[RADIOCARBON, VOL 31, NO. 1, 1989, P 85–98]

RUDJER BOŠKOVIĆ INSTITUTE RADIOCARBON MEASUREMENTS XI

DUŠAN SRDOČ, BOGOMIL OBELIĆ, NADA HORVATINČIĆ
INES KRAJCAR BRONIĆ
Rudjer Bošković Institute, P O Box 1016, 41001 Zagreb, Yugoslavia

and

ADELA SLIEPČEVIĆ
Faculty of Veterinary Medicine, University of Zagreb

INTRODUCTION

This is a list of radiocarbon analyses determined since our previous list (R, 1987, v 29, no. 1, p 135–147). As before, with the exception of speleothems and groundwaters, the calculations follow conventional RADIOCARBON protocol (Stuiver & Polach, 1977). Sample pretreatment, combustion and counting techniques are essentially the same as described in R, 1971, v 13, no. 1, p 135–140, supplemented by new techniques for groundwater processing (R, 1979, v 21, no. 1, p 131–137). Speleothem and groundwater model ages (given in the comment section of each listing) are based on an initial activity of 85 ± 10 percent modern carbon (pMC), as recommended in Srdoč *et al* (1986), without adjustment for $\delta^{13}C$. These model ages can be converted from the 5570-yr half-life to the chronometrically more correct half-life of 5730 yr by multiplying by the factor 1.029. The "± figures" on these model ages are statistical combinations of the 1σ counting uncertainty and the ±10% uncertainty in the assumed 85 pMC. Ages and "± figures" of all other samples are adjusted for stable isotope fractionation according to the recommendations in Stuiver and Polach (1977). Data processing is done by computer (Obelić & Planinić, 1977; Obelić, 1980). Sample descriptions are prepared in collaboration with collectors and submitters.

ACKNOWLEDGMENTS

We thank E Hernaus for preparation of samples and methane synthesis, A Turković for data processing and P Hojski for technical assistance.

ARCHAEOLOGIC SAMPLES

Z-1641. Vladikina ploča cave — 290 ± 100

Wood fragment (*Quercus* sp) from soil wall in Vladikina ploča cave, Rsovac near Pirot (43° 11′ N, 22° 45′ E, 715m asl) 15m from entrance, 1.5m above ground. Coll and subm by D Gavrilović, Univ Belgrade. *Comment* (DG): expected age: 500 BP. Dates period of cave occupation.

Z-1674. Pepelane — 5850 ± 130

Charcoal from prehistoric layer, depth 1.6m at Pepelane near Virovitica (45° 44′ N, 17° 30′ E) E Slavonia, Croatia. Coll and subm 1985 by K Minichreiter, Regional Inst Preservation Cultural Monuments, Osijek. *Comment* (KM): expected age: 4th millennium BC.

Z-1752. Koprivnički bregi **32,500 $^{+2600}_{-2000}$**

Charcoal underlying plowed humus, 25cm thick, pit S-III/IV, at Koprivnički bregi—Seče (46° 10′ N, 14° 34′ E), 124m asl. Coll and subm 1984 by Z Marković, Town Mus Koprivnica. *Comment* (ZM): expected age: 5000–6000 BP.

Z-1862. Okrugla pećina **98.6 ± 1.4 pMC**

Charcoal from Okrugla pećina cave at Gornje Sinjevo near Sarajevo, Bosnia. Coll and subm 1986 by DJ Basler, Regional Mus, Sarajevo. *Comment:* (DJB): expected age: Bronze Age. Possible contamination with recent material.

Z-1742. Vela spilja **5430 ± 100**

Charcoal mixed with clay from fireplace in Vela spilja cave, 2.70 to 2.90m below ground level, near Vela Luka, Korčula I, Croatia. Coll and subm 1986 by B Čečuk, Archaeol Inst Yugoslav Acad Sci & Arts, Zagreb. *Comment* (BČ): expected age: 5000 BP.

Ajdovska jama cave series

Charcoal and speleothems from Ajdovska jama cave, site of systematic excavation of Neolithic settlement near Nemška Vas, Krško, E Slovenia. Coll and subm 1986 by A Šercelj and M Horvat, Slov Acad Sci & Arts, Ljubljana. Dates correspond to earlier measurements, Z-1042 to-1045 (R, 1984, v 26, no. 3, p 451) and Z-1178, -1179, -1554, -1602, -1603 (R, 1987, v 29, no. 1, p 138–139).

Z-1822. Ajdovska jama No. 25A **6900 ± 130**

Speleothem from central hall, depth 2.2m.

