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UNIVERSITY OF ROME CARBON-14 DATES XIII

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This list includes the second group of age measurements made from September 1972 to July 1974 using the benzene scintillation method. All archaeologic and geologic samples come from Italian territory. Chemical apparatus for benzene synthesis and the liquid scintillation spectrometer are unchanged (Alessio *et al*, 1970a, 1973). Charcoal and wood samples underwent standard pretreatment by boiling with 5 to 10% HCl; α-labeled samples were given additional leaching with .2N NaOH. The counting rate of approx half the samples was corrected based on the $^{13}C/^{12}C$ ratio, mass-spectrometrically measured on 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 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 1σ. Errors quoted are 1σ statistical error. Ages were calculated using the Libby half-life of 5568 ± 30 yr, with 1950 as the standard year of reference. Direct transformation of carbonate materials ($CaCO_3$) into carbide was also attempted, using the following reaction (Fontes, 1971):

$$2CaCO_3 + 10Li \xrightarrow[\text{ca } 700°C]{} 2CaO + 4Li_2O + Li_2C_2$$

We operated as follows: finely pulverized carbonate exceeding stoichiometrically required quantity by 80% (Barker, 1953) was thoroughly mixed in the reactor bottom with metallic lithium pellets. At ca 700°C most CO_2 from thermal decomposition of carbonate reacted almost immediately with melted lithium; reaction was completed and radon removed at ca 700°C. Pressure inside the reactor was carefully controlled throughout the process (120 to 150 min).

Calcium carbonates obtained from different materials in CO_2 preparation and purification line for proportional counter (Alessio *et al*, 1970a), and already dated by this method, were used as check samples.

As shown in Table 1, yields, calculated as the ratio of quantity of acetylene (L at P_o V_o) from all carburization and hydrolysis reactions to theoretical acetylene quantity, are rather low, possibly due to some faults in experimental apparatus. Dates obtained (Table 1) agree fairly well with corresponding ones measured with the CO_2 proportional counter; in fact, only R-566 dates are unaccountably discordant.

TABLE 1
Transformation of $CaCO_3$ into Li_2C_2—Check samples

Sample	$CaCO_3$(g)	Acetylene yield (liters) Theo-retical	Actual	Yield (%)	^{14}C age liquid scintillation method	^{14}C age CO_2 proportional counting method	References
R-11	30.0	3.36	2.96	88.1	7900 ± 100	8000 ± 100	R, 1964, v 6, p 87
R-22A	35.0	3.92	3.42	87.3	1830 ± 60	2280 ± 90	R, 1964, v 6, p 83
R-82	35.0	3.92	3.42	87.3	4030 ± 70	3600 ± 60	R, 1964, v 6, p 86
R-83	30.0	3.36	1.97	58.8	15,250 ± 250	14,480 ± 100	Remeasured, unpub
R-566	30.0	3.36	2.96	88.1	9800 ± 120	11,180 ± 120	R, 1970, v 12, p 607
R-825	27.0	3.02	2.66	88.0	15,360 ± 260	15,090 ± 140	R, 1973, v 15, p 173
R-826	27.0	3.02	2.66	88.0	12,200 ± 600	12,280 ± 100	R, 1973, v 15, p 174

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC AND HISTORIC SAMPLES

Italy

Massarosa series

A small Etruscan perilacustrine settlement was discovered in 1966 in Massarosa reclamation area at S Rocchino near Viareggio, prov Lucca, Tuscany (43° 52′ 52″ N, 10° 17′ 22″ E). Excavations carried out 1969-70 by M Cristofani, Sopr Antichità Etruria, Florence, uncovered some superimposed stamped earth floors of huts overlying archaeol sterile peat and surrounded by a double quadrangular palisade externally reinforced on S side by a system of random horizontal trunks supported by wooden piles driven into peaty soil. Pottery datable to 7th or early 6th century BC was found both inside, embedded in hut bottoms, and outside, in peaty soil (Maetzke *et al*, 1970; Cristofani, 1974, 1975). Wood (*Quercus ilex, Fraxinus orno, Coniferae*) from wooden piles and palisade coll 1969 by M Cristofani and subm 1969 by G Maetzke, Sopr Antichità Etruria, Florence.

