

**UNIVERSITY OF ROME CARBON-14 DATES XV**

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This list includes ages measured from August 1974 to May 1976 using the benzene scintillation method. All archaeological and geologic samples except Sahara Libico series, come from Italian territory. These datings were carried out partly with the liquid scintillation counter previously described (Alessio *et al*, 1973) and partly with a new liquid scintillation counter (Alessio *et al*, 1976b). Vials, 4.5ml in volume, described in Alessio *et al*, 1973. Mixture consists of 3.5ml of benzene from sample and 1ml of commercial liquid scintillator NE 216. The characteristics of new counter are: background 2.90 cpm and figure of merit  $\frac{E^2}{B} = 2000$ .

Charcoal and wood samples underwent standard pretreatment by boiling with 5 to 10% HCl;  $\alpha$ -labelled samples were given additional leaching with 0.2 N NaOH.

The counting rate of approx half the samples was corrected based on the  $^{13}\text{C}/^{12}\text{C}$  ratio, mass-spectrometrically measured on  $\text{CO}_2$  obtained in combustion line set up after Broecker *et al* (1959), according to previously described procedure (Alessio *et al*, 1969). As in dating with the  $\text{CO}_2$  proportional counter, the modern standard is the same wood grown near Rome from 1949 to 1953, the activity of which is repeatedly checked with 95% of the activity of NBS oxalic acid and measurements are found coincident within  $1\sigma$ . Errors quoted are  $1\sigma$  statistical error. Ages were calculated using the Libby half-life of  $5568 \pm 30$  yr, with 1950 as the standard year of reference.

ACKNOWLEDGMENTS

We express our thanks to Consiglio Nazionale delle Ricerche for partial financial support. We also wish to thank A Delfino for his work in benzene synthesis.

SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC AND HISTORIC SAMPLES

*A. Italy*

**R-1073. Cavallo della Basilica di S Marco** **450 ± 50**  
 $\delta^{13}\text{C} = -23.8\text{‰}$

Charred wood fragments from left hind paw of 1 of 4 gold-plated copper horses removed for restoration from loggia of S Marco Cathedral, Venice. Coll 1973 and subm 1974 by late A Rusconi, Proto Procuratoria di S Marco. *Comment:* dated to solve controversy about Greek or Roman

origin of monument. Date does not settle question, but may indicate charred wood is remains of fire used in restoration or gilding work during Renaissance. Network of scratches apparently scattered at random to decrease surface reflectivity might be attributed to an artist contemporary to Ghiberti, as this technique was probably unknown in antiquity (Vittori and Mestitz, 1975).

### Gran Carro, Lago di Bolsena series

In 1974, stratigraphic excavations in 2m<sup>2</sup> area divided into 4 equal quadrangles, were made by A Fioravanti, E Loret and A Guidi, Gruppi Archeol Italia, for Sopr Etruria Meridionale, Rome, in undisturbed basal sediments of Bolsena crater lake, water depth 3.80m, near E shore at Gran Carro, prov Viterbo, Latium (42° 35' 23" N, 11° 59' 44" E). Darkened wood and charcoal coll and subm 1974, from depths up to 35cm below lake bottom, are assoc with abundant Villanovan, *Tarquiniac* and *Visentum* phases, pottery; sterile layer not reached (A Fioravanti, oral commun).

**R-1120α. Gran Carro 2** **2740 ± 50**  
 $\delta^{13}C = -25.7\%$

Darkened wood fragments from Quad I, 5cm depth below base of lake.

**R-1121. Gran Carro 3** **3470 ± 80**

Darkened wood fragments from Quad I, 10cm depth. *Comment:* sample too small to undergo .2N NaOH leaching.

**R-1122α. Gran Carro 4-5** **2710 ± 50**  
 $\delta^{13}C = -26.2\%$

Darkened wood fragments, from Quad II, 10cm depth.

**R-1123α. Gran Carro 7** **2860 ± 50**  
 $\delta^{13}C = -25.9\%$

Darkened wood fragments from Quad II, Layer 1, 15cm depth.