Z-1860. Ajdovska jama No. 33 **5420 ± 150**

Charcoal from central hall, depth 2.17m. Sample assoc with human and animal bones.

Z-1875. Zagreb skeletons **100.0 ± 1.4 pMC**

Bone collagen from human skeletons discovered during reconstruction of city sewage, Zagreb (45° 48′ N, 16°, 0′ E) Croatia. Coll and subm 1987 by D Strinović, Inst Forensic Med, Med Fac, Zagreb. *Comment* (DS): expected age: Middle Ages to Modern.

Z-1948. Sigetec **>37,000**

Tar from pit, 60cm deep, in prehistoric site at Sigetec near Ludbreg (46° 16′ N, 16° 38′ E) NW Croatia. Coll and subm 1980 by M Šimek, Town Mus Varaždin.

Z-1921. Slavonska Požega **790 ± 120**

Timber fragments from wall under fresco paintings from medieval church Sv Lovro dated in 13th or 14th century AD in Slavonska Požega (45°

20′ N, 17° 41′ E) Slavonia, Croatia. Coll and subm 1987 by J Velnić, Croatian Inst Restoration, Zagreb.

Vučedol series

Continuation of excavations at Eneolithic site "Streim's vineyard," on bank of Danube R near Vukovar (45° 21′ N, 19° 01′ E) 110m asl, E Croatia. Most finds were coll from oval pits used as waste dumps and burying grounds. Samples coll and subm 1986 and 1987 by A Durman, Dept Archaeol, Univ Zagreb. Dated to determine span of Baden, Kostolac, and Vučedol cultural layers (R, 1987, v 29, no. 1, p 135–136: Horvatinčić *et al,* in press).

Z-1820. Vučedol **4370 ± 140**

Charcoal, Pit 32, Kostolac phase.

Z-1821. Vučedol **4500 ± 150**

Charcoal, Pit 103, Kostolac phase.

Z-1863. Vučedol **4190 ± 180**

Collagen from human bones, Pit 13, Vučedol phase.

Z-1864. Vučedol **4620 ± 150**

Collagen from human bones, Pit 2, Baden phase.

Z-1865. Vučedol **4030 ± 140**

Collagen from human bones, Pit 6, Vučedol phase.

General Comment (AD): results correspond to second Indo-European migration wave (Gimbutas, 1980) and place Vučedol settlement in same period as Ezero, Sitagroi IV-V, Poliochni II-III, and Troy I-II.

Vinkovci series

Two charcoal samples from Eneolithic site near Vinkovci (45° 16′ N, 18° 49′ E) ca 20km W of Vučedol; dated to determine duration of Vučedol culture in this area. Coll and subm 1986 by A Durman.

Z-1817. Vinkovci 1 **3810 ± 140**

Charcoal, Pit VH 175, depth 3.4m. *Comment* (AD): expected age: Vučedol phase.

Z-1818. Vinkovci 2 **3830 ± 140**

Charcoal, House HV 226, depth 1.5m. *Comment* (AD): expected age: Vinkovci phase.

General Comment: disturbed strata at Vinkovci site consist of Vučedol and Vinkovci-Somogyvár cultures.

Liber Linteus Zagrabiensis series

Coll 1848 by M Barić and subm 1986 by I Mirnik and A Rendić-Miočević, Archaeol Mus Zagreb. *Comment:* dated to determine true age of

Etruscan linen book with long inscription which found its way to Egypt to be used as mummy wrappings. Besides linen cloth, other datable materials, such as embalming unguent and leaves assoc with mummy were dated. Samples were sent to Groningen for interlaboratory comparison of data (Srdoč & Horvatinčić, 1986, in press).

Z-1653. Mummy linen wrappings **2290 ± 80**

Comment: GrN-13875: 2210 ± 13, 2335 ± 15.

Z-1682. Embalming unguent **2230 ± 90**

Fraction insoluble in $CHCl_3$; GrN-13860: 2240 ± 13.

Z-1654. Leaves (Dicotyledon) **2580 ± 90**

Comment: very limited amount of leaves resulted in considerable error and deviation from mean values of linen and unguent age; GrN-14467: 2825 ± 15.

Z-1675. Embalming unguent **4540 ± 120**

Exuded fraction. *Comment* (NH): much older age of exuded fraction indicates that several components used in preparation of unguent contained carbon much older than rest of components.

Z-1496. Egyptian sarcophagus **2700 ± 110**

Wood from Egyptian sarcophagus of private collection. Subm 1985 by E Kavurić, Zagreb. Calibrated date corresponds to 22nd dynasty.

