

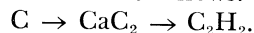
## GEOLOGICAL INSTITUTE RADIOCARBON DATES I\*

V. V. CHERDYNTSEV, V. A. ALEKSEYEV, N. V. KIND,  
V. S. FOROVA, and L. D. SULERZHITSKIY

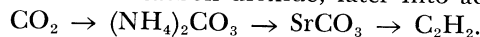
Geological Institute, Academy of Sciences, USSR

### INTRODUCTION

We used the scintillation variant of the radiocarbon method. The scintillator is prepared on the basis of ethylbenzol [benzene]\*\* synthesized from acetylene according to the method of Kuchkarev and Kondratenko (1955). For radiocarbon dating we used materials both rich in carbon: wood and charcoal, and [those] poorer: also peat, buried soils, and fossil bones. In the first instance, the initial material for synthesis was [char]coal, which was treated as follows:



In the second instance, the samples, after removal of foreign carbonaceous materials, were burned in a stream of  $\text{O}_2$ , and the carbon was then transformed into carbon dioxide; later into acetylene:



In both cases acetylene served for the synthesis of  $\text{C}_6\text{H}_5\text{C}_2\text{H}_5$ .

The material was first treated with hydrochloric acid to remove carbonate, which reached up to 60 percent in fossil bone. Carbonate carbon we do not investigate for radiocarbon, since earlier studies (Kind and Alekseyev, 1964, p. 70) established that it commonly represents "dead" carbon, ultimately deriving from the carbonates of old bedrock. All samples other than soils and peat were also treated with alkali to remove humic substances introduced into the sample by secondary processes. In addition, samples (especially peat and soils) were mechanically cleaned of foreign inclusions: contemporary roots, etc. Treatment with acid and alkali can reduce the carbon content of a sample by as much as 85%. The yield of carbon in the synthesis of ethylbenzol [benzene] was not too high (about 20%), and the synthesis was laborious. Thus ethylbenzol should not be regarded as the best basis for scintillators in radiocarbon measurements. However, in starting the laboratory, we fixed upon it in view of the relative simplicity of the method.

The purity of the ethylbenzol was controlled by measurements of specific gravity and indices of refraction, as well as by the scintillation effectiveness of the reagent prepared. To the extracted ethylbenzol we added n-terphenyl (4g/l.) and POPOP (0.1g/l.). The resulting solution served as the scintillator.

Measurements were conducted on an apparatus with two scintillation counters (with photomultiplier FEU – IS), working in coincidence.

\* Submitted as part of Radiocarbon Dates from Soviet laboratories, 1 January 1962–1 January 1966. See p. 417, this issue. Published as: Radiocarbon dates of the Laboratory of the Geological Institute, Academy of Sciences, USSR: *Geokhimiya* (Geochemistry), 1964, no. 4, p. 315-317.

\*\* Information in brackets interpolated by translator (E.M.S.) and commentator (D.B.S.).

The scintillator was poured into a fluorine-plastic chamber with a standard volume of 15 cm<sup>3</sup>, geometrically enclosing the cathode of the photo-multiplier. The apparatus uses standard units.

The counting system is surrounded by shielding of lead (20 cm), steel (3 cm), and mercury (2 cm). . . . The standard of accuracy of the apparatus ( $n/\sqrt{n_0}$ ) varies from 5 to 6. Using a 3  $\sigma$  criterion on 48-hour determination of sample and background, we find that our apparatus can measure ages up to 35,000 yr.

#### **Odessa Oblast series, Ukrainian SSR**

**10,430 ± 170**

##### **GIN-4. Gradenitsa, Ukrainian SSR**

**[8480 B.C.]**

Buried soil from Gradenitsa village, Belayevka Raion, Odessa Oblast, Ukrainian SSR [46° 30' N Lat, 30° 10' E Long]. Exposure 37; Stratum 2. Upper buried soil. Subm. 1960 by A. I. Moskvitin, Geol. Inst., Acad. of Sci., USSR; according to him, soil belongs to Mologo-Sheksnya Interglacial [Paudorf Interstadial], corresponding in age to ca. 40,000 yr. *Comment* (D.B.S.): Cf. Grichuk *et al.*, 1966, p. 102; dates given are 25,000-35,000 yr.

**9540 ± 740**

##### **GIN-5. Odessa Oblast, Ukrainian SSR**

**[7590 B.C.]**

Buried soil from Odessa Oblast. Cape "E". See GIN-4. Subm. 1960 by A. I. Moskvitin.

