

**RUDJER BOŠKOVIĆ INSTITUTE RADIOCARBON
MEASUREMENTS IV**

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The following list contains dates of samples measured since our previous list (R, 1975, v 17, p 149-155). As before, age calculations are based on the Libby half-life 5570 ± 30 yr and reported in years before 1950. The modern standard is 0.950 of the activity of NBS oxalic acid.

Sample pretreatment, combustion, and counting technique are essentially the same as described in R, 1971, v 13, p 135-140. A new technique was introduced for soil sample preparation (Srdoč Sliepčević, 1975) consisting of combustion of bulky samples of soil having very low carbon content in a large stainless steel cylinder, heated by an electric oven. The sample is distributed in several dishes; the total capacity of the furnace is ca 1kg of soil per combustion. A stream of purified oxygen flows through the tube and combustion products are trapped in cooled stainless steel traps. Carbon dioxide is subsequently purified by vacuum distillation and condensed in stainless steel cylinders. The synthesis of methane is performed in a similar furnace containing ruthenium catalyst. Statistical processing of data has been computerized (Obelić Planinić, 1975). 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.

Ages of speleothems (dripstones) are calculated using 65% (subtracting 3461 yr) and 85% (subtracting 1305 yr), respectively, of NBS standard of contemporary ^{14}C values. The initial ^{14}C content in groundwaters depends namely upon the geology of the catchment area (Münnich & Vogel, 1959; Geyh, 1972).

ACKNOWLEDGEMENTS

We thank E Hernaus for preparation of samples and methane synthesis, V Andreić for construction and maintenance of gas lines, and A Gregoran for continuous help in electronics.

I. PALEOLITHIC AND MESOLITHIC SAMPLES OF CENTRAL AND EASTERN EUROPE

Z-321. Donja Cerovačka pećina **>40,000**

Crystalline calcite coating on animal bones (*Ursus spelaeus*), Cave Donja Cerovačka pećina near Gračac, Lika, S Croatia. Coll and subm 1972 by M Malez, Yugoslav Acad Sci & Arts, Zagreb.

Z-324. Hijenska pećina **7810 \pm 150**

Calcite coating on animal bones (*Ursus spelaeus*, *Crocuta spelaea*) from Cave Hijenska pećina in Plovunija limestone quarry near Buje,

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Istria, W Croatia. Coll and subm 1973 by M Malez (1956). *Comment*: 65% modern.

Z-325. Pisana Stina Cave **4840 ± 100**

Calcite coating on animal bones and teeth (*Ursus spelaeus*, *Capra ibex*, *Leopardus pardus*), Cave Pisana Stina, Opor Mt near Trogir, S Croatia. Coll and subm 1969 by M Malez (1961). *Comment*: 65% modern.

Z-326 Kamenika Cave **1660 ± 100**

Porous calcite coating on animal bones (*Bison priscus*), Cave Kamenika near Srednji Lipovac, Slavonia, E Croatia. Coll and subm 1969 by M Malez (1971). *Comment* (MM): date younger than expected (Upper Pleistocene). 85% modern.

Medvjedja pećina series

Calcite deposits and stalagmites from cave Medvjedja pećina near Lučice, Lošinj I., Croatia. Coll and subm 1974 by M Malez. *Comment* (MM): samples containing fossil faunae from time when Lošinj I. was part of mainland. Dates indicate period of North Adriatic transgression (Malez Božičević 1964); 65% modern.

Z-338. Medvjedja pećina 2 **>40,000**

Z-339. Medvjedja pećina 3 **>40,000**

Z-340. Medvjedja pećina 4 **>40,000**

Z-341. Medvjedja pećina 5 **>40,000**

Z-328. Medvjedja pećina 1 **12,830 ± 300**

Z-343. Medvjedja pećina 6 **>40,000**

Z-346. Medvjedja pećina 7 **>40,000**

Z-347. Medvjedja pećina 8 **26,000 ± 1100**

Z-348. Medvjedja pećina 9 **121% modern**

Z-349. Medvjedja pećina 10 **128% modern**

Z-329. Pećina near Ličko Lešće **>40,000**

Travertine with embedded snail shells and animal bones from cave near Ličko Lešće, Lika, S Croatia. Coll and subm 1959 by M Malez. *Comment* (MM): expected age: Upper Pleistocene; 65% modern.