GEOLOGIC SAMPLES

Fossil Wood

Z-1881. Trenta valley **6820 ± 120**

Fossil wood (unid. sp) buried in lake chalk, Trenta valley (46° 23′ N, 13° 46′ E), Slovenia. Coll and subm by A Šercelj.

Z-1888. Gračanica **180 ± 110**

Fossil wood (unid. sp), in Spreča R alluvium, 7m depth at Gračanica (44° 23′ N, 18° 46′ E), Bosnia. Coll and subm by H Juruzović, Gračanica. *Comment* (HJ): younger than expected (1000 BP).

Z-1775. Plat, B-4 **12,300 ± 300**

Fossil wood (unid. sp) from borehole B-4, depth 11.5m, on slope consisting of clay and Quaternary carbonaceous rocks at Plat near Dubrovnik (42° 36′ N, 18° 14′ E) at 30m asl. Coll and subm 1986 by V Jurak, Fac Min, Geol and Petrol Eng, Univ Zagreb. *Comment* (VJ): geophysical and geological investigations.

GROUNDWATER SAMPLES

For groundwater samples, model ages (see Introduction) are reported in the *Comment.*

Banja Koviljača series

Thermomineral artesian well, Banja Koviljača spa (44° 31′ N, 19° 10′ E) near Loznica, at 130m asl, W Serbia. Coll and subm April 1986 by M Milivojević. Measurements of radioactive and stable isotope content of groundwater. Hydrogeologic study of geothermal potential of aquifer. Age of groundwater was calculated assuming initial groundwater dissolved in organic carbon activity (A_o) = 85 pMC.

Z-1692. BK-1 **5.8 ± 0.5 pMC**

Thermal artesian water, depth 80m, highly mineralized. Tritium activity: <0.2 Bq/l. *Comment:* 21,500 ± 1200.

Z-1693. BK-2 **6.2 ± 0.5 pMC**

Thermal artesian water, depth 274m. Tritium activity: <0.2 Bq/l. *Comment:* 21,000 ± 1150.

Z-1694. BK-3 **8.4 ± 0.5 pMC**

Thermal artesian water, depth 483m, Triassic karst aquifer. Tritium activity: <0.4 ± 0.2 Bq/l. *Comment:* 18,600 ± 1120.

Z-1691. Vuk Karadžić **9.1 ± 0.5 pMC**

Thermal artesian water, depth 5.6m. Tritium activity: <0.2 Bq/l. *Comment:* 18,000 ± 1050.

Kostolac series

Groundwater from aquifer Katanski Brod near Kostolac (44° 43′ N, 21° 12′ E), E Serbia. Coll and subm March 1987 by M Hadžišehović, Boris Kidrič Inst, Belgrade.

Z-1877. OP 2/1 **115.0 ± 1.6 pMC**

Shallow aquifer, ca 4m below surface. Expected age: recent water. Tritium activity: 5.4 ± 0.2 Bq/l. *Comment:* modern.

Z-1878. IB-3 **107.0 ± 1.4 pMC**

Shallow aquifer, ca 20m below surface. Tritium activity: 6.5 ± 0.3 Bq/l. *Comment:* modern.

Z-1879. B-21/2 **20.4 ± 0.7 pMC**

Groundwater, depth 40m. Tritium activity: 2.6 ± 0.2 Bq/l. *Comment:* 11,460 ± 990.

Z-1880. B-21/3 **33.6 ± 0.8 pMC**

Groundwater, depth 70m. Tritium activity: 6.1 ± 0.3 Bq/l. *Comment:* 7460 ± 970.

Z-1882. Malo Lale **5.3 + 0.5 pMC**

Thermal artesian water from karst aquifer Malo Lale (44° 23′ N, 21° 25′ E) near Petrovac, E Serbia, depth 160m. Coll and subm 1987 by M Hadžišehović. Tritium activity: <0.2 Bq/l. *Comment:* 22,300 ± 1200.

Z-1652. Kakanj, IT-1 **10.1 ± 0.6 pMC**

Groundwater, Kakanj (44° 08′ N, 18° 05′ E), C Bosnia. Coll and subm Jan 1986 by J Slišković, Geoinženjering, Sarajevo. Tritium activity: 1.1 ± 0.2 Bq/l. *Comment:* 17,100 ± 1070.

Z-1838. Ilidža, IB-2 **15.6 ± 0.7 pMC**

Thermal artesian groundwater from borehole in Triassic dolomite, depth 47 to 246m, highly mineralized. Ilidža spa near Sarajevo (43° 50′ N, 18° 20′ E), 497m asl, Bosnia. Coll and subm Feb 1987 by B DJerković, Geoinst, Sarajevo. Hydrogeologic investigation of thermal water resources (DJerković, 1976). Tritium activity: <0.2 Bq/l. *Comment:* 13,600 ± 1020.