**R-1124α. Gran Carro 12** **2850 ± 50**  
 $\delta^{13}C = -28.0\%$

Darkened wood fragments and charcoal from Quad III, Layer 1, 20cm depth.

**R-1125α. Gran Carro 15** **3040 ± 50**

Darkened wood fragments and charcoal from Quad III, Layer 2, 25cm depth.

**R-1126α. Gran Carro 16** **3030 ± 50**  
 $\delta^{13}C = -25.0\%$

Darkened wood fragments and charcoal from Quad IV, Layer 1, 30cm depth.

**R-1127 $\alpha$ . Gran Carro 19** **2850  $\pm$  50**  
 $\delta^{13}C = -26.3\%$

Darkened and partly charred wood fragments from Quad IV, Layer 2, 35cm depth.

*General Comment:* R-1120-1127, except R-1121, ranging from 8th to mid-12th centuries BC, are to our present knowledge, judged too old for assoc Villanovan pottery (Fioravanti, oral commun). Another date available for Gran Carro R-859 $\alpha$  (R, 1975, v 17, p 320). Prehistoric settlements of nearby small Mezzano crater lake were dated (R, 1975, v 17, p 316-319), among others discovered in Central Italy lakes.

**Navi romane, Porto di Claudio, series**

During construction of Leonardo da Vinci airport in 1957, keels of 6 Roman merchant ships were found at 3.5m depth below surface in entrance area of Roman port of Emperor Claudius at Fiumicino, Rome (41° 46' N, 12° 15' E). All keels were embedded at same depth in sandy sediments rich in mollusk shells (Scrinari, 1961). Wood from keels id by M Follieri, Ist Bot, Univ Rome, coll 1957 and subm 1975 by V Scrinari, Sopr Antichità, Ostia.

**R-1128 $\alpha$ . Porto di Claudio 1** **2020  $\pm$  50**

Wood fragment (*Quercus* sp deciduous group) from keel of Ship 1, *Barca del Pescatore*.

**R-1129 $\alpha$ . Porto di Claudio 2** **1780  $\pm$  50**  
 $\delta^{13}C = -28.0\%$

Wood fragment (*Picea* or *Larix*) from keel of Ship 2, *Oneraria minore*.

**R-1130 $\alpha$ . Porto di Claudio 3** **1790  $\pm$  50**

Wood fragment (*Quercus* sp deciduous group) from keel of Ship 3, *Oneraria minore fatiscente*.

**R-1131 $\alpha$ . Porto di Claudio 4** **1820  $\pm$  50**  
 $\delta^{13}C = -26.3\%$

Wood fragment (*Quercus* sp deciduous group) from keel of Ship 4, *Oneraria maggiore*.

**R-1132 $\alpha$ . Porto di Claudio 5** **1830  $\pm$  50**  
 $\delta^{13}C = -24.9\%$

Wood fragment (*Quercus* sp deciduous group) from Ship 5, *Oneraria caudata*.

**R-1133 $\alpha$ . Porto di Claudio 6** **1750  $\pm$  50**  
 $\delta^{13}C = -27.6\%$

Wood fragment (*Quercus* sp deciduous group) from keel of Ship 6, *Bordata di Oneraria*.

*General Comment:* R-1128 $\alpha$  *Barca del Pescatore* date (70  $\pm$  50 BC) is of Roman republican age: probably old wood reused for ship restoring.

R-1129 $\alpha$ -1132 $\alpha$  dates, ranging between 1st and 2nd centuries AD, agree with building time (42 to 54 or 66 AD) of Emperor Claudius port.

**R-1134. Antemurale, Roma** **2230  $\pm$  50**  
 $\delta^{13}C = -27.4\text{‰}$

**R-1134 $\alpha$ . Antemurale, Roma** **1990  $\pm$  50**  
 $\delta^{13}C = -26.9\text{‰}$

Wood fragments (*Abies* sp) id by M Follieri, from rampart belonging to remains of structure of large republican Roman villa found during underground excavation work in SW area of Piazza della Repubblica, Rome. Coll 1973 and subm 1975 by V Scrinari. Rampart found at 6.5m depth at ground water level in contact with a travertine ashlar and remains of a gray pozzolana with tuff fragments mortar from rough-cast foundation. *Comment:*  $^{14}C$  date agrees with archaeol age.