Z-330. Druška peč **17,000 ± 250**

Bone breccia in rock shelter near Mošćenička Draga, Istria, W Croatia. Coll and subm 1972 by M Malez (1971). *Comment* (MM): agrees with expected age: Upper Pleistocene; 85% modern.

Z-331. Djurkovina Cave **14,630 ± 400**

Calcite deposit on animal bones (*Ursus spelaeus*) from cave near Grebci, Hercegovina. Coll and subm 1958 by M Malez (1957). *Comment* (MM): date agrees with expected age: Upper Pleistocene; 65% modern.

Z-333. Kuvija or Megara Cave 3730 ± 110

Porous stalagmite, Deposit b, Sonda I from cave on Bjelašnica Mt, Bosnia. Coll and subm 1971 by M Malez (1971). *Comment* (MM): dates sedimentation of speleothems in high alt, 1290m, and occurrence of faunae. The cave was a bear hole. 85% modern.

Z-335. Banić Cave or Čampari Cave 10,100 ± 600

Stalagmite deposited on animal bones (*Ursus arctos priscus*) in Banić Cave near Petrići, Cres I. Coll 1973 by B Jalžić and subm by M Malez, both Yugoslav Acad Sci & Arts, Zagreb (Malez, 1975). *Comment* (MM): dates appearance of fossil bear. Agrees with expected age: Lower Holocene; 65% modern.

Zelena pećina series

Calcite deposit, remains on the right wall of cave hall, Buna R, spring near Blagaj, Bosnia. Coll and subm 1974 by M Malez. *Comment*: 85% modern.

+2400

Z-390. Zelena pećina 5 32,600

-2300

Z-391. Zelena pećina 6 27,400 ± 1900

Z-394. Donji Miholjac 11,700 ± 500

Loess dolls from Donji Miholjac (45° 45' N, 18° 10' E) Slavonia. Profile 398,70; 120cm depth. Coll and subm 1974 by M Malez. *Comment*: 85% modern.

Z-406. Vindija 2770 ± 190

Porous stalagmite with embedded Neolithic animal bones and ceramics from Cave Vindija, Gornja Voća near Ivanec, N Croatia. Coll and subm 1974 by M Malez. *Comment* (MM): expected period: Upper Pleistocene — Holocene; 65% modern.

Savudrija series

Calcareous concretions in loess profile from Savudrija (45° 29' N, 13° 30' E) Istria, W Croatia. Sample assoc with gastropod shells. Coll and subm 1975 by M Malez. *Comment* (MM): expected age: Upper Pleistocene; 85% modern.

Z-488. Savudrija (No. 4) 11,160 ± 210
Middle layer.

Z-489. Savudrija (No. 6) 7190 ± 150
Lower layer.

II. GEOLOGIC SAMPLES

Z-449. Leskovica 2530 ± 120

Peat from boring hole in moor, depth 60 to 70cm, near Leskovica (46° 08' 40" N, 11° 44' 20" E) Slovenia. Coll and subm by A Šercelj, Slov

Acad Sci & Arts. *Comment* (AŠ): expected period: Middle Holocene (Šercelj, 1975). Dates period shortly before human influence in area. Date confirms palynologic data.

National Park Plitvička jezera series

Calcareous tufa, National Park Plitvice Lakes (44° 50' N, 15° 35' E), Lika, Croatia. Samples from various places and depths should indicate chronology of tufa formation. Coll and subm 1974 by M Malez, A Brnek, A Sliepčević and D Srdoč. *Comment*: Ages are only approximate due to possibility of isotopic exchange between ¹⁴C atoms between tufa porous surface and air.

Z-396. Plitvički Ljeskovac 1 **>40,000**

Calcareous tufa barrier above present lake surface.

Z-398. Plitvički Ljeskovac 3 **>40,000**

Same as Z-396, crystalline structure.

Z-400. Gradinsko jezero 5 **103% modern**

Calcareous tufa under water, surface layer.

