

UNIVERSITY OF ROME CARBON-14 DATES III

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The following list comprises age measurements carried out between December 1963 and September 1964. The samples dated are almost all of archaeological interest and are drawn from Italian and Egyptian territory.

The pretreatment of samples, the production of pure CO_2 and the counting techniques have been described elsewhere (Bella and Cortesi, 1960; Alessio, Bella and Cortesi, 1964). All dates were calculated on the basis of two to eight values, obtained from different measurements of each sample. With only one exception (see comment on sample R-93 in the following date list) the errors quoted are the 1σ statistical errors, which in the measurements here reported are of the same order as the "experimental error" (Crevecoeur, Vander Stricht and Capron, 1959).

Ages have been calculated using Libby's half-life of 5568 ± 30 yr with 1950 as the standard year of reference. As for the measurements of Rome II (1964), a modern wood grown near Rome between 1949 and 1953 has been used as modern standard. Its activity was checked again by measurements of known age samples and judged satisfactory.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. Italy

R-95. Grotta Aisone **5825 \pm 75**
3875 B.C.

Charcoal from deposit in small cave or shelter of Aisone, Valle Stura, province of Cuneo, Piedmont ($44^\circ 19'$ N Lat, $7^\circ 13'$ E Long, 850 m above sea-level). Excavated, coll. 1956 and subm. 1957 by E. Rittatore, Gabinetto di Paletnologia, Univ. of Milan. Pottery belonging to Danubian square-mouthed pot Culture, Middle Neolithic, and a child's tomb were discovered in deposit (Radmilli, 1960). *Comment*: age obtained agrees with that expected for culture discovered in the deposit.

R-27. Bec Berciassa **2190 \pm 65**
240 B.C.

Charcoal collected in Late Iron Age hut settlement on southern side of mountain Bec Berciassa, Roccavione, Val Vermenaga, province of Cuneo,

Piedmont (44° 19' N Lat, 7° 29' E Long, 970 m above sealevel). The only remains of the huts are floors of piled earth containing sherds, bones of wild and domestic animals, and charcoal. Discovery occurred of plentiful domestic pottery, belonging to Golasecca Culture which existed in Piedmont, Lombardy and Canton Ticino (Rittatore, 1952a,b,c). Excavated 1932-1952 by F. Rittatore and L. Cardini. Coll. and subm. 1953 by L. Cardini, Ist. Italiano di Paleontologia Umana. *Comment*: date obtained agrees with last manifestations of Iron Age in Italy.

Cà Morta series

Charcoal mixed with carbonous soil from Iron Age tombs of Cà Morta necropolis near Camerlata, 3.5 km S of Como, Lombardy (45° 45' N Lat, 9° 05' E Long). Excavation 1956-57 by E. Rittatore who coll. 1956 and subm. 1957 through the interest of the late A. C. Blanc, Ist. Italiano di Paleontologia Umana. Necropolis contains cinerary tombs of various types and was in use during a millennium from end of Bronze Age to 1st century of Roman Empire (Barsega, 1916, 1919-21a,b and 1922; Randall-Maclver, 1927). Charcoal was found in the earth filling four pit-shaped cinerary tombs, scattered around pottery and bronze objects. The four tombs have been judged to be contemporaneous, and belong to 2nd phase of Golasecca culture, for which Cà Morta is considered the most important necropolis (Rittatore, 1956, 1958). As tombs were not far below surface, rootlets had penetrated into pottery objects.

R-94A. Cà Morta 1

2050 ± 50

100 B.C.

Charcoal from tombs no. 9, 11, and 18. Owing to the nature of the material, earth has only been roughly separated.

R-94B. Cà Morta 2

2440 ± 55

490 B.C.

Pure charcoal carefully selected from tomb no. 16.

General Comment: age of R-94B agrees fairly closely with archaeological date. R-94A proved younger probably because of contamination that could not be eliminated by pretreatment.

Isolone delle Moradelle or Isolone del Mincio series

Fragments of wooden piles from lake dwellings of Isolone delle Moradelle in the river Mincio, downstream from Valeggio, 4 km E of Volta Mantovana, province of Mantua, Lombardy (45° 19' N Lat, 10° 43' E Long). Coll. and subm. 1957 by E. Rittatore through the interest of the late A. C. Blanc. Isolone del Mincio was artificial island formed around wooden piles; it was destroyed in 1956-1957. Excavation carried out at that time by Soprintendenza alle Antichità della Lombardia and by E. Rittatore brought to light wooden piles dating from Late Bronze Age: three distinct layers of dwellings were discovered (Mirabella Roberti, 1956). The wood, id. by Villaret von Rochov (1958), was impaired and eaten into by rootlets picked out by hand as far as possible.