R-688α. Massarosa 1 — **2580 ± 50**, **630 BC**, $\delta^{13}C = -27.9‰$

Wood, block of roots from Sq XLVIII-11, Layer T, Cut 4.

R-689α. Massarosa 2 — **2110 ± 50**, **160 BC**, $\delta^{13}C = -26.8‰$

Darkened wood, fragment of wooden pile from Sq XLVIII-11, Layer T, Cut 4.

R-690α. Massarosa 3 — **2360 ± 50**, **410 BC**, $\delta^{13}C = -23.2‰$

Darkened wood, fragment of wooden pile from Sq XLVIII-11, Layer T, Cut 4.

R-691α. Massarosa 4 — **2260 ± 50**, **310 BC**, $\delta^{13}C = -23.2‰$

Darkened wood, fragment of wooden pile from Sq XLVIII-11, Layer T, Cut 4.

R-692α. Massarosa 5 — **2200 ± 50**, **250 BC**, $\delta^{13}C = -27.7‰$

Darkened wood, fragment of wooden pile from Sq XLVIII-11, Layer T, Cut 3.

R-693α. Massarosa 6 **2250 ± 100**
300 BC
$\delta^{13}C = -26.3‰$

Darkened wood from wooden pile of NS palisade.

R-694α. Massarosa 7 **2230 ± 50**
280 BC
$\delta^{13}C = -26.7‰$

Darkened wood from wooden pile of NS palisade, E side of huts.

R-695α. Massarosa 8 **2470 ± 50**
520 BC

Darkened wood from wooden pile of NS palisade.

R-696α. Massarosa 9 **2280 ± 50**
330 BC

Darkened wood (*Quercus ilex*) from wooden pile of hut, E side.

General Comment: based on archaeol data, these dates must be considered too young; only R-688α and -695α ages agree.

Lago di Mezzano series

In 1972, 2 lake dwelling settlements were discovered at bottom of Mezzano little crater lake in caldera of Latera, Vulsini Mts volcanic region, Comm Valentano, prov Viterbo, Latium (42° 36′ 30″ N, 11° 46′ 08″ E) at +452m, max water depth 36m. In 1973 an underwater archaeol exploration was made for Sopr Etruria Meridionale, by L Ferri-Ricchi, Comitato Ital Ricerche e Studi Subacquei, and M C Franco. Geologic investigations and a topographic and bathymetric survey were also made: ca 50 piles, diam 10 to 20cm, driven in to the bottom, were mapped and sampled. Abundant archaeol material was recovered, including some bronze objects and "impasto" pottery, namely domestic, consisting of >50 entire vases, one incised, the others plain or with plastic decoration, attributed to end of Middle and Late Bronze age, possibly up to its final phase (M C Franco, 1975). Wood from piles and planks subm 1973 by L Ferri-Ricchi and id by M Follieri and A Catullo, Ist Bot, Univ Rome. 5% HCl pretreatment of darkened and impaired wood did not disclose CO_3^{--}; soluble organic fraction (fulvic acids) and abundant Fe^{++} were detected; scarce or absent humic acids soluble in .2N NaOH.

Mezzano I settlement

NE side of lake near effluent Olpeta R, 20 to 30m from shore, water depth 3 to 10m. Settlement comprises 2 units separated by apparently sterile zone and marked *Mezzano I-A* (42° 36′ 39″ N, 11° 46′ 19″ E, U T M 32-TQN-275217), and *Mezzano I-B* (42° 36′ 41″ N, 11° 46′ 18″ E, U T M 32-TQN-275218).

R-973α. Mezzano I-A, 1 **3230 ± 50**
1280 BC

Wood (*Quercus* sp, deciduous group), fragments of pile ca 30m from shore in bottom clayey sediment, water depth ca 7m, assoc with abundant archaeol finds.

R-974α. Mezzano I-A, 2 **3220 ± 50**
1270 BC
$\delta^{13}C = -24.9‰$

Unid. wood fragments of pile 5m from R-973α, water depth ca 7m.