#### **Molodova V site series, Ukrainian SSR**

This multi-stratum Paleolithic campsite, on Dnestr R. [approx. 48° 25' N Lat, 26° 30' E Long] was excavated 1951-1963 by A. P. Chernysh (1959). Regional geologic conditions were studied by I. K. Ivanova (1959). Samples GIN-6-10 coll. 1961 by N. V. Kind. (Cf. also GIN-54, 56, 147, 52, 105, 106, Geol. Inst. II) (D.B.S.). Alternate spelling: Molodovo (E.M.S.). [Ref.: Alekseyev *et al.*, 1964.]

**250 ± 160**

##### **GIN-6. Molodova V site**

**[A.D. 1700]**

Contemporary chernozem-type soil.

**10,590 ± 230**

##### **GIN-7. Molodova V site**

**[8640 B.C.]**

Fossil bones from cultural Stratum Ia, depth 1.0 to 1.1 m. Grayish-yellow limy loam. Archaeologic date: early Mesolithic; geologic date: approx. Allerød to Upper [Younger] Dryas. Date corresponds to age of Mesolithic sites in W Europe. According to A. P. Vinogradov *et al.* (1963), age of Upper Dryas in Upper Volga region is 10,535 ± 330 yr.

**11,900 ± 230**

##### **GIN-8. Molodova V site**

**[9950 B.C.]**

Fossil bones from cultural Stratum 2, depth 1.2 to 1.4 m. Light yellow loess-like loam. Archaeologic date: late Magdalenian, believed to be 11 to 13,000 yr old.

**GIN-9. Molodova V site** **13,370 ± 540**  
[9420 B.C.]

Charcoal from campfire in cultural Stratum 3, depth 1.6 to 1.8 m. Grayish-yellow loam, presumably Lower [Earlier] Dryas. Archaeologic date: late Magdalenian. Absolute age of Lower Dryas in W Europe is 14 to 16,000 yr.

**GIN-10. Molodova V site** **23,700 ± 320**  
[21,750 B.C.]

Buried soil from cultural Stratum 7, depth 3.1 to 3.25 m. Humus-enriched loam from campfire area with charcoal inclusions. Archaeologic age: late Solutrean. For charcoal from identical stratum, A. A. Vinogradov *et al.* (1962) obtained date 23,000 ± 800 yr (Mo-11, Vernadsky Inst. I-IV).

**GIN-3. Moscow area, Moscow Oblast** **290 ± 80**  
[A.D. 1660]

Wood from beginning of our century from Moscow area [55° 45' N Lat, 37° 37' E Long]. Sample studied for clarifying Suess effect, . . . from 1860-1950, because of augmentation of "dead" [*i.e.*, fossil] carbon dioxide through burning of mineral fuel in industrial installations. [Spurious] age . . . is of right order of magnitude [for effect].

**Nerl' River series, Vladimir Oblast**

**GIN-11. Nerl' River** **9750 ± 200**  
[7800 B.C.]

Top of peat, 1.2 m thick, with plant remains, in Kamenny Ovrage [ravine], Yakimanka village, on Nerl' R., Vladimir Oblast [56° 22' N Lat, 40° 22' E Long]. Deposit occurs on left bank near thalweg, 1 km from mouth, at depth 6 to 8 m. Base of peat disturbed by frost. Peat presumably overlies till of Dnepr [Mindel] Glaciation. Results of paleobotanical study of fruits, seeds, and pollen and especially presence of *Brasenia Schreberi* and *Tilia platyphyllos*, assign peat to Mikulino Interglacial (Riss-Würm)(Metel'tseva and Sukachev, 1961). Coll. 1963 by S. M. Tseytlin, Geol. Inst., Acad. of Sci., USSR. (Cf. GIN-84, this list and Mo-362, Vernadsky Inst. IV, 1968).

**GIN-12. Nerl' River** **>22,000**  
**27,000 ± 2700**  
[25,050 B.C.]

Compact peat from middle of same layer. Coll. 1962 by N. V. Kind.

**Sungir' series, Vladimir Oblast**

**GIN-13. Sungir' Brook, Vladimir Oblast** **13,300 ± 300**  
[11,350 B.C.]

Buried soil from high terrace, old hollow of channel on left bank, Sungir' brook, Moscow-Gor'kiy road on E outskirts of Vladimir [56° 10' N Lat, 40° 35' E Long]. Podsol type soil at depth 2.2 to 3.4 m,

is strongly deformed by frost cracking (Bader and Gromov, 1963). Coll. 1963 by S. M. Tseytlin.