Z-1738. Dvorovi **5.2 ± 0.4 pMC**

Thermal water from artesian borehole S-1 at Dvorovi near Bijeljina (44° 48′ N, 19° 16′ E), at 87m asl, E Bosnia. Karst aquifer, depth 1200 to 1300m, weakly mineralized water. Coll and subm Jan 1986 by A Lutvić, Geoinst, Sarajevo. Tritium activity: 0.5 ± 0.2 Bq/l. *Comment:* 22,400 ± 1140.

South Banat series

Study of groundwater in Banat region between Begej channel and Danube R included Deliblatska peščara sand desert. Groundwater in S part of sand desert close to Danube R is recent, that between Deliblat and Samoš-Velika greda line belongs to Holocene, whereas groundwater in N part of area is older than 37,000 yr. Coll and subm May 1985 by N Horvatinčić and S Grgić, Rudjer Bošković Inst.

Z-1517. Dolovo **28.5 ± 0.4 pMC**

Groundwater, pumping station Dolovo (44° 54′ N, 20° 53′ E). Tritium activity: <0.2 Bq/l. *Comment:* 8780 ± 960.

Z-1518. Deliblatska peščara 1 **70.3 ± 0.7 pMC**

Groundwater Deliblatska peščara (44° 52′ N, 21° 04′ E). Tritium activity: <0.2 Bq/l. *Comment:* 1530 ± 950.

Z-1519. Deliblatska peščara 2 **83.6 ± 0.6 pMC**

Groundwater well No. H-11 (44° 51′ N, 21° 09′ E). Tritium activity: <0.2 Bq/l. *Comment:* 130 ± 950 (modern).

Z-1529. Deliblatska peščara 3 **82.4 ± 0.6 pMC**

Water from spring Klokot in Deliblatska peščara desert (44° 49′ N, 21° 07′ E). Tritium activity: <0.2 Bq/l. *Comment:* 250 ± 950 (modern).

Z-1520. Danube R **107.15 ± 0.9 pMC**

River water near Kovin (44° 45′ N, 20° 59′ E). Tritium activity: 3.6 ± 0.2 Bq/l. *Comment:* modern.

Z-1522. Straža **25.9 ± 0.5 pMC**

Groundwater, pumping station Straža (44° 57′ N, 21° 18′ E). Tritium activity: <0.2 Bq/l. *Comment:* 9550 ± 960.

Z-1523. Dupljaja **45.5 ± 0.5 pMC**

Groundwater from artesian well at Dupljaja (45° 55′ N, 21° 17′ E). Tritium activity: <0.2 Bq/l. *Comment:* 5020 ± 950.

Z-1524. Šušara **55.0 ± 0.5 pMC**

Groundwater from pumping station at Šušara (44° 56′ N, 21° 07′ E), 200m depth. Tritium activity: <0.2 Bq/l. *Comment:* 3500 ± 950.

Z-1525. Vladimirovac **32.5 ± 0.5 pMC**

Groundwater from pumping water at Vladimirovac (45° 02′ N, 20° 52′ E). Tritium activity: <0.2 Bq/l. *Comment:* 7720 ± 960.

Z-1526. Alibunar **43.1 ± 0.2 pMC**

Artesian water at Alibunar (45° 05′ N, 20° 58′ E). Tritium activity: <0.2 Bq/l. *Comment:* 5460 ± 950.

Z-1527. Potporanj **36.5 ± 0.5 pMC**

Groundwater from well at Potporanj (45° 05′ N, 21° 15′ E). Tritium activity: <0.2 Bq/l. *Comment:* 6790 ± 960.

Z-1528. Gaj **70.6 ± 0.6 pMC**

Groundwater from well at Gaj (44° 47′ N, 21° 04′ E). Tritium activity: <0.2 Bq/l. *Comment:* 1490 ± 950.

Z-1531. Samoš **10.6 ± 0.4 pMC**

Groundwater, pumping station at Samoš (45° 12′ N, 20° 46′ E). Tritium activity: <0.2 Bq/l. *Comment:* 16,720 ± 1000.

Z-1532. Ilandža **16.3 ± 0.4 pMC**

Artesian water at Ilandža (45° 10′ N, 20° 55′ E). Tritium activity: <0.2 Bq/l. *Comment:* 13,270 ± 970.