R-975α. Mezzano I-A, 3 **2760 ± 50**
810 BC

Wood (*Quercus* sp, deciduous group), fragments of pile ca 15m from shore, water depth ca 5m.

R-976α. Mezzano I-A, 4 **3090 ± 50**
1140 BC
$\delta^{13}C = -24.8‰$

Unid. wood fragment of pile ca 2m from R-975α, water depth ca 5m.

R-984α. Mezzano I-A, 24A **3320 ± 60**
1370 BC

Wood (*Quercus* sp, deciduous group) from pile, diam 14cm, just protruding from bottom ca 20cm at mapped point 24A, water depth 7.60m.

R-987. Mezzano I-A, 28A **3200 ± 50**
1250 BC
$\delta^{13}C = -26.7‰$

Wood (*Alnus* sp) from pile, diam ca 14cm, just protruding from bottom at 28A mapped point, water depth 9m. *Comment*: test with .2N NaOH did not disclose humic acids.

R-988. Mezzano I-B, 30B **2680 ± 50**
730 BC
$\delta^{13}C = -25.7‰$

R-988α. Mezzano I-B, 30B **2730 ± 50**
780 BC
$\delta^{13}C = -25.7‰$

Wood (*Quercus* sp, deciduous group) from pile sq sec, 9cm side, coated with clayey matrix and evidence of industry just protruding from bottom at 30B mapped point, water depth 4m. *Comment*: 2 dates agree: scarce humic acids disclosed by .2N NaOH leaching (R-988α) seemed uncontaminating.

R-989. Mezzano I-B, 33B **2910 ± 50**
960 BC
$\delta^{13}C = 26.1‰$

Wood (*Alnus* sp) from pile, diam 14cm, just protruding from bottom

at 33B mapped point, water depth 9m. *Comment*: test with .2N NaOH did not disclose humic acids.

Mezzano II settlement

NE side of lake, 500m S Mezzano I, 20 to 30m from shore, water depth ca 6 to 12m (42° 36′ 25″ N, 11° 46′ 17″ E, U T M 32-TQN-275213).

R-985Aα. Mezzano II, 27a — **2870 ± 50 / 920 BC**

Wood (*Quercus* sp, deciduous group) from 2 fragments of same plank, ca 2cm thick, with charred side from bottom at 27a mapped point, water depth 9m, near R-986.

R-985B. Mezzano II, 27a — **2840 ± 50 / 890 BC** / $\delta^{13}C = -26.6‰$

Wood from other 2 fragments of R-985A plank. *Comment*: test with .2N NaOH did not disclose humic acids. 2 dates agree as expected.

R-986. Mezzano II, 27b — **2800 ± 50 / 850 BC** / $\delta^{13}C = -27.5‰$

Wood (*Acer* cf *opalus* Mill) from pile, diam 10cm, just protruding from bottom at 27b mapped point, water depth 9m. *Comment*: test with .2N NaOH did not disclose humic acids.

R-990. Mezzano II, 34 — **3000 ± 50 / 1050 BC** / $\delta^{13}C = -26.8‰$

Wood (*Acer* cf *platanoides* L) from pile, diam 13cm, just protruding from bottom at mapped point 34, water depth 9.30m. *Comment*: test with .2N NaOH did not disclose humic acids.

R-991. Mezzano II, 35a — **2970 ± 60 / 1020 BC** / $\delta^{13}C = -26.6‰$

Wood (*Acer* cf *platanoides* L) from pile, diam 12cm, just protruding from bottom at 35a mapped point, water depth 9.30m. *Comment*: test with .2N NaOH did not disclose humic acids. 35a to 35e samples are close together.

R-992. Mezzano II, 35b — **2760 ± 60 / 810 BC** / $\delta^{13}C = -26.1‰$

R-992α. Mezzano II, 35b — **2840 ± 50 / 890 BC** / $\delta^{13}C = -26.0‰$

Wood (*Quercus* sp, deciduous group) from pile, diam 12cm, just protruding from bottom at 35b mapped point, water depth 9.30m. *Comment*:

2 dates agree; scarce humic acids disclosed by NaOH leaching (R-992α) seemed uncontaminating.