**GIN-14. Sungir' site** **14,600 ± 600**  
**[12,650 B.C.]**

Bones from Paleolithic campsite of Sungir' near Vladimir. Coll. 1963 by S. M. Tseytlin. Campsite excavated by O. N. Bader (1959; Bader and Gromov, 1963), according to whom date is latest Aurignacian.

**GIN-15. Sungir' site** **16,200 ± 400**  
**[14,250 B.C.]**

Buried steppe soil from upper part of right-side slope of valley of Sungir' brook. Coll. 1963 by S. M. Tseytlin. At campsite, soil is at depth 4.75 to 5.4 m (Bader and Gromov, 1963), and disturbed by solifluction. Above sampled horizon are bone remains and flint inventory of superimposed cultural stratum of campsite.

**GIN-16. Ulovka River, Vladimir Oblast** **>35,000**

Buried soil from depth 7 m in upper terrace of ancient channel. [Taken] 3 km from mouth of Ulovka R., branch of Nerl' R., at Ulovo village [approx. 56° 20' N Lat, 40° 50' E Long], Vladimir Oblast. Coll. 1963 by S. M. Tseytlin. Lower buried soil in cross section of left bank of stream is at depth 7 m from surface. Moraine, presumably of Dnepr [Mindel] Glaciation, lies 5 m below this soil (Bader and Gromov, 1963). Soil is oldest encountered in Quaternary deposits in Sungir' campsite region (GIN-11-15).

**GIN-17. Sungir' flood plain** **1580 ± 140**  
**[A.D. 370]**

Wood from alluvium, lower horizon of cross section of high flood plain of Sungir' brook (height, 4 to 5 m), at Suromna village [approx. 56° 10' N Lat, 40° 35' E Long]. Coll. 1963 by S. M. Tseytlin.

**GIN-18. Klyaz'ma River flood plain, Vladimir Oblast** **4500 ± 210**  
**[2550 B.C.]**

Wood from lower horizon of high flood plain of Klyaz'ma R. at Bogolyubova village below mouth of Sungir' brook [approx. 56° 10' N Lat, 41° 00' E Long], Vladimir Oblast. [Coll. name and date not given. (E.M.S.)]

**Vyatka River series, Kirov Oblast**

**GIN-19. Vas'kino village** **7400 ± 230**  
**[5450 B.C.]**

Wood from Vas'kino village [probably near Karino village, see GIN-20. (D.B.S.)], Kirov Oblast. Peat in high terrace of Vyatka R. Sample taken from lower horizon of upper layer, separated from lower layer by sandy horizon. Geologic age is Holocene. Coll. 1962 by V. V. Cherdyntsev.

**GIN-20. Karino village** **8080 ± 250**  
**[6130 B.C.]**

Spruce from Karino village, [probably Karintorf: 58° 35' N Lat, 50° 15' E Long (D.B.S.)], Kirov Oblast, from peat deposit of high terrace of Vyatka R. Conditions of deposition are same as for GIN-19. Coll. 1962 by V. V. Cherdyntsev. In other specimen from this stratum were detected following ratios of radioactive isotopes:  $U^{234}/U^{238} = 1.55 \pm 0.03$ ;  $Io/U = 0.10 \pm 0.01$  (units of activity), which by ionium accumulation method, dates wood at  $8000 \pm 1000$  yr. For 6 samples of peat from same deposit, ionium method gives values of 5 to 16 millennia with a mean of  $8900 \pm 1700$  yr.

**GIN-1. Teysheb-baini, Armenian SSR** **2600 ± 135**  
**[650 B.C.]**

Charred wood. Karmir-blur hamlet near Erevan. Excavations of ancient Urartu city of Teysheb-baini [40° 11' N Lat, 44° 35' E Long], burned during assault by nomads at beginning of 6th century B.C. (Piotrovskiy, 1959). Coll. 1961 by V. V. Cherdyntsev. (Cf. GIN-32, this list and Mo-241, Vernadsky Inst. V, 1968. [D.B.S.]).

**GIN-2. Lchashen, Armenian SSR** **3150 ± 100**  
**[1200 B.C.]**

Wood remains of ritual chariot from burial, presumably 13th century B.C., from Lchashen [approx. 40° 20' N Lat, 45° 10' E Long], Lake Sevan, Armenian SSR. Sample received 1961 by T. S. Khachatryan, State Hist. Mus. of Armenian SSR [Erevan]).