Z-1533. Kovačica **13.7 ± 0.4 pMC**

Tap-water, sugar refinery water supply, Kovačica (45° 07′ N, 20° 37′ E). Tritium activity: <0.2 Bq/l. *Comment:* 14,660 ± 980.

Z-1534. Zrenjanin **3.7 ± 0.4 pMC**

Groundwater, pumping station in Zrenjanin (45° 23′ N, 20° 24′ E). Tritium activity: <0.2 Bq/l. *Comment:* 25,200 ± 1290.

Z-1535. Žitište **1.1 ± 0.3 pMC**

Tap-water, Žitište (45° 29′ N, 20° 34′ E). Tritium activity: <0.2 Bq/l. *Comment:* 35,000 ± 2500.

Z-1536. Velika greda **11.0 ± 0.4 pMC**

Artesian well at Velika greda (45° 15′ N, 21° 02′ E). Tritium activity: <0.2 Bq/l. *Comment:* 16,400 ± 990.

Z-1537. Sečanj **0.6 ± 0.4 pMC**

Artesian well at Sečanj (45° 22′ N, 20° 46′ E). Tritium activity: <0.2 Bq/l. *Comment:* >37,000.

Z-1538. Krajišnik **2.9 ± 0.3 pMC**

Groundwater from pumping station at Krajišnik (45° 27′ N, 20° 44′ E). Tritium activity: <0.2 Bq/l. *Comment:* 27,000 ± 1300.

Z-1946. Danube R **103.2 ± 1.4 pMC**

River water near Dubovac (44° 48′ N, 18° 53′ E). Coll and subm October 1987 by B Orlić. Tritium activity: 3.8 ± 0.2 Bq/l. *Comment:* modern.

Z-1539. Tomaševac **3.2 ± 0.4 pMC**

Artesian well at Tomaševac (45° 16′ N, 20° 37′ E). Tritium activity: <0.2 Bq/l. *Comment:* 26,300 ± 1400.

CALCAREOUS SEDIMENTS

Z-1298. Obrovac Tunnel **>37,000**

Crystalline speleothem from cavern in tunnel of hydroelectric power plant on Zrmanja R near Obrovac (44° 11′ N, 15° 41′ E) Dalmatia, S Croatia. Coll and subm 1982 by S Božičević, Inst Geol, Zagreb.

Z-1350. Švica Tunnel **84.5 ± 0.6 pMC**

Calcareous tufa deposited on outer rim of discharge tunnel of small hydroelectric power plant at Švica (44° 52′ N, 15° 10′ E) Lika, Croatia. Plant in operation from 1939 to 1963. Coll and subm 1984 by D Srdoč. *Comment* (DS): tufa deposited before bomb-test contamination.

Perinka ponor series

Wood branches and timber partially encrusted with calcareous deposits from Perinka ponor (swallow hole) at 50m depth at Donja Švica near Otočac (44° 52′ N, 15° 10′ E), Lika, central Croatia. Coll and subm 1987 by S Božičević, Geol Inst Zagreb. *Comments* (SB): dates phases of tufa precipitation. (DS): calcareous deposits from pre-bomb test era on two wooden samples enable determination of the initial activity A_o of groundwater and calcareous deposits.

Z-1905. No. 1 **99.9 ± 1.5 pMC**

Wooden beam at entrance of hole.

Z-1906. No. 2 **68.8 ± 1.1 pMC**

Inner part of calcareous deposit, 35m depth.

Z-1907. No. 3 **67.7 ± 1.1 pMC**

Calcareous deposit on wooden beam (Z-1908), 40m depth. *Comment* (DS): ratio of contemporaneous wood and tufa ^{14}C activities $A_o = 0.69$.

Z-1908. No. 4 **97.8 ± 1.4 pMC**

Wooden beam coated with calcite layer, 40m depth.

Z-1909. No. 5 **68.7 ± 1.1 pMC**

Tufa coating on twig (Z-1910), 50m depth. *Comment* (DS): ratio of contemporaneous wood and tufa ^{14}C activities $A_o = 0.68$.

Z-1910. No. 6. **101.4 ± 1.4 pMC**

Twig with calcite coating, 50m depth.

Kapsia cave series

Two stalagmites from Kapsia cave with sink hole (37° 38′ N, 22° 24′ E), at 630m asl, Peleponnesus, S Greece. Coll and subm 1985 by R Gospodarič, Slov Acad Sci & Arts, Postojna. *Comment* (RG): dated to determine period of Holocene flood.

Z-1604. K-2, No. 1 **53.6 ± 0.6 pMC**

Core of rust-colored stalagmite. *Comment:* 3700 ± 950.