R-993. Mezzano II, 35c — **3100 ± 50** / **1150 BC** / $\delta^{13}C = -27.3‰$

Wood (*Acer* cf *platanoides* L) from pile, diam 15cm, with evidence of industry just protruding from bottom at 35c mapped point, water depth 9.30m. *Comment*: test with .2N NaOH did not disclose humic acids.

R-994A. Mezzano II, 35d — **2900 ± 50** / **950 BC** / $\delta^{13}C = -27.5‰$

Wood (*Fagus silvatica* L) fragment of plank, 3cm thick, with partially charred side from bottom at 35d mapped point, water depth 9.30m. *Comment*: test with .2N NaOH did not disclose humic acids.

R-994B. Mezzano II, 35d — **2970 ± 60** / **1020 BC** / $\delta^{13}C = -27.1‰$

Charcoal from charred portion of R-994A plank. *Comment*: 2 dates agree as expected.

R-995α. Mezzano II, 35e — **2920 ± 50** / **970 BC** / $\delta^{13}C = -26.9‰$

Wood (*Quercus* sp, deciduous group) fragment of plank, 3cm thick, with partially charred side from bottom at 35e mapped point, water depth 9.30m.

General Comment: 14 of 16 dates from Mezzano agree with Late Bronze age, 10th to 13th centuries BC. Specifically, 6 of 8 dates for Mezzano II are from 10th to 13th centuries BC; those of Mezzano I-A, except a younger one (R-975), are between 12th and 14th centuries BC; Mezzano I-B, not sufficiently explored and dated (only 2 dates), appears somewhat younger, 8th to 10th centuries BC, the age of R-988 pile, from minimum water depth 4m, is the youngest.

The discovery, even in Bolsena and Bracciano crater lakes, of prehistoric settlements previous to 7th century BC, now submerged >5m, along with geologic, geomorphologic, archaeol, and historical data relevant to other lakes in Central Italy, eg, Trasimeno, Vico, Martignano, Monterosi, Albano, Nemi, and Fucino Lakes, reveal similar fluctuations in water level, possibly contemporaneous in the last 4000 yr. A common cause, according to L Ferri-Ricchi, might be assoc with climatic changes, namely cyclic alternations of rainy and dry periods (Ferri-Ricchi, 1975a,b, and oral commun). ^{14}C dates contribute to chronology of these events. See also Gran Carro, Lago di Bolsena and Lago di Martignano, *General Comment*, below.

2700 ± 50

R-859α. Gran Carro, Lago di Bolsena **750 BC**

$\delta^{13}C = -26.3‰$

Darkened wood (*Quercus* sp, deciduous group) id by M Follieri and R D'Alessandro, Ist Bot, Univ Rome, from wooden pile driven in and just protruding from bottom sediments of Bolsena crater lake, water depth ca 5m, near E shore at Gran Carro, prov Viterbo, Latium (42° 35′ 23″ N, 11° 59′ 44″ E). Coll and subm by A Fioravanti and E Loret, Gruppi Archeol Italia, for Sopr Etruria Meridionale, Rome. *Comment*: this lake dwelling settlement yielded abundant pottery of Villanovan culture (Colonna, 1965, 1967) id through underwater explorations (Fioravanti, 1963, 1965, 1967-68, 1969). ^{14}C age agrees with archaeol data. See also Lago di Mezzano *General Comment*, above.

1350 ± 150

R-915. Monti del Forno, Montelibretti **AD 600**

Charcoal from hearth in deposit obstructing surface entrance and filling along ca 10m a tunnel excavated in tuff found during foundation work at Monti del Forno, 29.3km along state rd No. 4 Salaria, Comm Montelibretti, prov Rome (42° 06′ 27″ N, 12° 38′ 28″ E) at +45.5m. Coll 1972 by R Caciagli and subm 1972 by G Donato, both of Servizio Sci Sussidiarie Archeol C N R, Rome. *Comment*: tunnel, 70cm wide and 180cm high, is well preserved and practicable; a stretch of ca 130m roughly explored is downhill for ca 10m below surface. So far there is no data to determine excavation time and early use of tunnel which is in an area rich in archaeol remains and tunnels of various epochs under study. Probably ^{14}C age dates its re-use in the Middle ages, possibly as a sheperd shelter.