Z-403. Gradinsko jezero 8 **1065 ± 80**

Calcareous tufa above water, surface layer.

Z-405. Gavanovac jezero 10 **2850 ± 100**

Calcareous tufa deposited on limestone above present water level.

III. SOIL SAMPLES

Z-361. Rajhenavski Rog **235 ± 70**

Charcoal in soil profile, 15 to 20cm depth from Rajhenavski Rog Mt (45° 40' 55" N, 15° 1' 5' E) Kočevska, Slovenia. Dated to estimate forest age for vegetational map of Yugoslavia. Coll 1974 by I Puncer, Biol Inst, Slov Acad Sci & Arts, Ljubljana and subm by A Šercelj. *Comment* (AŠ): expected period: Holocene.

Snežnik series

Humus horizons A₁ of forest soil from various places of Snežnik Mt (45° 35' N, 14° 24' E) Slovenia. Coll 1973 by M Župančič, Biol Inst "Jovan Hadži" Ljubljana and subm by A Šercelj. *Comment*: modern rootlets removed. Soil samples measured to date sequence of forest vegetation, to correlate dates with pollen analyses, and to elucidate origin of forest phytocenoses, partly as a result of transhumance.

Z-308. Sežanje **2145 ± 80**

Soil léssivé, A₁ horizon, 5 to 15cm depth; forest: *Piceetum subalpinum dinaricum*.

Z-309. Medvedova draga 101% modern

Soil léssivé, A₁ horizon, 8 to 15cm depth; vegetation: *Arnico-Nardetum*.

Z-310. Medvedova draga 545 ± 70

Soil léssivé, A_{1,2} horizon, 5 to 15cm depth; forest: *Piceetum montanum dinaricum*.

Z-311. Leskova dolina 70 ± 45

Brown soil, A₁ horizon, 8 to 15cm depth; forest: *Abieti-Fagetum dinaricum*.

Trnovski gozd series

Humus horizons A₁ from Mt Trnovski gozd (45° 57' N, 13° 52' E). Coll by M Župančič and subm 1973 by A Šercelj. *Comment* (AŠ): expected age: 500 to 1000 yr. Modern rootlets removed.

Z-312. Smrečje 925 ± 70

A_{1,2} horizon, 7 to 18cm depth; forest: *Luzulo-Piceetum*.

Z-356. Smrekova draga 1 460 ± 80

A₁ horizon, 10 to 15cm depth; forest: *Piceetum subalpinum*.

Z-357. Smrekova draga 2 1450 ± 100

A_{1,2} horizon, 20 to 25cm depth; forest: same as above.

Slatnik series

Forest humus Mali Slatnik near Novo Mesto (45° 48' 40" N, 15° 13' 30" E), E Slovenia. Dates forest succession. Coll 1974 by L. Marinček, Biol Inst, Slov Acad Sci & Arts and subm by A Šercelj. *Comment*: modern rootlets removed.

Z-369. Slatnik A 112% modern

Upper horizon, 5 to 10cm depth.

Z-370. Slatnik B 112% modern

Lower horizon, 10 to 20cm depth.

National Park Plitvička jezera series

Soil samples from comparative lots (forest, ploughland) of National Park Plitvice lakes (44° 50' N, 15° 35' E), Lika, Croatia anthropogenic period of soil development and characteristic of A horizons of soils on limestone. Coll and subm 1974 by J Martinović, Inst Forest Sci, Jastrebarsko. *Comment*: modern rootlets removed.

Z-371. Korenička kapela 1 265 ± 70

Rendzina on dolomite, 5% C, A horizon, forest soil, 0 to 20cm depth.

Z-373. Jezerce 3 106% modern

Brownearth (Cambisol) on cretaceous limestone, 3% C, A horizon, forest soil, 0 to 12cm depth.

Z-374. Jezerce 4 **940 ± 110**

Brownearth on cretaceous limestone, 1% C, B horizon, forest soil, 20 to 40cm depth.

Z-375. Jezerce 5 **107% modern**

Brownearth on cretaceous limestone, 2% C, A horizon, plough-land, 0 to 15cm depth.