R-96. Isolone del Mincio 1

3230 ± 60

1280 B.C.

Part of wooden pile from lower layer of dwellings.

R-97. Isolone del Mincio 2**3475 ± 60**
1525 B.C.

Part of wooden pile from middle layer of dwellings.

R-98. Isolone del Mincio 3**3075 ± 60**
1125 B.C.

Part of wooden pile from upper layer of dwellings.

General Comment: R-96 and R-98 dates agree with archaeological age and are an indication of length of settlement. Age measurements at Pisa of other fragments of piles from same two layers were: Pi-25, 3333 ± 115 ; Pi-26, 3100 ± 113 (Pisa I). Age of R-97 proved inexplicably too early.

R-25. Cavriana**3495 ± 60**
1545 B.C.

Darkened, partially charred wood from dwellings built on horizontal wooden packwork, so-called "bonifica," in peat-bog of Bande di Cavriana, 37 km N of Mantua, Lombardy ($45^{\circ} 21' N$ Lat, $10^{\circ} 37' E$ Long). Excavated 1952 by E. Rittatore who coll. 1952; subm. 1953 by L. Cardini. Pottery and other material belonging to Lower-Middle Bronze Age, Polada Culture, have been found (Rittatore, 1953). *Comment:* wood from dwelling on "bonifica" at Barche di Solferino, 27 km NW of Mantua together with archaeological finds belonging to Polada Culture have been dated at Pisa; age is in agreement: Pi-87, 3341 ± 115 (Pisa II).

R-109. Grotta Arma dello Stefanin**7800 ± 100**
5850 B.C.

Charcoal from Layer IV of Grotta Arma dello Stefanin deposit, Val Pennavaira, province of Savona, Liguria ($44^{\circ} 06' 13'' N$ Lat, $8^{\circ} 00' 57'' E$ Long, 440 m above sealevel). Cave no. 257 in "Catalogo Speleologico Ligure." Coll. 1957 and subm. 1958 by M. Leale Anfossi, Ist. Italiano di Paleontologia Umana. Throughout deposit, various hearths, charred bones of wild animals, food refuse, have been found. Level III contains pottery dating from Lower Neolithic and Iron Ages; Levels IV and V contain a number of flint instruments with characteristics of a final Upper Paleolithic or Epipaleolithic industry. An industry that can be assigned to Upper Paleolithic has been found in Layers IX and X. Indications given here as regards the cultures are general ones since both pottery and industries are still being examined (Leale Anfossi, 1953, 1956, 1958-61a, 1958-61b). *Comment:* age obtained for Level IV would agree with a rather late Epipaleolithic industry. Dating of other levels is being carried out.

R-80. Soragna**470 ± 45**
A.D. 1480

Partially charred wood found at depth of ca. 4 m during excavation near Soragna 20 km NW of Parma, Emilia ($44^{\circ} 56' N$ Lat, $10^{\circ} 07' E$ Long). Coll. and subm. 1956 by G. Monaco, Soprintendenza alle Antichità dell'Emilia e Romagna. *Comment:* besides C^{14} age, there are not yet other elements for dating this wood.

R-5. Valle Trebba**700 ± 60**
A.D. 1250

Wood excavated in Valle Trebba, ca. 5.5 km NW of Comacchio, province of Ferrara (44° 46' N Lat, 12° 08' E Long), and housed in premises of Soprintendenza alle Antichità dell'Emilia e Romagna at Bologna. Subm. 1952 by the late S. Aurigemma, formerly Soprintendente alle Antichità dell'Emilia e Romagna. *Comment*: wood believed to belong to lake-dwelling of 5th to 3rd centuries B.C. Owing to uncertain attribution, C¹⁴ date was requested. Age obtained refutes attribution.

R-26. Firenze**1935 ± 55**
A.D. 15

Charcoal found together with human bones and Roman pottery from Roman layer of end of 2nd or beginning of 1st century A.D. (Maetzke, 1950), Via Por Santa Maria, Florence (43° 46' 22" N Lat, 11° 16' 16" E Long). Coll. 1950 and subm. 1953 by L. Cardini. Roman layer was discovered during 1950 excavation in area of war-destroyed buildings now partially occupied by trade stock-exchange. *Comment*: date agrees well with expected historical age.