#### **Pontile romano, fiume Tevere series**

In 1974 in Tiber R bed, at 1 to 1.5m water depth, a concrete wharf with large embedded piles and a palisade between wharf and right bank were found downstream of Magliana bridge, Rome, by C Mocchegiani Carpano, Soprin Archeol, Rome. Wood id by R D'Alessandro, Ist Bot, Univ Rome; coll and subm by C Mocchegiani Carpano.

**R-1111 $\alpha$ . Pontile 1** **1780  $\pm$  120**  
 $\delta^{13}C = -26.3\text{‰}$

Well-preserved wood (*Quercus* sp, deciduous group) from wharf pile, sec 30  $\times$  20cm.

**R-1112 $\alpha$ . Pontile 2** **1760  $\pm$  120**

Well-preserved wood (*Quercus* sp, deciduous group) from wharf board, 2cm thick.

**R-1113 $\alpha$ . Pontile 3** **2020  $\pm$  100**

Well-preserved wood (*Quercus* sp, deciduous group) from wharf pile, sec 30  $\times$  20cm.

**R-1114 $\alpha$ . Palizzata 4** **2150  $\pm$  110**

Slightly darkened wood (*Quercus* sp, deciduous group) from palisade pile, sec 20  $\times$  20cm.

*General Comment:*  $^{14}C$  dates confirm Roman epoch, suggesting use of wharf for some centuries.

#### **Toppo Daguzzo series**

Charcoal from prehistoric settlement at Toppo Daguzzo near Comm Rapolla, prov Potenza, Lucania (41° 00' 00" N, 15° 43' 38" E). Coll 1972 and subm 1974 by M Cipolloni, Ist Paletnol, Univ Rome. Stratigraphic sec exposes one of most complete sequences so far known in SE Italy for Middle and Late Bronze age, Apennines and Subapennines culture, respectively (Cipolloni, 1977).

**R-1090. Toppo Daguzzo DB5** **2920 ± 50**

Charcoal from Balk B, Layer 5 with pottery of Apennines culture.

**R-1091 $\alpha$ . Toppo Daguzzo III A-B6** **3340 ± 50** $\delta^{13}C = -24.5\%$ 

Charcoal from Sec III, Sq AB, Level 6 with pottery of Subapennines culture.

*General Comment:* R-1090 -1091 $\alpha$  dates disagree, inexplicably inverted with respect to corresponding cultures.**R-807 $\beta$ . Capo di Ponte, via S Bartolomeo, 70-1** **440 ± 50** $\delta^{13}C = -28.8\%$ **R-807 $\alpha$ . Capo di Ponte, via S Bartolomeo, 70-1** **360 ± 220**Peat from 1.70m depth, underlying level with prehistoric remains, S Bartolomeo St, Capo di Ponte, Valcamonica, prov Brescia, Lombardy. Coll 1969 and subm 1970 by E Anati. *Comment:* R-807 $\alpha$  was given 5% HCl pretreatment and additional leaching with .2N NaOH; R-807 $\beta$  fraction insoluble in above .2N NaOH leaching. Sample, expected to be Neolithic, is recent; reworking is possible.**Grotticella Incudine series**

Impaired wood fragments, supposedly remains of Late Bronze structure from deposit inside Incudine small cave 6km NE Edolo prov Brescia, Lombardy (46° 13' 07" N, 10° 21' 48" E). Coll 1969 and subm 1970 by E Anati. WW I trench-work discovered cave which collapsed afterwards and was rediscovered in 1969.

**R-809 $\alpha$ . Incudine 70-3** **<150**

Impaired wood fragment from Incudine small cave deposit.

**R-810 $\alpha$ . Incudine 70-4** **<150** $\delta^{13}C = -26.2\%$ 

Impaired wood and other fragments from Incudine small cave deposit.

