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# UNIVERSITY OF ROME CARBON-14 DATES XVI

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This list includes dates measured from July 1975 to December 1976 with $CO_2$ proportional counters. All archaeologic and geologic samples except for Turkey and Sistan series come from Italian territory. Laboratory equipment, largely unchanged but expanded and technically improved, has been previously described (Alessio *et al*, 1970b, 1976).

Charcoal and wood samples received standard pretreatment by boiling with 5 to 10% HCl; $\alpha$-labeled samples were given additional leaching with .2N NaOH.

The activity of our modern standard, wood grown near Rome between 1949 and 1953, is checked repeatedly with 95% activity of NBS oxalic acid and measurements agree within $1\sigma$. For each sample of $CO_2$, except for two, the counting rate was corrected according to mass-spectrometrically measured $^{13}C/^{12}C$ ratio as described previously (Alessio *et al*, 1969). Dates are reported in conventional radiocarbon years, using the Libby half-life of 5568 ± 30 yr, with 1950 as the standard year of reference. When requested, MASCA corrected dates (Ralph *et al*, 1973) are reported.

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## SAMPLE DESCRIPTIONS

### I. ARCHAEOLOGIC AND HISTORIC SAMPLES

#### *A. Italy*

**Riparo di Romagnano III series**

In 1968-69 agric and quarry work uncovered some prehistoric settlements at Loc, Comm Romagnano, along right side of Adige Valley, on alluvial cone of Rio Bondone near its junction with Adige R, 10km S Trento, Trentino-Alto Adige. At top of Bondone cone (46° 00′ 26″ N, 11° 06′ 23″ E) at +210m, relict edge of Romagnano III shelter deposit was excavated 1970—Iron, Bronze and Neolithic levels, by R Perini, Mus Sci Nat, Trento (Perini, 1971), and 1971-73—Epipaleolithic levels, with Tardenoisian and Sauveterrian complexes, by G Bartolomei and A Broglio, Ist Geol, Paleont, & Paleont Umana, Univ Ferrara (Broglio,

1971, 1973a, 1976; Bartolomei *et al*, 1972). On debris bottom of deposit, average thickness ca 8m, Layers AF-AE of limestone rubble underlie, AD, Bondone alluvial sands and gravels with superimposed, AC, eaolian paleosol; upper Layers, AB, AA, T to A, until top, mainly crumbled limestone rubble and blocks. Epipaleolithic fauna complex confirms transition from scarcely forested mt environment to progressively woodier one with rise of broad-leaved tree forest and migration of periglacial fauna towards higher Alpine zones. Paletnol and paleont studies as well as pollen and sediment analyses are in progress. Charcoal from Layers I2 and T4 coll and subm 1970 by R Perini, and from Layers AA to AF coll and subm 1971-73 by G Bartolomei and A Broglio, id by M Follieri, Ist Bot, Univ Rome: *Pinus* sp dominant together with *Quercus* sp deciduous group.

*1970 excavations*

**R-767. Romagnano III 1, I2** **2600 ± 140**

$\delta^{13}C = -25.0‰$

Charcoal from Layer I2 in ash and carbonaceuos earth lens, probably hearth. Final Bronze age. Luco culture, recent phase apparently ending in 8th century BC. *Comment*: $^{14}C$ date agrees.

**R-768. Romagnano III 2** **3000 ± 50**

$\delta^{13}C = -25.0‰$

Charcoal from N landslide. Hearth and pottery of Final Bronze age, Luco culture ancient phase attributable to 11th and 10th centuries BC as coeval to Ha A of Reinecke (Frei, 1955; Perini, 1970). *Comment*: $^{14}C$ dates agrees.

**R-769. Romagnano III 3, P1** **3720 ± 50**

$\delta^{13}C = -24.9‰$

Charcoal from Layer P1, in No. 1 inhumation burial of Early Bronze necropolis. *Comment*: see R-770$\alpha$.

**R-770$\alpha$. Romagnano III 4-7, P2-3** **3630 ± 50**

$\delta^{13}C = -24.4‰$

Charcoal from Layer P2-3, in No. 4 and 5 inhumation burials of Early Bronze necropolis. *Comment*: necropolis, containing remains of 31 children and 9 adults mainly in inhumation burials, is attributed to Polada-A culture, local facies, synchronizable to Bz A1 of Reinecke (Perini, 1973, 1975). R-769 and -770 dates agree, being within chronologic range of above culture.

**R-775. Romagnano III 12, R4** **4810 ± 50**

$\delta^{13}C = -25.2‰$

Charcoal from Layer R4, inside hearth with scarce Upper Neolithic pottery. *Comment*: $^{14}C$ date agrees with Po plain Upper Neolithic; no comparisons available.

**R-776. Romagnano III 13-14, T1** **5560 ± 50**

$\delta^{13}C = -25.1‰$

Charcoal from Layer T1, near and inside hearth, Middle Neolithic, Square-mouthed pottery culture, middle phase. *Comment*: see R-779.

**R-777α. Romagnano III 15, T1** **5530 ± 50**

$\delta^{13}C = -25.5‰$

Charcoal from Layer T1, under R-776 hearth. *Comment*: see R-779α.

