

**RUDJER BOŠKOVIĆ INSTITUTE RADIOCARBON
MEASUREMENTS III**

DUŠAN SRDOČ, ADELA SLIEPČEVIC,* and JOSIP PLANINIC**

Rudjer Bošković Institute, P O B 1016, 41001 Zagreb, Yugoslavia

The following list contains dates of samples measured since our previous list (R, 1973, v 15, p 435-441). As before, age calculations are based on the Libby half-life 5568 ± 30 yr, and reported in years before 1950. The modern standard is 0.950 of the activity of NBS oxalic acid.

Before combustion, wood and charcoal were treated with 4% HCl. Samples of soil with high percentage of limestone were treated with 50% HCl. Samples containing recent carbon (mold, rootlets) were boiled in 4% NaOH. The counting method is essentially the same as described in R, 1971, v 13, p 135-140. Sample descriptions were prepared with collectors and submitters. The errors quoted correspond to 1σ variation of sample net counting rate and do not include the uncertainty in ^{14}C half-life. Data are not corrected for isotopic fractionation. The recent activity of speleothems (dripstones) is assumed to be 85% of modern samples; therefore 1305 yr was subtracted from the radiocarbon age (Münnich and Vogel, 1959).

ACKNOWLEDGMENTS

We thank E Hernaus for preparation of samples and methane synthesis, B Obelić, and B Novak for data processing, and V Andreić for construction and maintenance of gas lines and electronics.

I. ARCHAEOLOGIC SAMPLES

Selevac series

Charred grain (*Triticum* sp) from a baked earth receptacle that rested on lowest occupation floor, underlying several occupation levels and overlying ashy layer devoid of artifacts, in Sonda S-VII at Selevac, loc "Staro Selo", near Smederevska Palanka ($44^{\circ} 30' \text{ N}$, $20^{\circ} 53' \text{ E}$), N Serbia. Site spans most of Serbian Middle and Late Neolithic sequence. Figurine found in receptacle, the only artifact, is diagnostic of Vinča "A" at type site. Coll 1970 by Radovan Milošević and Vojislav Novaković, Nat Mus Smederevska Palanka, and subm by A McPherron, Univ Pittsburgh.

Z-233A. Selevac

**6113 $\pm$ 80
4163 BC**

Whole unbroken grains treated with 4% HCl and 4% NaOH.

Z-233B. Selevac

**6152 $\pm$ 90
4202 BC**

Whole unbroken grains without chemical treatment; mean value of 2 measurements.

* Faculty of Veterinary Medicine, Univ Zagreb, Yugoslavia

** Faculty of Pharmacy and Biochemistry, Univ Zagreb, Yugoslavia

- 6366 ± 100**
4416 BC
- Z-233. Selevac**
Rest of sample, treated with 4% HCl and 4% NaOH. *Comments* (DS): while both samples gave very close dates, whole-grains samples are regarded as more reliable; (AM): date confirms early position of occupation level in Vinča sequence.
- 283 ± 60**
AD 1667
- Z-234. Varaždinske toplice**
Fragments of wood from draw-well 2m below surface (46° 14' N, 14° 05' E). Sample coll 1973 by Marcel Gorenc, Archaeol Mus, Zagreb.
- 1533 ± 75**
AD 417
- Z-269. Varaždinske toplice**
Fragments of charred wood, remains of rafter from NW capitol of early Roman imperial settlement Aquae Jasae (46° 14' N, 14° 05' E). Coll 1973 and subm by Marcel Gorenc.
- 430 ± 60**
AD 1520
- Z-236. Hutovo Blato**
Fragment of wooden boat (*Quercus*) 11m below surface, spring Desilo, Hutovo Blato (43° 3' N, 17° 45' E) near Čapljina, Hercegovina. Coll 1972 and subm by Vukosava Atanacković-Salčić, Inst Protection Cultural Monuments, Regional Center, Mostar.
- Hrvatska Dubica series**
Fragments of wooden boat from muddy bed of Una R near Hrvatska Dubica (45° 11' N, 16° 49' E) Croatia. Coll 1973 and subm by Members Regional Inst Protection Cultural Monuments, Zagreb.
- 541 ± 60**
AD 1409
- Z-251. Hrvatska Dubica I**
- 417 ± 60**
AD 1533
- Z-255. Hrvatska Dubica II**
- 1759 ± 55**
AD 191
- Z-256. Bosanska Gradiška**
Fragment of wooden boat from sandy bed of Jablanica R NW of Bosanska Gradiška (45° 7' 30" N, 17° 11' 30" E). Coll 1973 and subm by Drago Malešević, Bosanska Gradiška.
- 320 ± 60**
AD 1630
- Z-257. Dubrovnik, Knežev dvor**
Wooden pillar from foundation of Duke's Palace (Knežev Dvor). Found during restoration of palace. Date important for chronology of building.
- 194 ± 60**
AD 1756
- Z-260. Lopar**
Charcoal from hearth, Lopar (44° 51' N, 14° 43' E) on Rab I. Coll 1972 and subm by Vjeko Legac, Rab.