Etruscan Ovens series

Charcoal from Etruscan ovens, Valle del Temperino 1 km N of Campiglia Marittima, province of Leghorn, Tuscany (43° 03' N Lat, 10° 10' E Long). Coll. 1936 and subm. 1951 by E. Tongiorgi, Lab. di Geologia Nucleare, Univ. of Pisa.

R-10A. Etruscan Oven no. 2**2175 ± 45**
225 B.C.**R-10B. Etruscan Oven no. 4****2250 ± 45**
300 B.C.

Comment: Commission for study of Old Mine Working Activities of Soprintendenza alle Antichità dell'Etruria excavated six Etruscan ovens in this locality in 1936. They were identified through study of the slag as copper manufacturing furnaces. Charcoal belongs to *Quercus robur*, *Quercus cerris* and *Pirus aucuparia* (Tongiorgi, 1937). Previous date of charcoal from oven no. 3, R-10, 2140 ± 65 (Rome II), and the present dates are in agreement, confirming that ovens belonged to last phase of Etruscan civilization. No archaeological find had indicated historical date of ovens (D'Achiardi and Stefanini, 1937).

R-6. Necropolis of Cerveteri**2380 ± 60**
430 B.C.

Charcoal from focus of tomb no. 2 of Maroi Tumulus, Etruscan Necropolis of Cerveteri, locality of Banditaccia, 3 km N of Cerveteri, Lazio (42° 00' N Lat, 12° 05' E Long). Tumulus excavated 1951-1953 by M. Moretti, present Soprintendente alle Antichità dell'Etruria Meridionale. Coll. and subm. 1952 by M. Moretti through the interest of the late R. Bartoccini, formerly Soprintendente alle Antichità dell'Etruria Meridionale. Necropolis was in use from beginning of 7th century B.C. until 2nd-1st century B.C. The Maroi Tumulus, a

notable monument, has been dated end of 6th century B.C. on basis of characteristics of Etruscan objects found in it and presence of three Attic vases decorated with black figures. Foculus also contained remnants of a funeral meal (Moretti, in preparation). Charcoal finds in Etruscan tombs are very rare. *Comment*: age obtained agrees well with archaeological date. Previous date at Rome with a solid carbon counter gave 2730 ± 240 (Ballario *et al.*, 1955).

Grotta Misa series

Charcoal and burnt *Triticum sativum* and *Panicum miliaceum* (id. by E. Tongiorgi) from Grotta Misa deposit, Ischia di Castro, province of Viterbo, Lazio ($42^\circ 30' N$ Lat, $11^\circ 38' E$ Long). Excavated 1947 by L. Cardini, F. Rittatore and E. Tongiorgi. Late Bronze Age Culture is represented in deposit by bronze objects and pottery (Rittatore, 1949).

R-9. Grotta Misa 1 (remeasured)

**2870 ± 60
920 B.C.**

Charcoal coll. 1947 and subm. 1951 by E. Tongiorgi.

R-24. Grotta Misa 2

**2700 ± 60
750 B.C.**

Burnt wheat and millet coll. 1947 and subm. 1953 by L. Cardini.

General Comment: charcoal from same deposit has been dated at Pisa, Pi-54, 3030 ± 75 (Pisa II). New measurements at Rome are in closer agreement with Pisa date and culture contained in deposit. First date for R-9 was 2460 ± 100 (Rome II).

R-32. Sasso di Furbara

**2515 ± 45
565 B.C.**

Wood-carbonaceous material together with clayey soil found in tomb no. 4 of Caolino Necropolis, Sasso di Furbara, Via Aurelia, 60 km from Rome ($42^\circ 03' N$ Lat, $12^\circ 02' E$ Long). Excavated by A. M. Radmilli and S. Patrizi 1949-1956 and by D. Brusadin since 1957. Coll. and subm. 1954 by the late S. Patrizi, Ist. Italiano di Paleontologia Umana. Iron Age mixed rite necropolis consisting mainly of inhumation tombs (like tomb no. 4). Archaeological finds attributable to 2nd period of "Tarquinia Series," southern facies of Villanovian. However, owing to probable presence of a gold object, tomb no. 4 seems later and might be assigned to Tarquinia III (Brusadin, 1964, private commun.). *Comment*: age obtained also compatible with later date (Tarquinia III).