Z-1606. K-2, No. 2a **54.9 ± 0.5 pMC**

Middle part of same stalagmite. *Comment:* 3510 ± 950.

Z-1608. K-2, No. 3 **55.6 ± 0.5 pMC**

Top of same stalagmite, 1.5 to 3.0cm below surface. *Comment:* 3410 ± 950.

Z-1683. K-1a **88.7 ± 0.8 pMC**

Upper part of stalagmite. *Comment:* modern.

PEAT AND SOIL SAMPLES

Lovrenško barje series

Peat samples from borehole, Lovrenško barje peat bog, Pohorje Mt, (46° 29′ N, 13° 00′ E), at 1300 asl, N Slovenia. Coll and subm 1986 by A Šercelj, Slov Acad Sci & Arts, Ljubljana. Dates help determine forest vegetation development (Culiberg, 1986). *Comment:* very good stratigraphic correlation with Z-1157, 130 to 140cm and Z-1158, 200 to 220cm (R, 1984, v 26, no. 3, p 454).

Z-1773. Lovrenško barje, No. 1 **1620 ± 130**

40 to 60cm depth.

Z-1774. Lovrenško barje, No. 2 **3860 ± 140**

230 to 250cm depth.

Ribniško barje series

Peat from bog Ribniško barje (46° 30′ N, 12° 56′ E), at 1550m asl, Pohorje Mt, N Slovenia. Coll and subm 1986 by A Šercelj. Dates help determine forest vegetation development periods (Culiberg, 1986). Corresponds to earlier reported results, *cf* Z-1365, -1366 (R, 1987, v 29, no. 1, p 142).

Z-1780. Ribniško barje, No. 1 **2790 ± 130**

Peat, depth 40 to 60cm. Expected age, 3000 yr BP.

Z-1781. Ribniško barje, No. 2 **4450 ± 150**

Peat, depth 250cm. Expected age, 5000 yr BP.

Z-1947. Morijeve luže **4130 ± 150**

Peat from Morijeve luže bog near Dravograd (46° 39′ N, 15° 5′ E), at 1000m asl, N Slovenia. Coll and subm 1987 by A Šercelj. Systematic palynol investigation of Holocene vegetation in Slovenia. *Comment* (AŠ): expected age: Holocene.

Malo polje series

Peat and gyttja from moor in Malo polje (46° 21′ N, 13° 51′ E) at 1600m asl, Triglav Mt, Julian Alps, NW Slovenia. Coll and subm 1987 by A Šercelj. Systematic palynol investigation of Holocene vegetation in Slovenia, NW Yugoslavia (Šercelj, 1965).

Z-1922. Malo polje, No. 1 **5720 ± 170**

Peat, 70 to 100cm depth.

Z-1923. Malo polje, No. 2 **6500 ± 180**

Gyttja, 100 to 120cm depth.

Z-1951. N Adriatic shelf **9030 ± 270**

Peat from sediment core 80cm below sea bottom, N Adriatic Sea (44° 50′ N, 13° 30′ E) 40km W of Pula, Istria, W Croatia. Coll and subm 1987 by S Puškarić, CIM Rudjer Bošković Inst, Rovinj. *Comment* (SP): good stratigraphic correlations with Z-713 (R, 1981, v 23, no. 3, p 415).

Z-1609. Sajan E-7869 **9470 ± 180**

Organic fraction of soil (chernozem) from K-22-Sn core, depth 1.8 to 1.9m. Sajan (45° 51′ N, 20° 16′ E) near Kikinda, N Banat, at 82m asl. Coll and subm 1985 by D Koprivica, Geoinst Belgrade. Dated for drafting geologic map of AP Vojvodina, NE Yugoslavia. *Comment* (DK): expected age: Holocene.

Z-1854. Bočar E-8288 **2720 ± 180**

Organic fraction of soil from sandy soil profile, depth 0.4 to 0.7m, at Bočar (45° 46′ N, 20° 16′ E) near Kikinda, N Banat, 93m asl. Coll and subm 1986 by D Koprivica. Dated for drafting of geologic map of Yugoslavia. *Comment* (DK): expected age: Holocene.

Z-1612. Crna bara E-7963 **2530 ± 150**

Organic fraction of soil from sandy soil profile, depth 0.35 to 0.45m, at Crna bara (45° 59′ N, 20° 16′ E), near Kikinda, N Banat, at 82m asl. Coll and subm 1985 by D Koprivica. *Comment* (DK): expected age: Holocene.