Z-376. Jezerce 6 **1140 ± 70**

Brownearth on cretaceous limestone, 1% C, B horizon, plough-land, 20 to 45cm depth.

Z-377. Jezerce 7 **570 ± 70**

Rendzina on Triassic dolomite, 5% C, A horizon, forest soil, 0 to 20cm depth.

Z-378. Jezerce 8 **100% modern**

Rendzina on Triassic dolomite, 2% C, A horizon, plough-land, 0 to 20cm depth.

Z-379. Bigina Poljana 9 **102% modern**

Brownearth on Triassic dolomite, 3% C, A horizon, forest soil, 0 to 13cm depth.

Z-380. Bigina Poljana 10 **480 ± 130**

Brownearth on Triassic dolomite, 1% C, B horizon, forest soil, 20 to 45cm depth.

Z-381. Bigina Poljana 11 **103% modern**

Brownearth on Triassic dolomite, 2% C, A horizon, plough-land, 0 to 15cm depth.

Z-382. Bigina Poljana 12 **1835 ± 80**

Brownearth on Triassic dolomite, 0,5% C, B horizon, plough-land, 20 to 45cm depth.

Z-383. Draga 13 **111% modern**

Luvisol on Triassic dolomite, 2% C, A horizon, forest soil, 0 to 10cm depth.

Z-384. Draga 14 **680 ± 80**

Luvisol on Triassic dolomite, 0,5% C, E horizon, forest soil, 15 to 30cm depth.

Z-385. Draga 15 **1770 ± 80**

Luvisol on Triassic dolomite, 0,5% C, B horizon, forest soil, 50 to 75cm depth.

Oborovo series

Samples of peat and clay from boring hole at Oborovo (45° 41' N, 16° 16' E) near Zagreb, Croatia. Coll and subm 1975 by Ana Sokač, Fac Min, Geol & Petrol Eng, Univ Zagreb. *Comment* (AS): dating Quaternary sediments to determine tectonic dislocations. Expected period: Upper Pleistocene.

Z-478. OS-1 >**45,000**
Peat, 27.6 to 29m below surface.

Z-479. OS-1 >**45,000**
Carbonaceous clay, 69.6 to 69.8m below surface.

Z-480. OS-1 >**45,000**
Peat, 86.8 to 87.1m below surface.

Z-482. OS-3 >**45,000**
Peat, 31.1 to 31.4m below surface.

Z-485. OS-4 **20,000 ± 1000**
Brown, sandy clay, containing organic material 5.1 to 5.2m below surface.

IV. ARCHAEOLOGIC SAMPLES

Z-300. Podgorač **3410 ± 100**
Charcoal mixed with earth, 0.80 to 1.90m depth, scattered in cultural pit of settlement Podgorač (Breški) (45° 27' N, 18° 13' E) near Našice, E Croatia. Coll and subm by Nives Majnarić-Pandžić, Archaeol Inst, Fac Arts & Sci, Zagreb.

Ljubljansko Barje series I

Palynol and archaeol studies from a basin 20km long and 10km wide S and SW of Ljubljana, Slovenia. Ancient moor filled with Quaternary deposits and alluvium of clay, sand, and peat. Peat and sediment samples.

Z-301. Ljubljansko Barje – Črna Vas **2850 ± 100**
Peat mixed with earth, 1m depth, Črna Vas (46° 0' N, 14° 29' E), Slovenia. Coll and subm 1973 by A Šercelj. *Comment* (AŠ): age younger than expected: 4000 yr.

Z-302. Ljubljansko Barje – Bevke **9710 ± 170**
Lake chalk mixed with organic matter, 3.40 to 3.60m depth, Bevke (45° 59' N, 14° 21' E). Coll and subm 1973 by A Šercelj. *Comment* (AŠ): expected age: 8000 to 10,000 yr.

Ljubljansko Barje series II

Fragments of wood from Neolithic lake pile-dwelling. Coll 1974 by Tatjana Bregant, Fac Arts & Sci, Ljubljana; subm by A Šercelj. Dates estimate archaeol chronology (Bregant, 1975).