R-117. Leporano, Porto Perone

**3100 ± 60
1150 B.C.**

Charcoal from prehistoric station of Porto Perone near Leporano, ca. 16 km SE of Taranto, Apulia ($40^\circ 23' N$ Lat, $17^\circ 19' E$ Long). Excavated, coll. August 1958 and subm. Nov. 1958 by F. G. Lo Porto and Soprintendenza alle Antichità della Puglia e del Materano. Further excavation carried out in 1960. Bronze Age huts and remains of Iron Age dwellings have been found in the station (Lo Porto, 1960). Charcoal was discovered under the piled earth floor of the hut at depth of from 10 to 20 cm in a "black layer." *Comment*: age agrees with Late Bronze Age.

R-54. Grotta Romanelli **9050 ± 100**
7100 B.C.

Humic acids extracted from top layer (0 to 5 cm) of "terra bruna" formation of deposit in Grotta Romanelli, Costiera Salentina, 2 km from Castro towards S. Cesarea, province of Lecce, Apulia (40° 01' N Lat, 18° 24' E Long). Coll. and subm. by the late A. C. Blanc and L. Cardini. *Comment:* G. A. Blanc's interpretation of Grotta Romanelli deposit and measurements carried out at Rome and Groningen of charcoal and humus from other levels of "terra bruna" formation have been illustrated and discussed in the preceding date list (Alessio, Bella and Cortesi, 1964: see R-58, p. 79-80). Age of R-54 seems too recent if compared with ages obtained for R-58 and R-56 (humus and charcoal from same level 30 cm below surface) and suggests surface contamination, probably by small animals, of the palaeosoil humus.

R-28. Megara Hyblaea **2350 ± 65**
400 B.C.

Charcoal found in 7th century B.C. layer during excavation 1949-1959, directed by F. Villard, of the ancient Megara Hyblaea near Augusta, province of Syracuse, Sicily (37° 12' N Lat, 17° 19' E Long). Coll. by F. Villard, Ecole Française de Rome, and subm. 1953 by L. Cardini. Megara Hyblaea was founded by the Greeks at end of 8th century B.C. on remains of Neolithic village belonging to Stentinello Culture; it flourished from 7th to beginning of 5th century B.C. when it was destroyed. A Hellenistic village was built on its ruins around 330 B.C., and site was later inhabited by the Romans till the time of Constantine. *Comment:* date obtained does not agree with expected historical age.

R-93. Statue **200 ± 200**
A.D. 1750

Fragments of cedar wood from female statue apparently found in river at mouth of Tiber and reckoned to be part of prow decorations (figure-head) of Roman ship of Late Roman Empire (4th-5th centuries A.D.). Subm. 1956 by U. Lumini, Soprintendenza alle Antichità delle provincie di Firenze, Arezzo e Pistoia, through the interest of M. Salmi, Ist.di Storia dell'Arte, Univ. of Rome. *Comment:* attribution based on stylistic features of statue and on state of wood which bears traces of long immersion in fresh water. Different measurements of sample did not agree well enough to permit statistical treatment of the results, so error in this dating is a maximum error. Age obtained refutes attribution, the statute being of more recent date.

R-130. Mortar **13,170 ± 175**
11,220 B.C.

Mortar containing 30% CaCO₃ from historical building, locality not communicated; expected age 2000-2500 yr B.P. Subm. 1959 by Padre Cristoforo O. F. M. Cap. *Comment:* many times our lab. has been asked if it is possible to date buildings, monuments etc. by measuring activity of carbon of CaCO₃ formed during carbonation by atmospheric CO₂ of lime contained in the mortar used. We have always made it clear that such dating was only theoretically possible and that the following quite improbable conditions would have to exist:

a) complete decomposition of limestone roasted in limekiln in order to manufacture quicklime; b) absence of carbonate materials among the other component of the mortar; c) no subsequent exchanges between the CaCO_3 formed throughout hardening of the lime and atmospheric and water CO_2 . Nevertheless, as this request was repeated with insistence, activity of this mortar was measured and, as it was to be expected, age obtained was completely fortuitous and meaningless owing to an unverifiable combination of the disturbance factors mentioned.