Bogojevo series

Organic fraction of soil from profile and fossil wood from borehole at Bogojevo (45° 32′ N, 19° 07′ E), S Bačka, AP Vojvodina, near Danube R. Geotectonic investigations in NE Serbia. Coll and subm by N Krstić, Geoinst, Belgrade.

Z-1676. **7750 ± 150**

Depth 4.8 to 4.9m.

Z-1677. **$34{,}200\ ^{+\ 3200}_{-\ 2300}$**

Depth 23.85 to 24.00m.

Z-1678. **>37,000**

Depth 24.5 to 24.65m.

Z-1679. **>37,000**

Depth 35.8 to 36.0m.

Z-1627. LS-5 **9270 ± 180**

Fossil wood (unid. sp) from borehole LS-5, Danube R sandy alluvium, depth 16.3 to 17.0m. *Comment* (NK): expected age based on paleologic analyses: Holocene.

Prevlaka series

Organic clay and peat from borehole, Prevlaka near Zagreb (45° 40′ N, 16° 16′ E) W Croatia. Coll and subm 1984 by E Prohić, Geol Inst, Zagreb. Geotectonic investigations.

Z-1741. S-5 **29,000 ± 1100**

Organic clay, depth 15.4 to 16.0m. *Comment* (EP): expected age 30,000 BP.

Z-1756. S-10 **>37,000**

Peat, depth 26.2 to 27.0cm. *Comment* (EP): expected age: 40,000 BP.

https://doi.org/10.1017/S0033822200044635 Published online by Cambridge University Press

Lipar series

Soil carbonate from Lipar (45° 42′ N, 19° 33′ E), Bačka loess plateau in NE Yugoslavia. Coll and subm 1987 by M Galečić, Geoinst, Belgrade. Dating of loess formation for drafting of geologic map of Yugoslavia.

Z-1893. D-91322 **50.1 ± 0.9 pMC**

Depth 1.2m. Humic loess sediment (chernozem) assoc with roots and shell fragments. *Comment* (MG): expected age: Würm-Holocene.

Z-1892. D-91321 **14.6 ± 0.7 pMC**

Humic loess assoc with shell and fauna fragments, depth 1.8m. *Comment* (MG): expected age: Würm. *General Comment:* initial activity of soil carbonate is not known.

Z-1895. Banatsko Karadordevo D-87486 **15,530 ± 380**

Macrofossil remains in sediment, Banatsko Karađorđevo (45° 34′ N, 20° 35′ E), Banat, depth 3.5m. Coll and subm 1984 by S Žolnaj, Geoinst, Belgrade. *Comment* (SŽ): expected age: Würm; dates terraces of Tisa and Tamiš Rivers.

Z-1896. Čestereg D-87485 **11,930 ± 250**

Macrofossil remains in sandy river sediment at Čestereg (45° 34′ N, 20° 32′ E), Banat, depth 4m. Coll and subm 1987 by S Žolnaj. *Comment* (SŽ): expected age: Würm.

Z-1628. Otok, Vi-85, 3882 **7830 ± 120**

Calcareous concretions from clayey silt, near Otok (45° 09′ N, 18° 53′ E), Slavonia, E Croatia. Coll and subm 1985 by M Brkić, Geol Inst, Zagreb. *Comment* (MB): dated for drafting of geologic map of Slavonia.

Vinkovci series

Clayey silt assoc with charred wood fragments and silty clay from pit at Privlaka (45° 12′ N, 18° 51′ E), near Vinkovci, E Croatia. Coll and subm 1985 by M Brkić.

Z-1629. 5422/4 **2100 ± 90**

Clayey silt assoc with charred wood fragments, depth 0.5m.

Z-1630. 5422/1 **17,900 ± 460**

Silty clay with organic detritus, Žanića Krivina, depth 6m.

Z-1640. Gornja Gorevnica T-3060/II **4.1 ± 0.3 pMC**

Loess from brickyard Gornja Gorevnica near Sombor (45° 48′ N, 19° 27′ E) at 104m asl, AP Vojvodina. Coll and subm 1985 by S Trifunović, Geol Inst, Belgrade. Age close to limit for loess deposits. Initial activity of carbonates is unknown. *Comment:* 24,350 ± 1120.

Z-1650. Draž, MO/85 **17,950 ± 360**

Land snail shells from sediment, Profile IX, partly contaminated with carbonate concretions. Draž near Batina (45° 50′ N, 18° 46′ E), Baranja, E Croatia, at 190m asl. Coll and subm 1986 by M Pikija, Geol Inst, Zagreb. *Comment* (MP): dated for drafting of geologic map of Yugoslavia.