Z-351. Ljubljansko Barje – Maharski Kanal XLI 5080 ± 110

Wood, 80cm below surface embedded in gyttja and lake chalk deposit at Maharski Kanal, a drainage channel near Ig (45° 58' 25" N, 14° 32' 20" E). *Comment* (AŠ): corresponds to earlier measurements, Z-314 and Z-315 (R, 1975, v 17, p 149).

Z-353. Ljubljansko Barje – Maharski Kanal S-4 4330 ± 120

Comment (AŠ): corresponds to previous measurement, Z-305 (R, 1975, v 17, p 149).

Z-354. Ljubljansko Barje – Resnik Kanal 5850 ± 150

Wood, 50cm below surface in carbonaceous clay in Notranje Gorice (45° 59' 30" N, 14° 24' 40" E).

Z-336. Divostin A 6000 ± 180

Charcoal from Feature 121 ca 35cm below Level 7 at Divostin, village near Kragujevac (44° 00' N, 26° 55' E), Serbia. Coll 1969 by Ruth Tringham, Dept Anthropol, Harvard Univ, Cambridge, Massachusetts. Subm by A McPherron, Dept Anthropol, Univ Pittsburgh, Pennsylvania. *Comment* (AMcPh): sample was divided into 3 portions and dated in 3 labs: (Bl-898:3910 BC, BM-574: 3297 BC and Z-336: 4050 BC) (McPherron & Srejšović, 1971).

Kranj series

Charcoal from hearth under recent church at Kranj (46° 14' 25" N, 14° 21' 40" E) from 80cm depth. Coll 1973 by A Valič, Gorenjski Mus, Kranj, subm by A Šercelj.

Z-358. Kranj IV 2160 ± 100**Z-359. Kranj XIX 1160 ± 80****Z-360. Barje Kaznarice near Pišece 7760 ± 600**

Peat from core, 170cm depth from Kaznarice peat bog, near Pišece (46° 30' N, 15° 40' E), Slovenia. Dated to estimate chronology of late-glacial and postglacial vegetation. Coll and subm 1974 by A Šercelj. *Comment* (AŠ): expected age: end of Pleistocene, beginning of Holocene.

Tumba series I

Excavation in Crnobuki village, near Bitola (41° 04' N, 21° 25' E), Macedonia. Coll and subm 1974 by B Kitanosli, Narodni Mus, Prilep, Macedonia.

Z-362. Tumba 5390 ± 180

Cockle (?) from Sonda II, Horizon 1. *Comment* (BK): older than expected: 2000 BC.

Z-363. Tumba 5310 ± 180

Charcoal or soot (?) from Sonda I, Level 26-31.

Excavation in Karamani village, near Bitola, Macedonia. Coll and subm by B Kitanosli.

- Z-364. Tumba** **3600 ± 175**
Cockle from Sonda I, Horizon 1. *Comment* (BK): expected age: Bronze age, ca 1800 BC.
- Z-365. Tumba** **3660 ± 150**
Charcoal from Sonda I, Horizon 2.
- Z-367. Tumba** **3820 ± 150**
Wheat from Sonda I, Horizon 2.

- Z-408. Goričan** **2110 ± 90**
Fragments of charred wooden beam, tumulus, 1.1m depth, Goričan near Čakovec (46° 22' N, 16° 40' E). Col and subm 1974 by Ksenija Vinski, Archaeol Mus, Zagreb.

Odmut series

Charcoal samples from Odmut rock shelter (45° 12' N, 18° 50' E), Piva R spring, 12km downstream, Montenegro. Coll and subm 1974 by D Srejšević, Fac Arts & Sci Archaeol Dept, Belgrade.

- Z-409. Odmut 1 (No. 37)** **4280 ± 120**
Charcoal from Eneolithic, Block V, Level III.
- Z-410. Odmut 2 (No. 40)** **4390 ± 150**
Charcoal from Late Neolithic, Block V, Level VI.
- Z-411. Odmut 3 (No. 72)** **7440 ± 150**
Charcoal from Late Neolithic, Block V, Level XV.
- Z-412. Odmut 4 (No. 61)** **6730 ± 160**
Charcoal from Early Mesolithic, Block V, Level XI.
- Z-413. Odmut 5 (No. 78)** **7350 ± 160**
Charcoal from Late Mesolithic, Block V, Level XXI.
- Z-457. Odmut 6 (No. 24)** **7030 ± 160**
Charcoal from Mesolithic, Block I, Level XIX.