**Ust' Port series, Krasnoyarsk Krai, Siberia**

**GIN-21. Yenisey River flood plain** **220 ± 140**  
**[A.D. 1730]**

Large trunk from flood plain of Yenisey R. terrace, 7 m high, region of Ust'-Yenisey Port [correctly, Ust' Port: 69° 45' N Lat, 84° 34' E Long]. Flood plain composed of interlayered clays, loam, and alluvia with streaks of peat, with large tree boles along entire cross section. Samples GIN-21-24 coll. by N. V. Kind and S. L. Troitskiy, Inst. of Geol. and Geophysics, Siberian Branch, Acad. of Sci., USSR [Novosibirsk].

**GIN-22. Yenisey River flood plain** **765 ± 85**  
**[A.D. 1185]**

Wood from same cross section as GIN-21; depth 1.3 m.

**GIN-23. Yenisey River flood plain** **3700 ± 100**  
**[1750 B.C.]**

Bits of slightly decomposed wood from same cross section as GIN-21 and 22, depth 3.5 m.

**GIN-24. Yenisey River flood plain** **4330 ± 160**  
**[2380 B.C.]**

Large trunk from same cross section as GIN-21-23. Depth 6.8 m.

**Malaya Kheta River series, Krasnoyarsk Krai, Siberia****GIN-25. Malaya Kheta River** **6800 ± 200**  
[4850 B.C.]

Wood from peat overlying 20-m “Karginskoye” terrace of Yenisey R. on Malaya Kheta R., 7 km above its mouth [69° 35' N Lat, 84° 30' E Long]. Depth, 1.3 m. Pine cones and bark of white-boled birch [*B. platyphylla*] indicate warmer climate (Holocene Climatic Optimum) than today. Samples GIN-25-27 coll. 1962 by N. V. Kind and S. L. Troitskiy. *Comment* (D.B.S.): Karginskoye period in Siberia has been tentatively equated with Paudorf Interstadial by Cherdyntsev *et al.* (1964, p. 322-323).

**GIN-26. Malaya Kheta River** **8500 ± 250**  
[6550 B.C.]

Wood from same peat deposit at Malaya Kheta settlement [69° 35' N Lat, 84° 30' E Long] in same stratigraphic position as GIN-25, at depth ca. 3 m.

**GIN-27. 17 km above mouth of Malaya Kheta R.** **26,800 ± 1400**  
[24,850 B.C.]

Wood from lower horizon of same cross section of “Karginskoye” terrace, 17 km above mouth of river [69° 28' N Lat, 84° 30' E Long]. Sample at depth 19 m from surface, elev. 3.5 m above water level of Malaya Kheta R., from peat in loam, alluvium, and sand. *Comment* (N.V.K. and S.L.T.): these are flood-plain deposits of Karginskoye age.

**GIN-28. Igarka Permafrost Station** **21,350 ± 650**  
[19,400 B.C.]

Large tree trunk from depth 6 m in alluvium in shaft at Igarka Permafrost Station, Krasnoyarsk Krai [Igarka city: 67° 30' N Lat, 86° 30' E Long]. Alluvium is from “Karginskoye” terrace of Yenisey R. Mouth of shaft 22 to 23 m [elev.] above water level. Sample taken from accumulation of tree boles in alluvial deposits frozen for many yr. Alluvium unconformably overlies varved clay of last stage of Zyryanka [Early Würm (?) (Cherdyntsev, *et al.*, 1964)] Glaciation, (Saks, 1951, Sheveleva, 1963). Vinogradov *et al.* (1959) dated another wood sample from same locality at >24,500 yr (Mo-4).

**GIN-30. Bol'shaya Ercha River flood plain** **3150 ± 100**  
[1200 B.C.]

Birch wood from lower part of high flood plain of Bol'shaya Ercha R., tributary to Indigirka R., Yakut ASSR [69° 40' N Lat, 148° 00' E Long]. Inferred age: Atlantic. Wood from same stratum was dated 4770 ± 280 yr (Vinogradov *et al.*, 1962, Mo-229, Vernadsky Inst. I-IV, 1966). Subm. 1960 by Yu. A. Lavrushin.

**GIN-29. Amguyema River, Magadan Oblast** **9350 ± 230**  
**[7400 B.C.]**  
Wood from II terrace of Amguyema R. [approx. 68° 00' N Lat, 177° 30' W Long], Chukchi Peninsula. Sample from sand with layers of peat at depth 8.5 to 9 m. Subm. 1962 by O. M. Petrov.

REFERENCES appear on p. 443.