II. GEOLOGIC SAMPLES

Italy

Grange La Coche series

Peat and wood from Grange La Coche Holocene peat bog, 1.3km E Clavière, Alta Val di Susa, Alpi Cozie, prov Turin, Piedmont (44° 56′ 06″ N, 6° 46′ 21″ E; U T M 32-TLO-23887853), at +1924m. Coll 1968 and subm 1969 and 1972 by G Charrier, Ist Giacimenti Min, Politec Turin. Profile, ca 1m thick, includes: surface soil; *Cyperaceae* peat remains; darker and more compact peat crossed by abundant root remains *in situ* of *Larix decidua* Mill (id by G Charrier, written commun, 1972) found elsewhere even below peat in thin silty layer, transition to underlying moraine. La Coche peat bog belongs to series of Lowmoor bogs "sagnes" type formed during Holocene on a recent moraine system.

1220 ± 100

R-621A. Grange La Coche 1 **AD 730**

890 ± 60

R-621α. Grange La Coche 1 **AD 1060**

Light and soft upper peat, mainly *Cyperaceae* remains 5cm below surface. *Comment*: R-621 was given no pretreatment; R-621α underwent acid-alkaline pretreatment. Two dates must be considered as minimum since upper peat was pervaded by several roots of present plants removed by hand during preparation.

3730 ± 100

R-620A. Grange La Coche 2 **1780 BC**

4870 ± 120

R-620α. Grange La Coche 2 **2920 BC**

Dark and compact lower peat from 100cm depth near base of peat bog. *Comment*: R-620α was given acid-alkaline standard pretreatment; date is reliable. R-620A was given no pretreatment: date shows strong contamination by younger humic materials.

4475 ± 95

R-914aA. Grange La Coche 3a **2525 BC**

3310 ± 100

R-914a. Grange La Coche 3a **1360 BC**

Well preserved wood, large fragment of root (*Larix decidua* Mill) *in situ* at base of peat bog. See R-914b comment.

3380 ± 100

R-914b. Grange La Coche 3b **1430 BC**

Well preserved wood, other fragments of roots (*Larix decidua* Mill) *in situ* at base of peat bog. *Comment*: R-914a/b are reliable ages of roots; samples were pretreated with 5% HCl only because test with .2N NaOH did not disclose humic acids. R-914aA was given no pretreatment: age is not reliable as sample appears strongly contaminated by humic materials, mainly fulvic acids soluble in 5% HCl, from overlying older peat.

General Comment: R-621A/α dates belong to uppermost level of upper peat, −5 to −50cm, which began forming only after end of cold phase in Early Sub-Atlantic, also agrees with pollen analysis, showing a strong decrease of *Abies* curve from −50cm upwards. R-620α dates beginning of peat formation in intermorainal basin in Late Atlantic; pollen analysis confirms attribution of lower peat, up to −50cm level, to Atlantic/sub-Boreal transition and to Sub-Boreal. R-914a/b, *Larix* wood, dated from 1260 to 1530 BC, belongs to warmer phase in Sub-Boreal which caused a rise of upper limit of forest line and a vast retreat of alpine glaciers, as proved in many places in the Alps.

Agreeing with pollen analytic data (Charrier and Peretti, 1974), ^{14}C ages set Holocene peat bogs in Val di Susa in chronologic sequence from Pre-Boreal, Villar Dora (R-158: R, 1968, v 10, p 359), through Boreal and Boreal/Atlantic transition, Novaretto (R-52: R, 1964, v 6, p 86), up to Atlantic/Sub-Boreal transition, to Sub-Boreal and Sub-Atlantic, Grange La Coche (above) which appears somewhat older than Colle del Sestrière

peat bog in nearby Val Chisone, dated between late Sub-Boreal and early Sub-Atlantic (R-53: R, 1964, v 6, p 86; R-617A/α: R, 1970, v 12, p 610).