1944 ± 83**Z-261. Maslovare****AD 6**

Charcoal from layer in Illyrian iron melting-furnace in Blagaj near Bosanski Novi (45° 0' N, 16° 25' E). Depth: 2m below dross layer in gray clay. Coll 1973 and subm by Djuro Basler, Regional Mus, Sarajevo. *Comment* (Dj B): expected age: 70 BC to AD 50.

Vlasac series

Charcoal from archaeol excavation of Mesolithic settlement Vlasac (44° 32' N, 22° 3' E) near Donji Milanovac. Settlement discovered during construction of Djerdap hydro-electric power plant. Coll 1970 and subm by Dragoslav Srejović and Zagorka Letica, Fac Arts & Sci, Archaeol Dept, Belgrade.

7000 ± 90**Z-262. Vlasac I****5050 BC**

Charcoal from hearth, House I, Sonda A, Level XXVI, depth 4.1m below surface, oldest horizon. *Comment* (DS): dates agree with expected period (Mesolithic, 7-6th millennium BC).

6335 ± 92**Z-264. Vlasac I****4385 BC**

Charcoal from Burial 54, Quad A/17, Level XI.

7559 ± 93**Z-267. Vlasac II****5609 BC**

Charcoal below Hearth 16. *Comment* (DS): expected age: end of Mesolithic, 7-6th millennium BC.

6713 ± 909**Z-268. Vlasac ?****4763 BC**

Charcoal from Burial 11, Quad a/6, Level VII.

317 ± 65**Z-270. Vela Svitnja****AD 1579**

Fragments of charred wood (*Pinus*) from sand at depth 35m, Vela Svitnja, Vis bay (43° 04' N, 16° 12' E), Vis I. Coll 1973 and subm by Nenad Cambi, Archaeol Mus, Split.

1949 ± 77**Z-283. Ščitarjevo****AD 1**

Charcoal from cult fireplace in burial place, Block 7, depth 1m, in Roman municipality Andautonia near Zagreb (45° 46' N, 16° 00' E). Coll 1973 and subm by Branka Vikić and Marcel Gorenc, Archaeol Mus, Zagreb.

Nin series, Croatia

Fragments of wooden ship from sea under muddy sand at 2m depth at Ždrijac, port of Nin (44° 15' N, 15° 15' E). Coll 1973 and subm by Zdenko Brusić and Božidar Vilhar, Archaeol Mus, Zadar.

