 173-190. Facoltà di Lettere, Università di Genova.

TASIĆ, N. 2000 - Salt Use in the Early and Middle Neolithic of the Balkan Peninsula. In NIKOLOVA, L. (ed.) *Technology, Style and Society. Contributions to the Innovations between the Alps and the Black Sea in Prehistory*. BAR, International Series, 854: 35-40. Oxford.

TASIĆ, N. 2003 - The White Painted Ornament of the Early and Middle Neolithic in the Central Balkans. In NIKOLOVA, L. (ed.) *Early Symbolic Systems for Communication in Southeast Europe*, 1. BAR, International Series, 1139: 181-191. Oxford.

THIESSEN, L. 2000a - A Chronological Framework for the Neolithisation of the Southern Balkans. In HILLER, S. and NIKOLOV, V. (eds.) *Karanovo III. Beiträge zum Neolithikums in Südosteuropa*: 193-212. Phoibos Verlag, Wien.

THIESSEN, L. 2000b - Thessaly, Franchthi and Western Turkey: Clues to the Neolithisation of Greece? *Documenta Praehistorica*, XXVII: 141-154. Ljubljana.

TICHÝ, R. 2000 - Námorní plavba v raném Neolitu. Príspevek experimentalní archeologie k pocatkúm neolitizace stredomorí. *Archeologické Rozhledy*, LII (2): 234-260. Prague.

TODOROVA, H. 1995 - The Neolithic, Eneolithic and Transitional Period in Bulgarian Prehistory. In BAILEY, D.W. and PANAYOTOV, I. (eds.) *Prehistoric Bulgaria*. Monographs in World Archaeology, 22: 79-98. Prehistory Press, Madison.

VAN ANDEL, T.H. and RUNNELS, C.N. 1995 - The earliest farmers in Europe. *Antiquity*, 69: 481-500.

VLASSA, N. 1972 - Cea nai veche fază a complexului cultural Starčevo-Criş în România. *Acta Musei Napocensis*, IX: 7-28. Cluj-Napoca.

WHITTLE, A., BARTOSIEWICZ, I., BORIĆ, D., PETTITT, P. and RICHARDS, M. 2002 - In the beginning: new radiocarbon dates for the Early Neolithic in northern Serbia and south-east Hungary. *Antaeus*, 25: 65-118. Budapest.

ZILHÃO, J. 2003 - The Neolithic Transition in Portugal and the Role of Demic Diffusion in the Spread of Agriculture across West Mediterranean. In AMMERMAN, A.J. and BIAGI, P. (eds.) *The Widening Harvest. The Neolithic Transition in Europe: Looking Back, Looking Forward*: 207-223. Colloquia and Conference Papers, 6. The Archaeological Institute of America, Boston.