*General Comment:* recent, see also R-810 $\alpha$ , proportional counting age (R, 1976, v 18, p 322).*B. Sardinia***Ossi series**Two stone huts, A and B, of Nuragic age (Alessio *et al.*, 1969) found during 1967 excavations carried out by M L Ferrarese Ceruti at Sa Mandra 'e sa Giua near Ossi, ca 11km S Sassari (40° 40' 35" N, 8° 37' 03" E). Charcoal from Huts A and B and from open space E. Coll and subm 1969 by M L Ferrarese Ceruti.**R-1092 $\alpha$ . Ossi I** **2740 ± 50**

Charcoal from Hut B, lower cultural Layer II.

**R-1093 $\alpha$ . Ossi 2** **2690  $\pm$  50**  
 $\delta^{13}C = -25.1\text{‰}$

Charcoal from crumbling in Open Space E before Hut A.

**R-1094 $\alpha$ . Ossi 3** **3050  $\pm$  50**  
 $\delta^{13}C = -23.5\text{‰}$

Charcoal from sole cultural layer in Open Space E before Hut A.

**R-1095 $\alpha$ . Ossi 4** **2590  $\pm$  50**  
 Charcoal from crumbling inside Hut A entrance.

**R-1096. Ossi 5** **2810  $\pm$  50**  
 $\delta^{13}C = -23.7\text{‰}$

Charcoal from crumbling inside Hut A.

**R-1097. Ossi 6** **2800  $\pm$  50**  
 Charcoal from Hut A, upper cultural Layer I.

**R-1098. Ossi 7** **2670  $\pm$  50**  
 $\delta^{13}C = -24.7\text{‰}$

Charcoal from Hut A, older cultural Layer II.

*General Comment:* Hut A believed to be newer as partly built on ash and charcoal lens on floor of Hut B;  $^{14}C$  dates do not reveal this difference; besides, date complex is slightly older than previous ones (R, 1969, v II, p 491) but still somewhat younger than expected.

### *C. Africa*

#### **Uadi Ti-n-Tohra, Sahara Libico, series**

In 1971-72 Italian Archaeol Mission in Sahara Libico, Ist Paleontol, Univ Rome, Head S M Puglisi, made excavations in both N and E shelter deposits 300m apart at Uadi Ti-n-Tohra, Uadi Auis's affluent, Tadrart-Acacus sandstone massif Sahara Libico (25° 00' N, 10° 20' E). N shelter deposit, ca 2m thick up to rocky soil, revealed 2 archaeol horizons separated by thick sterile layer. Upper horizon, Layers I-II, Bovidian complex or series, dotted pottery and stone industry with large tools; lower horizon, Layer IV-V, dotted wavy line pottery and microlithic stone industry. E shelter deposit, ca 1.70m thick up to rocky soil, showed, Layers I to IV, sole archaeol horizon with dotted wavy line pottery and abundant stone industry; animal bone remains also present (Barich, 1976). Rock paintings and engravings, peculiar rock incision called "paired holes" (Mori, 1961), and sepulchral monuments of various kinds (Barich, 1976) were found nearby, indicating successive settlements of different prehistoric peoples. Charcoal and bovine excrement from both N and E shelters coll and subm 1972 by B Barich, Ist Paletnol, Univ Rome, who carried out excavations.

*N shelter*

**R-1028. Ti-n-Tohra Ia** **5600 ± 50**

Bovine excrement from Layer I, Level a with series dotted pottery, Bovidian phase.

**R-1029. Ti-n-Tohra Ib** **5260 ± 130**

Bovine excrement from Layer I, Level b with series dotted pottery, Bovidian phase.

**R-1030. Ti-n-Tohra Ic** **5360 ± 120**

Bovine excrement from Layer I, Level c with series dotted pottery, Bovidian phase.

**R-1031α. Ti-n-Tohra II** **5940 ± 50**

$\delta^{13}C = -27.0\text{‰}$

Charcoal from Layer II with series dotted pottery, Bovidian phase.