- 961 ± 64**
AD 989
- Z-296. Nin I**
Hull fragments.
- 937 ± 71**
AD 1013
- Z-297. Nin II**
Hull fragments of same ship.
- 1177 ± 80**
AD 773
- Z-298. Nin III**
Fragments of wooden rib from same ship.
- Z-299. Slavonski Brod** **>35,000**
Fragments of wood assoc with steppe elephant (*parelephas trogontherii*) skull from Glogovica channel near Slavonski Brod (45° 10' N, 18° 02' 30" E). Coll 1973 and subm by Mirko Malez, Yugoslav Acad Sci, Zagreb.
- 2735 ± 100**
785 BC
- Z-306. Hruševje**
Fragments of driftwood, Hruševje near Postojna (45° 46' N, 14° 07' 15" E). Date determines period of accumulation of driftwood in Nanošca creek valley. Coll 1973 and subm by Alojz Šercelj, Slov Acad Sci & Arts, Ljubljana.
- 7150 ± 100**
5200 BC
- Z-307. Loče**
Fragments of driftwood, Loče near Slovenska Bistrica (46° 22' 45" N, 15° 33' 30" E). Date determines period of accumulation of driftwood in Ložnica creek valley. Coll 1973 and subm by Alojz Šercelj.
- Ljubljansko Barje series**
Wood fragments from ash (*Fraxinus*) pilings of pile houses from Ljubljansko Barje peat bog (45° 58' N, 14° 32' E), Slovenia. Potsherds, estimated age, 3800 yr old, assoc with fragments.
- 4633 ± 117**
2683 BC
- Z-278. Ljubljansko Barje**
- 4345 ± 113**
2395 BC
- Z-305. Veliki Mah No. 1**
- 4964 ± 99**
3104 BC
- Z-314. Maharski prekop**
- 4701 ± 104**
2751 BC
- Z-315. Maharski prekop**
- Kaptol series**
Charcoal from rectangular charcoal-filled trench in prehistoric Barrow I in Kaptol village near Požega (45° 26' N, 17° 44' E). Results important for chronology of Early Iron age of Požega Valley. Coll 1973 and subm by Vera Vejvoda and Ivan Mirnik, Archaeol Mus, Zagreb.

Z-316. Kaptol 1	2626 ± 90 676 BC
Z-317. Kaptol 2	2294 ± 97 644 BC

II. GEOLOGIC SAMPLES

Grapa series, Slovenia

Calcite from stalagmite, Grapa Cave (46° 49' N, 14° 09' E) near Belsko. Coll 1972 and subm by France Habe, Slovenian Acad Sci & Arts, Postojna. Samples date periods of growth of sinter.

Z-231. Grapa	6380 ± 100 4430 BC
Calcite from stalagmitic core, entrance gallery.	

Z-231/I. Grapa	3330 ± 80 1380 BC
Calcite from same stalagmite, 0 to 4mm below surface.	

Z-231/II. Grapa	4300 ± 90 2350 BC
Calcite from same stalagmite, 7 to 12mm below surface.	

Z-231/IV. Grapa	2201 ± 63 251 BC
Calcite from tip of same stalagmite.	

Z-232/I. Grapa	3942 ± 80 1992 BC
Calcite from stalagmite grown on clay in N gallery, 0 to 10mm below surface.	

Z-232/II. Grapa	6252 ± 100 4302 BC
Calcite from same stalagmitic core.	

Z-227. Grapa	2410 ± 78 460 BC
Calcite from stalagmite from N gallery. <i>Comment</i> (FH): expected period: Holocene.	

Rastuša series

Calcite from stalactite from top of Rastuša cave near Teslić (44° 41' 48" N, 17° 48' 20" E). This stratum is sterile, but next layer contains bones of cave bear (*Ursus spelaeus*). Coll 1972 and subm by Mirko Malez, Yugoslav Acad Sci, Zagreb. *Comment* (MM): expected period: Pre-Boreal.

Z-238/I. Rastuša	9808 ± 124 7858 BC
Calcite from core of stalactite.	

Z-238/II. Rastuša **9412 ± 126**
7462 BC
 Calcite from same stalactite 0 to 2cm below surface.