Branjina series

Calcareous concretions and snail shells from sediment, Branjina (45° 50′ N, 18° 42′ E), Baranja, E Croatia, at 130m asl. Coll and subm 1986 by M Pikija. *Comment* (MP): expected age: Pleistocene. Dated for drafting of geologic map of Yugoslavia.

Z-1644. MO-231(K) **5.1 ± 0.6 pMC**

Calcareous concretions. *Comment:* 22,600 ± 1350.

Z-1649. MO-231(P) **33,400 $^{+2800}_{-2100}$**

Land snail shells.

General Comment: calcareous concretions show younger age, indicating carbonate-rich freshwater penetration.

Kneževo series

Calcareous concretions and snail shells from sediment in brickyard, Kneževo (45° 51′ N, 18° 39′ E), 197m asl, Baranja, E Croatia. Coll and subm 1986 by M Pikija. *Comment* (MP): expected age: Pleistocene. Dated for drafting of geologic map of Yugoslavia.

Z-1647. MO-473(K) **76.5 ± 0.8 pMC**

Calcareous concretions. *Comment:* 850 ± 950.

Z-1648. MO-473(P) **16,000 ± 280**

Land snail shells.

Z-1651. Zmajevac **20,400 ± 460**

Land snail shells from sediment, Zmajevac brickyard (45° 48′ N, 18° 48′ E), at 130m asl, Baranja, E Croatia. Coll and subm 1986 by M Pikija. *Comment* (MP): expected age: Pleistocene. Dated for drafting of geologic map of Yugoslavia.

References

Culiberg, M, 1986, Palynological investigations of two peat-bogs, Lovrenško and Ribniško barje from the Pohorje Mts: Biol Vestn, v 34, p 1–14.

Djerković, B, 1976, Podzemni karstni oblici kao prirodni rezervoari termalne vode: Geol glasnik, v 21, p 231–238.

Gimbutas, M, 1980, The Kurgan Wave 2 (c 3400–3200 BC) into Europe and the following transformation of culture: Jour Indo-European Studies, v 8, nos. 3–4, p 273–315.

Horvatinčić, N, Obelić, B, Srdoč, D, Durman, A, Benkö, L and Sliepčević, A, in press, Radiocarbon and TL dating of the Eneolithic site Vučedol in East Croatia, Yugoslavia: Pact.

Krivic, K, 1985, Los tudi na Soriški planini: Loški razgledi, v 32, p 93–97.

Obelić, B, 1980, Computer analysis and interpretation of radiocarbon data: Fizika, v 12, supp 2, p 139–161.

Obelić, B and Planinić, J, 1977, Computer processing of radiocarbon and tritium data, *in* Povinec, P and Usačev, S, eds, Internatl conf on low-radioactivity measurement and applications, Proc: The High Tatras, Slovenske pedagogicke nakladatelstvo, Bratislava, p 117–120.

Srdoč, D, Breyer, B and Sliepčević, A, 1971, Rudjer Bošković Institute radiocarbon measurements I: Radiocarbon, v 13, no. 1, p 135–140.

Srdoč, D and Horvatinčić, N, 1986, Radiocarbon dating of Liber linteus Zagrabiensis: Vjesnik Arheol muz Zagreb, ser 3, v XIX, p 83–98.

———— in press, Radiocarbon dating of an Etruscan linen book: Pact.

Srdoč, D, Krajcar Bronić, I, Horvatinčić, N and Obelić, B, 1986, Increase of ^{14}C activity of dissolved inorganic carbon along a river course, *in* Stuiver, M and Kra, R S, eds, Internatl ^{14}C conf, 12th, Proc: Radiocarbon, v 28, no. 2A, p 515–521.

Srdoč, D, Obelić, B, Horvatinčić, N, Krajcar, I and Sliepčević, A, 1984, Rudjer Bošković Institute radiocarbon measurements VIII: Radiocarbon, v 26, no. 3, p 449–460.

Srdoč, D, Obelić, B, Sliepčević, A, Krajcar Bronić, I and Horvatinčić, N, 1987, Rudjer Bošković Institute radiocarbon measurements X: Radiocarbon, v 29, no. 1, p 135–147.

Srdoč, D, Sliepčević, A, Obelić, B and Horvatinčić, N, 1979, Rudjer Bošković Institute radiocarbon measurements V: Radiocarbon, v 21, no. 1, p 131–137.

Stuiver, M, and Polach, H A, 1977, Discussion: Reporting of ^{14}C data: Radiocarbon, v 19, no. 3, p 355–363.

Šercelj, A, 1965, Paleofloristic research in the Triglav mountains: Razprave SAZU, v VIII, p 473–498.