Rovagnate series

Dark peaty clay with abundant vegetable remains at 150cm depth from surface soil, at top of lacustrine sediments of Rovagnate, at Fornace, Comm Castello Di Brianza, prov Como, Lombardy (45° 44′ 54″ N, 09° 21′ 14″ E). Coll and subm by G Orombelli, Ist Geol, Univ Milano. 180cm sec reveals deposits of final phases and extinction of Rovagnate Lake, an intermorainal basin dammed by ice-contact delta. For descriptions of stratigraphic sec, see: Riva (1954, 1957); Gnaccolini and Orombelli (1971); Orombelli (1975).

6300 ± 100

R-837. Rovagnate **4350 BC**

Dark peaty clay from top of lacustrine sediment, −150cm depth from surface soil.

4780 ± 80

R-837a. Rovagnate a **2830 BC**

Vegetable remains, mainly small darkened wood fragments, from R-837 peaty clay. *Comment*: wood fragments were carefully separated by sieving.

General Comment: R-837, the more reliable age, places last phase of Rovagnate Lake in postglacial climatic optimum, Hypsithermal, and gives maximum age for overlying sediments and soil, the latter can be correlated to other neighboring soils. ^{14}C date agrees well with geologic data for region (Orombelli, 1975).

17,700 ± 360

R-801α. Pontida **15,750 BC**

Darkened vegetable remains, mainly twigs, leaves and seeds, from thin layer of fine sand embedded in laminated silty clays of Pontida lacustrine sediments ca 20m thick, from 10m depth from surface soil in sec of quarry Fornace Magnetti, Comm Cisano Bergamasco, prov Bergamo, Lombardy (45° 44′ 08″ N, 09° 29′ 27″ E). Coll and subm 1970 by G Orombelli. *Comment*: Pontida lacustrine sediments were lain in a frontal intermorainal basin formed by piedmont glacial lobe of Adda di Lecco R in S Martino Valley (Desio, 1928; Riva, 1957; Venzo, 1948; Gabert, 1962). ^{14}C age, 1st available for Würm deposits in Lombardy, dates a phase of lacustrine sediments and represents minimum age for moraine damming the basin. Date is important for chronology of last glaciation S of Alps (Orombelli, 1975).

Pianico series

Three fragments of warped and lignitous trunks from glacial and lacustrine sediments of Pianico, right bank of Borlezza Stream, Comms Sovere and Pianico, prov Bergamo, Lombardy (45° 48′ N, 10° 02′ E). Coll and subm 1970 by G Orombelli.

R-804α. Pianico 1 **>43,000**

Heavily darkened wood, fragment of apparently lignitous trunk longitudinally flattened, from ca 8m depth from surface in glacial basal layer overlying lacustrine sediments of Pianico, right bank of Borlezza Stream (45° 48′ 57″ N, 10° 01′ 53″ E). *Comment*: 5% HCl pretreatment detects scarce carbonate and abundant Fe^{++}, probably ferrous humate. R-804, quite similar in aspect and impairment to R-805 and -806 wood, must be considered as reworked by glacier and belonging to underlying lacustrine sediments.

R-805α. Pianico 2 **>43,000**

Heavily darkened wood, fragment of apparently lignitous and longitudinally flattened trunk, from ca 6m depth from soil surface in lacustrine sediments of Pianico, right bank of Borlezza Stream (45° 48′ 53″ N, 10° 02′ 00″ E). *Comment*: 5% HCl pretreatment detects scarce carbonate and abundant Fe^{++}, probably ferrous humate.

R-806. Pianico 3 **>43,000**

R-806α. Pianico 3 **>43,000**

Heavily darkened wood, fragment of apparently lignitous and longitudinally flattened trunk, from ca 15m depth from soil surface in lacustrine sediments of Pianico ca 100m E from R-805α, right bank of Borlezza Stream (45° 48′ 48″ N, 10° 02′ 07″ E). *Comment*: 5% HCl pretreatment detects scarce carbonate and abundant Fe^{++}, probably ferrous humate.