B. Egypt

R-33. Kau-el-Kebir

3300 ± 50
1350 B.C.
3290 ± 60
1340 B.C.
average 3300 ± 40
1350 B.C.

Wood fragments in excellent state of preservation presumably from coffin of tomb excavated by E. Schiaparelli at Kau-el-Kebir, Upper Egypt (26° 50' N Lat, 31° 32' E Long), housed in Museo Egizio, Turin. Subm. 1954 by E. Scamuzzi, Soprintendente alle Antichità, Egittologia, Torino II. *Comment*: tomb is thought to belong to Middle Kingdom and attributed to period 2000-1800 B.C. Age obtained is significantly younger than expected.

R-36. Thebes

2950 ± 45
1000 B.C.
2945 ± 70
995 B.C.
average 2950 ± 40
1000 B.C.

Well-preserved sycamore wooded fragments from anonymous tomb, Thebes, Valley of the Queens, Upper Egypt (25° 44' N Lat, 32° 38' E Long), housed in Museo Egizio, Turin. Subm. 1954 by E. Scamuzzi. *Comment*: estimated age, Ramses II, XIXth Dynasty 1300 to 1235 B.C.; date is somewhat younger.

R-38. Egypt

3320 ± 60
1370 B.C.
3000 ± 75
1050 B.C.
average 3200 ± 45
1250 B.C.

Wooden fragment from coffin; original location in Egypt is not known; housed in Museo Egizio, Turin. Subm. 1954 by E. Scamuzzi. *Comment*: sample is classified as belonging to Middle Kingdom 2100 to 1580 B.C.; age obtained is younger than expected.

General Comment: dates of 54 archaeological and historical samples from Egypt were published up to the summer of 1964. Some of these have been repeatedly dated both by the same lab. and as cross-check samples (C-1, C-62, C-81, Gro-1100, Gro-1109, BM-27); for all samples dated see: Libby, 1955;

Suess, 1960; British Museum I, II, III; Groningen I, II, III; Uppsala I; UCLA I, II; Arizona III, IV; Pennsylvania III; USGS V; Rome, I, II; Louvain II; Saclay I; Sharp Labs. I; Tata Inst. I. These measurements have shown that most Egyptian samples give a C^{14} age which is less than expected historical age often based on astronomical evidences. No satisfactory physical or archaeological explanation of this fact yet found, except a physical attempt by Damon and Long (1963).

II. GEOLOGIC SAMPLES

Italy

R-39. Massaciucoli, peat pebble (remeasured) **18,550 ± 400**
16,600 B.C.

Pebble of compressed and hardened peat perforated by pholads, Lago di Massaciucoli near Torre del Lago, Bassa Versilia, Tuscany ($43^{\circ} 50' N$ Lat, $10^{\circ} 09' E$ Long). Subm. 1954 by the late A. C. Blanc. *Comment*: for origin and significance of the sample see Alessio, Bella and Cortesi (1964, p. 87). New date agrees with preceding one: R-39, $18,800 \pm 400$ (Rome II), and thus confirms Main Würm age of sample.

III. CROSS-CHECK SAMPLES

R-64. Ruds Vedby (remeasured) **11,200 ± 145**
9250 B.C.

Wood from thin, dark layer of peaty lake mud forming pollen-zone boundary II/III, Alleröd-Younger Dryas; Ruds Vedby, Zealand, Denmark ($55^{\circ} 32' N$ Lat, $11^{\circ} 22' E$ Long). Distributed by H. Tauber as cross-check sample (K-101). *Comment*: dates of K-101, published up to end of 1963 by many European labs. and by USGS, are listed and discussed in Alessio, Bella and Cortesi (1964, p. 78). Subsequently Copenhagen remeasured the sample: K-101, $10,970 \pm 120$ (Copenhagen VI), obtaining a date in agreement with previous ones. The new Rome date agrees with that of Copenhagen and Groningen, the previous one being too old: R-64, $11,900 \pm 170$ (Rome II); average of the previous and present date is $11,500 \pm 110$.

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Arizona IV	Damon, Long, and Sigalove, 1963
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British Museum II	Barker and Mackey, 1960
British Museum III	Barker and Mackey, 1961
Copenhagen VI	Tauber, 1964
Groningen I	de Vries and Barendsen, 1954
Groningen II	de Vries, Barendsen, and Waterbolk, 1958
Groningen III	de Vries and Waterbolk, 1958
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