Buško Blato series

Speleothems from caves discovered during construction of dam, Orlovac hydroelectric plant (43° 40' N, 16° 59' E). Dates helped to establish chronology of cave formation, growth of speleothems and tectonic changes. Coll 1972 and subm by Srećko Božičević, Inst Geol, Zagreb.

Z-239/I. Buško Blato 1 **1857 ± 74**
AD 93
 Base of submerged stalagmite, Sec 8, of interest for dating formation of sandy layer in stalagmite. Calcite below sand.

Z-239/II. Buško Blato 1 **1828 ± 62**
AD 122
 Calcite above sand.

Z-240/I. Buško Blato 2 **1821 ± 66**
AD 129
 Calcite from core, submerged stalagmite, Sec 8, near siphon.

Z-240/II. Buško Blato 2 **Modern**
 Calcite from tip of same stalagmite.

Z-241. Buško Blato 3 **2763 ± 78**
813 BC
 Calcite from tip, submerged stalagmite, Sec 8.

Z-243. Buško Blato 5 **1349 ± 74**
AD 601
 Calcite from core of base of broken stalagmite from great hall, Sec 8, grown on a calcite block.

Z-244/I. Buško Blato 6 **3776 ± 84**
1826 BC
 Calcite from stalagmite from Great Hall beneath block with stalagmite Z-243, Sec 8. Calcite from core of base of stalagmite.

Z-244/II. Buško Blato 6 **2886 ± 64**
934 BC
 Calcite from same stalagmite 0 to 5cm below surface.

Z-245. Buško Blato 7 **312 ± 70**
AD 1638
 Calcite from outer layer of stalagmite grown on a block under rock in right canal, Sec 8.

Z-246/I. Buško Blato 8 **2481 ± 77**
531 BC
 Calcite from stalagmite grown on a block under inclined rock, Sec 17. Calcite from base of stalagmite.

- Z-246/II. Buško Blato 8** **659 ± 70**
AD 1291
 Calcite from tip of same stalagmite.
- Z-247. Buško Blato 11** **3382 ± 78**
1432 BC
 Calcite from base of stalagmite grown on muddy ground behind block with stalagmite Z-246, Sec 17.
- Z-248/I. Buško Blato 9** **2041 ± 64**
91 BC
 Calcite from stalagmite grown on calcite block, Sec 17. Calcite from base of stalagmite.
- Z-248/II. Buško Blato 9** **1970 ± 79**
20 BC
 Calcite from tip of same stalagmite.
- Z-249/I. Buško Blato 12** **>30,000**
 Calcite from fragment of speleothem 10cm thick, Sec 27. Core of speleothem.
- Z-249/II. Buško Blato 12** **20,990 ± 405**
19,040 BC
 Outer part of speleothem. Sample mixed with dead gas for counting.
- Z-250. Buško Blato 13** **1945 ± 94**
AD 5
 Calcite from base of broken stalagmite grown on calcite crust 0 to 6mm below surface. Sample mixed with dead gas for counting.
- Z-279. Ciganske Jame** **4790 ± 120**
2840 BC
 Speleothem from cave Ciganske Jame near Kočevje (45° 39' N, 14° 53' E). Coll 1973 by Mitja Brodar and subm by Alojz Šercelj, both of Slovenian Acad Sci & Arts, Ljubljana.

REFERENCES

- Münnich, K O and Vogel, J C, 1959, Alterbestimmung von Süßwasser-Kalkablagerungen: Naturwissenschaften, v 46, p 168.
- Srdoč, D, Breyer, B, and Sliepčević, A, 1971, Rudjer Boškovic Institute radiocarbon measurements I: Radiocarbon, v 13, 1971, p 135-140.
- Srdoč, D, Sliepčević, A, Planinic, J, Obelic, B, and Breyer, B, 1973, Rudjer Boškovic Institute radiocarbon measurements II: Radiocarbon, v 15, 1973, p 435-441.