General Comment: lacustrine sediments of Pianico, mainly fossiliferous marly and clayey rythmites with abundant vegetable remains, and deltaic sands and gravels up to 70m thick, with Würm glacial deposits on top, constitute a typical formation attributed to Riss-Würm interglacial, based on paleontologic, stratigraphic, and geomorphologic data (Venzo, 1955; Lona & Venzo, 1957; Casati, 1968). ^{14}C date is necessary, as a Main Würm interstadial age is also possible, as it is for other alpine glacial formations once attributed to the same interglacial which turned out to be datable by ^{14}C. R-804, -805, -806 minimum ages refute last assumption for Pianico formation and support traditional attribution (Orombelli, 1975).

Trentino Lakes

Systematic underwater explorations sponsored by Mus Tridentino Sci Nat, Trento, are revealing trunks of submerged forests at bottom of several lakes in Trentino. Measurements may date formation of lake basins, essential for palaeogeography of region. Wood id by M Follieri and R D'Alessandro, Ist Bot, Univ Roma.

Lago di Tenno series

Well preserved wood from trunks *in situ* at bottom of Tenno Lake, 4.5km N Tenno, prov Trento, Trentino (45° 56′ N, 10° 49′ E) at +570m. Lake 3 in "Catasto laghi del Trentino" (Tomasi, 1962). Coll 1970 by Gruppo Sommozzatori Riva Del Garda and subm by B Bagolini and G Tomasi, Mus Tridentino Sci Nat, Trento.

R-1026. Lago di Tenno 10 **940 ± 50** **AD 1010**

$\delta^{13}C = -26.9‰$

Well preserved wood (*Acer* sp) from Trunk 10 *in situ* in bottom sediments, water depth 21m.

R-1027. Lago di Tenno 39 **770 ± 50** **AD 1180**

$\delta^{13}C = -28.1‰$

Well preserved wood (*Fagus silvatica* L) from Trunk 39 *in situ* in bottom sediments, water depth 33m.

General Comment: like R-793, -784, -795 trunks previously dated (R, 1973, v 15, p 385), and all id as *Fagus silvatica* L, R-1026 and -1027 belong to submerged forest covering ca 1/5 lake bottom on W side where > 70 trees were mapped by Mus. ^{14}C dates, agreeing with previous ones, confirm once more traditional belief that Tenno Lake basin was formed by a landslide ca AD 1400 (Tomasi, 1962, 1963, 1974).

R-1023α. Lago di Canzolino **370 ± 60** **AD 1580**

$\delta^{13}C = -25.9‰$

Wood (*Castanea sativa* Mill) from outer part of large trunk, diam ca 85cm, found *in situ*, 11m water depth and 28m from W shore, at bottom of Canzolino Lake, ca 3km NW Pergine Valsugana, prov Trento, Trentino (46° 05′ 00″ N, 11° 13′ 33″ E) at +540m. Lake 240 in "Catasto laghi del trentino" (Tomasi, 1962). Coll 1972 by M Cont, Pioneer Sub Gruppo Ricerche, Trento, and subm 1972 by M Bagolini and G Tomasi. *Comment*: several large trunks *in situ* belonging to submerged forest were found in W area of lake where a large landslide, identifiable by blocks up to 3m in size, may have caused a sudden recent rise of water level. ^{14}C date explains present size of pre-existent basin. Area: 6.2 ha, max water depth: 15m (Tomasi, 1962, 1963, 1974). Corrected ^{14}C date (Ralph, Michael, & Ham, 1973) from AD 1430 to 1520-1610.

R-1024α. Lago di Cei **670 ± 50** **AD 1280**

$\delta^{13}C = -27.8‰$

Lightly darkened wood (*Fagus silvatica L*) from large trunk *in situ*, ca 7m water depth and 50m from N shore, in Cei Lake, ca 7km N Rovereto, prov Trento, Trentino (45° 57′ 00″ N, 11° 01′ 08″ E) at +912m. Lake 185 in "Catasto laghi del Trentino" (Tomasi, 1962). Coll 1972 by M Cont and subm 1972 by M Bagolini and G Tomasi. *Comment*: some large trunks *in situ* were discovered in N deepest zone of lake, 5 to 7m water depth, belonging to forest covering valley bottom before a landslide formed little barrier-lake. Area: 3.9ha, max water depth: 10m (Tomasi, 1962, 1963, 1974). Single ^{14}C age roughly dates event.