Comment: significant archaeol loc of more layers (from Mesolithic to Eneolithic). Dates prehistory of Piva R region. Settlement excavated during construction of hydroelectric power plant, Mratinje.

- Z-416. Spilia (No. 8)** **4880 ± 110**
Charcoal from Spilia rockshelter at 300m alt above Perast (42° 30' N, 18° 43' E), Montenegro. Late Neolithic, Block C, Level VII. Coll and subm 1974 by D Srejšević.

Most na Soči series

Charcoal samples from charred wooden wall of a Hallstatt house. Sonda 2, P1 5, 140cm depth. Munič's garden, Most na Soči (45° 15' N, 11° 15' E) SW Slovenia. Systematic archaeol excavation to study Hallstatt

culture and architecture. Coll and subm 1974 by D Svoljšak, Mus Nova Gorica. Expected age: 6th century BC.

Z-429. Most na Soči 1	2330 ± 100
Z-430. Most na Soči 2	2390 ± 100
Z-431. Most na Soči 3	2440 ± 80

Sudjuradj, Šipan Island series

Samples found in sunken ship, near Sudjuradj, Šipan I. (42° 20' N, 17° 55' E). Coll and subm 1975 by J Luetić, Centre Sci Work, Yugoslav Acad Sci & Arts, Dubrovnik. *Comment* (JL): expected age: 16th to 17th century.

Z-452. Sudjuradj Charcoal from gun powder.	410 ± 90
Z-453. Sudjuradj Fragment of wood from same ship.	440 ± 90

Beran Krš series

Samples of charcoal from excavation at Beran Krš near Ivangrad (42° 45' N, 19° 50' E), Montenegro. Coll and subm 1975 by D Srejšović. *Comment* (DS): expected age: Early Neolithic — Vinča culture.

Z-491. Beran Krš (No. 11) Charcoal from Sonda III, Excavation Layer 7.	6030 ± 160
Z-492. Beran Krš (No. 14) Charcoal from Sonda III, Base of Excavation Layer 13.	5870 ± 150

Čuka series

Charcoal assoc with pottery fragments from excavation site at Topolčani village (41° 16' N, 21° 28' E) Macedonia. Coll and subm 1975 by Dragica Simoska, Narodn Mus, Prilep. *Comment* (DS): expected period: Neolithic.

Z-494. Čuka 1 Charcoal from Sonda I, Layer 15-16.	7680 ± 160
Z-495. Čuka 2 Charcoal from Sonda I, Layer 22.	7010 ± 190

Tumba series II

Charcoal from excavation near Mogila village (41° 07' 03" N, 21° 07' 02" E) Macedonia. Coll and subm by Dragica Simoska. *Comment* (DS): expected period: Neolithic.

Z-496. Tumba I, 1 Charcoal from Sonda I, Excavation Layer 11, Horizon I.	6110 ± 170
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Z-497. Tumba I, 2 **1480 ± 80**

Charcoal from Sonda I, Excavation Layer 14-25, Horizon II.

Z-498. Tumba I, 3 **7010 ± 190**

Charcoal from Sonda I, Excavation Layer 28, Horizon III.

Lijeve Polje series

Excavation in marshy plain between Sava R and Vrbas R (45° 07' 30" N, 17° 27' 50" E) N Bosnia. Coll and subm 1975 by B Refik, Geoinž-injering, Inst Geol, Ilidža. *Comment* (BR): expected period: Pleistocene — Holocene.

Z-502. Lijeve Polje, No. 1919 **1725 ± 80**

Charred wood of tree trunk from left bank of Jablanica R, Čatrnja near Bosanska Gradiška.

Z-503. Lijeve Polje, No. 2287 **6210 ± 70**

Charcoal, possibly trunk, in bed of Sava R, right bank, Bajina near Srbac.

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