**R-1032. Ti-n-Tohra V** **7080 ± 60**

$\delta^{13}C = -24.5\text{‰}$

Charcoal from Layer V with dotted wavy line pottery.

*E Shelter*

**R-1033α. Ti-n-Tohra C4** **8400 ± 60**

$\delta^{13}C = -25.1\text{‰}$

Charcoal inside Hut 4, Level II with dotted wavy line pottery.

**R-1034α. Ti-n-Tohra C5** **7990 ± 70**

Charcoal inside Hut 5, Level II, with dotted wavy line pottery.

**R-1035α. Ti-n-Tohra IV** **8650 ± 70**

$\delta^{13}C = -24.1\text{‰}$

Charcoal from upper part of Level IV with dotted wavy line pottery.

**R-1036α. Ti-n-Tohra IV** **9080 ± 70**

$\delta^{13}C = -25.2\text{‰}$

Charcoal from lower part of Level IV with dotted wavy line pottery.

*General Comment:*  $^{14}C$  dates range from late 8th to late 4th millennium BC, with gap through 7th millennium BC between 2 cultures: area may have been temporarily abandoned owing to unfavorable climatic conditions (Bonadonna, 1976; Geyh and Jäkel, 1974, 1975; Rognon, 1975). R-1036 is oldest date now available for Acacus Massif. Date sequences for pottery cultures of other settlements in same climatic area in Acacus Massif measured by both American and Italian (Pi, unpub) labs (Mori, 1968) as well as Tibesti and Sahara-Sudan, by both French and German labs (Camps, 1974). All above chronologies indicate settlement between 8th and 3rd millennium BC, suggesting mid-2nd millennium BC as beginning of desert environment.

## II. GEOLOGIC SAMPLES

## Italy

**Torbiere d'Iseo series**

Peat from Holocene peat bogs S Iseo lake, prov Brescia, Lombardy (45° 39' 00" N, 10° 02' E). Coll 1969 and subm 1970 by E Anati. Samples from drilling core every 50cm from surface up to Würmian level, 4m depth. Peats were given only 5% HCl pretreatment, being completely soluble in .2N NaOH; sample from 2m depth: too small for dating.

**R-812. Iseo 70-6** **740 ± 50**  
 $\delta^{13}C = -28.6\%$

Peat from 0.5 to 1m depth.

**R-813. Iseo 70-7** **3340 ± 70**

Peat from 1 to 1.5m depth.

**R-815. Iseo 70-9** **4240 ± 60**  
 $\delta^{13}C = -28.4\%$

Peat from 2 to 2.5m depth.

**R-816. Iseo 70-10** **4580 ± 50**  
 $\delta^{13}C = -29.0\%$

Peat from 2.5 to 3m depth.

**R-817. Iseo 70-11** **5390 ± 70**  
 $\delta^{13}C = -28.2\%$

**R-818. Iseo 70-12** **7190 ± 60**

Peat from 3.5 to 4m depth.

*General Comment:* dates requested in support of pollen analysis as well as stratigraphic studies for Valcamonica Holocene paleoenvironment reconstruction. R-811 to -818 dates consistent with stratigraphy but systematically somewhat younger than pollen analysis data and 2 <sup>14</sup>C ages for nearby similar Tonale peat bogs (Horowitz, 1975); samples probably contaminated by recent vegetation. Iseo peat bog, unlike Tonale bogs, are under 1m water at S edge of lake.

**Lago di Tenno series**

Well-preserved wood from trunks *in situ* at base of Tenno Lake, 4.5km N Tenno, prov Trento, Trentino (45° 56' N, 10° 46' E) at +570m. Lake No. 3 in "Catasto laghi del Trentino". Coll 1970 by Gruppo Sommozzatori Riva del Garda and subm 1975 by F Pedrotti, Ist Bot, Univ Camerino, who id wood.

**R-1107α. Lago di Tenno 1** **920 ± 50**  
 $\delta^{13}C = -26.0\%$

Well-preserved wood (*Fagus sylvatica* L) from Trunk 1 *in situ* in basal sediments, water depth 24m.