R-1025α. Lago di Lavarone

2160 ± 50
210 BC
$\delta^{13}C = -26.6‰$

Deeply darkened wood (*Fagus silvatica* L) from trunk *in situ*, 12.5 water depth and 70m from S shore, at bottom of Lavarone Karst Lake, prov Trento, Trentino (45° 56′ 10″ N, 11° 15′ 08″ E) at +1114m. Lake 244 in "Catasto laghi del Trentino" (Tomasi, 1962). Coll by M Cont 1972 and subm 1972 by B Bagolini and G Tomasi. *Comment*: ca 15 large trunks *in situ* of submerged forest were mapped from 3 to 17m water depth on bottom of Lavarone Lake. Area: 5.4ha, max water depth: 17m. Forest covered doline bottom, until soil impermeability formed present lacustrine basin (Tomasi, 1962, 1963, 1974). Single ^{14}C age roughly dates event.

Lago di Martignano series

1971-73 underwater explorations made by L Ferri-Ricchi and E Loret, Gruppo Archeol Subacqueo Lazio, uncovered many well preserved large trunks *in situ* of perimetral submerged forest, 8 to 13m water depth, in Martignano crater Lake, Sabatini Mts volcanic region, ca 2km E Bracciano Lake, prov Rome (42° 06′ 40″ N, 12° 18′ 18″ E; U T M 33-TTG-774659) at +207m, max water depth: ca 60m. Some trunks still in growth position protruded up to 5m from bottom, others, up to 10m height, were in subhorizontal position with roots still fixed in bottom sediments; several scattered trunks were in water as deep as 17m (Ferri-Ricchi, 1972). Wood coll and subm 1972-73 by L Ferri-Ricchi and V Fornaseri; id by M Follieri.

1600 ± 80
R-905α. Martignano 1 **AD 350**

Wood (*Quercus* sp, deciduous group) from trunk *in situ* ca 20m from W shore, water depth 12m.

1450 ± 80
R-906A. Martignano 2 **AD 500**

1440 ± 80
R-906. Martignano 2 **AD 510**

1420 ± 80
R-906α. Martignano 2 **AD 530**

Wood (*Quercus* sp, deciduous group) from trunk *in situ* ca 20m from W shore, water depth 11m. *Comment*: R-906A was given no pretreatment; R-906 only 5% HCl pretreatment, R-906α was given additional leaching with .2N NaOH: 3 dates agree.

1420 ± 80
R-907A. Martignano 3 **AD 530**

1280 ± 80
R-907. Martignano 3 **AD 670**

R-907α. Martignano 3 **1390 ± 80 AD 560**

Wood (*Quercus* sp, deciduous group) from trunk *in situ* ca 20m from W shore, water depth 13m. *Comment*: see R-906 *Comment* above.

R-979α. Martignano 4 **1370 ± 50 AD 580**

$\delta^{13}C = -23.6‰$

Wood (*Quercus* sp, deciduous group) from trunk *in situ* ca 20m from W shore, water depth 10m.

R-980. Martignano 5 **1440 ± 50 AD 510**

Wood (*Quercus* sp, deciduous group) from trunk *in situ* ca 20m from W shore, water depth 12m. *Comment*: test with .2N NaOH did not disclose humic acids.

General Comment: ^{14}C ages of submerged trunks, 3rd to 6th centuries AD, date ancient water level ca 20m below present, controlled by an artificial effluent built last century. Another inlet of Roman effluent, built by Emperor Augustus 2 BC to supply *Alseatinum* aqueduct, was found in 1973 on S side of crater wall, 8m above present lake level; this, along with geomorphologic, geoarchaeol, and historic data, suggests ^{14}C dated oscillation of lake >30m. Climatic change probably caused decrease in level, as for similar contemporaneous drops in lakes in Central Italy (Ferri-Ricchi, 1975a,b, oral commun). See also Lago di Mezzano series, *General Comment*, above.

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