**R-1108 $\alpha$ . Lago di Tenno 8** **1420  $\pm$  50**  
 $\delta^{13}C = -26.1\%$

Well-preserved wood (*Fagus sylvatica* L) from Trunk 8 *in situ* in basal sediments, water depth 19m.

**R-1109 $\alpha$ . Lago di Tenno 13** **1000  $\pm$  50**  
 $\delta^{13}C = -28.0\%$

Well-preserved wood (*Fagus sylvatica* L) from Trunk 13 *in situ* in basal sediments, water depth 19m.

**R-1110 $\alpha$ . Lago di Tenno 32** **810  $\pm$  50**  
 $\delta^{13}C = -25.8\%$

Well-preserved wood (*Ostrya carpinifolia*) from Trunk 32 *in situ* in basal sediments, water depth 18m.

*General Comment:* R-1107 to -1110 dates, agreeing with previous ones (R, 1973, v 15, p 385; R, 1975, v. 17, p. 323-324), conclude detailed chronology of Tenno submerged forest. 12 trunks have been dated, and do not disagree with traditional belief that Tenno Lake basin was formed by landslide ca AD 1400.

#### **Aeroporto Leonardo da Vinci, Fiumicino series**

In 1968, for enlargement of Leonardo da Vinci airport, Ministero Lavori Pub entrusted R. Mortari, Ist Geol & Paleont, Univ Rome, with geol and geotech studies in recent sediments at Bonifica di Porto NE Fiumicino (41° 50' N, 12° 16' E). 15 drillings in present 3rd strip area revealed brackish lagoon formation from 35 to 60m thick; from surface downwards: Levels 1-3 clayey sediments, average thickness ca 20m, with interbedded peaty layer, 4m depth, and several horizons with both wood and vegetable remains, and mollusk shell accumulations; Levels 4 and 5, from 20 to 40-60m depth, silty-clayey sediments resting on fluvial sands and gravels. Stratigraphic sequence also recognized by penetration tests (Mortari, 1975a b). Wood and clays from Core P3-S5 (41° 50' 03.3" N, 12° 16' 01" E) coll 1968 and subm 1974 by R. Mortari.

**R-887. Aeroporto P3-S5 I** **4760  $\pm$  60**  
 $\delta^{13}C = -28.4\%$

Blackish clay rich in very small and microscopic vegetable remains (C = 13%), freed from larger wood fragments, Core 5, Level I, 4m depth.

**R-887A $\alpha$ . Aeroporto P3-S5 I** **4640  $\pm$  80**  
 $\delta^{13}C = -29.0\%$

Darkened wood fragments from blackish clay, R-887.

**R-888. Aeroporto P3-S5 II** **7730  $\pm$  80**  
 $\delta^{13}C = -28.1\%$

Blackish clay rich in very small and microscopic vegetable remains (C = 5.2%), freed from larger wood fragments, Core 5, Level II, 9.20m depth.

**R-888A $\alpha$ . Aeroporto P3-S5 II** **7660  $\pm$  80**  
 $\delta^{13}C = -24.7\%$

Darkened wood fragments from blackish clay, R-888.

**R-889. Aeroporto P3-S5 II** **7770  $\pm$  60**  
 $\delta^{13}C = -26.8\%$

Blackish clay rich in very small and microscopic vegetal remains and freed from larger wood fragments, Core 5, Level II, 9.35m depth.

**R-889A $\alpha$ . Aeroporto P3-S5 II** **7670  $\pm$  70**  
 $\delta^{13}C = -26.4\%$

Darkened wood fragments from blackish clay, R-889.

**R-890. Aeroporto P3-S5 II** **7930  $\pm$  70**  
 $\delta^{13}C = -28.0\%$

Grayish clay with scarce vegetable remains (C = 1.2%) from Core 5, Level II, 9.5m depth.

*General Comment:* dates consistent with stratigraphy indicate Holocene age. Further datings are in progress for Latium to attempt correlation of Holocene sequences id by geotech test and provide data on recent sea-level variations (Mortari, 1972, 1975a, 1975b).

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