**R-779α. Romagnano III 17, T2** **5470 ± 50**

$\delta^{13}C = -26.0‰$

Charcoal from Layer T2, Middle Neolithic, at Hearth I level with Square-mouthed pottery culture, middle phase. *Comment*: R-776, -777α, and -779α ages acceptable for Square-mouthed pots, middle phase, also in comparison to numerous available $^{14}C$ dates of Fimon-Molino Casarotto settlement, 1st half 4th millennium BC, belonging to late ancient phase of same culture (R, 1974, v 16, p 358-361) (Bagolini *et al*, 1973). Comparable dates for other sites: Grotta Aisone, R-95 (R, 1965, v 7, p 213); Arene Candide, P-27 (Tongiorgi *et al*, 1959) and R-103 (R, 1966, v 8, p 402); Rivoli "spiazzo", middle phase, Birm-103 (R, 1970, v 12, p 396).

**R-781. Romagnano III 19-20, T4** **5810 ± 50**

$\delta^{13}C = -25.7‰$

**R-781α. Romagnano III 19-20, T4** **6060 ± 50**

Charcoal from Layer T4, Cut 1 under Hearth I and Cut 2 on floor remains. Industry of Tardenoisian local tradition assoc with Lower Neolithic impressed pottery, some of Fiorano type (Bagolini, 1971; Bagolini and Biagi, 1975). *Comment*: R-781α date agrees, see also R-1136.

*1971-1973 excavations*

**R-1136. Romagnano III AA1-2** **6480 ± 50**

$\delta^{13}C = -26.9‰$

Charcoal from Layer AA1-2. Coll 1971. Industry of Tardenoisian local tradition assoc with Lower Neolithic impressed pottery as in Layer T4, see R-781α above. *Comment*: R-1136 date confirms supposed age of pottery appearing in Po plain and Adige valley.

**R-1137. Romagnano III AB1-2** **7850 ± 60**

$\delta^{13}C = -27.2‰$

Charcoal from Layer AB1-2. Coll 1972. Epipaleolithic: Tardenoisian industry similar to "Castelnovian" characterized by trapezes, rhomboids, and denticulate scrapers on blade. *Comment*: see R-1138.

**R-1138. Romagnano III AB3** **8140 ± 80**

$\delta^{13}C = -25.4‰$

Charcoal from Layer AB3. Coll 1971-73. Final Sauveterrian, or Epi-sauveterrian phase industry with trapezes and assoc elements belonging

to both overlying Tardenoisian and underlying Sauveterrian recent phase industries. *Comment*: R-1137 and -1138 dates too old in comparison with available ones for S France similar sequence in which Tardenoisian elements appear 1st half of 7th millennium BC, see: Rouffignac, GrN-2289 (R, 1972, v 14, p 58); Chateauneuf, Ly-438, and La Baume de Montclus, Ly-542 (R, 1973, v 15, p 526-527); and with Vatte di Zambana series, Adige valley (R, 1969, v 11, p 483-484) where Tardenoisian elements appear ca 2nd half same millennium. Wrong sampling may be inferred; R-1137 and -1138 partly coll from deposit zone where layer id was very difficult.

**R-1139. Romagnano III AC1** **8220 ± 80**
$\delta^{13}C = -26.7‰$

**R-1140. Romagnano III AC2** **8560 ± 70**
$\delta^{13}C = -26.3‰$

**R-1141. Romagnano III AC3** **8590 ± 90**
$\delta^{13}C = -25.6‰$

Charcoal from Layer AC1-3, Sauveterrian industry complex, recent phase, mainly characterized by bilaterally-backed and oblique-truncated both bladelets and short points, latter "triangles de Montclus".

**R-1142. Romagnano III AC4** **8740 ± 90**
$\delta^{13}C = -26.0‰$

**R-1143α. Romagnano III AC5-6** **9090 ± 90**
$\delta^{13}C = -25.7‰$

**R-1144α. Romagnano III AC7** **9100 ± 90**
$\delta^{13}C = -25.6‰$

**R-1145. Romagnano III AC8-9** **9200 ± 60**
$\delta^{13}C = -26.1‰$

**R-1145α. Romagnano III AC8-9** **9200 ± 60**
$\delta^{13}C = -25.9‰$

Charcoal from Layer AC4-9. Sauveterrian industry complex, middle phase, mainly characterized by small double-side-backed elongated points voluntary broken at base, small elongated backed points normally truncated, crescents, trapezoidal segments, and triangles.

**R-1146Aα. Romagnano III AE1-4** **9580 ± 250**
$\delta^{13}C = -25.5‰$

**R-1146α. Romagnano III AE1-5** **9420 ± 60**
$\delta^{13}C = -25.6‰$

**R-1146B. Romagnano III AE** **9490 ± 80**
$\delta^{13}C = -26.6‰$

**R-1147. Romagnano III AF** **9830 ± 90**

$\delta^{13}C = -27.9‰$

Charcoal from Layers AE1-5 and AF, Sauveterrian industry complex, ancient phase, mainly characterized by double-side-backed and double-truncated bladelets, small backed and normally truncated short points, nearly isosceles triangles trilaterally retouched, crescents, trapezoidal segments, and short triangles.

*General Comment on Sauveterrian complexes*: R-1139 to -1141 dates from 8600 to 8200 BP confirm assumption (Broglio, 1973b) that Sauveterrian industry complex, recent phase, is older at Romagnano III than at Vatte di Zambana (R, 1969, v 11, p 482-484). Therefore, on the whole, Val d'Adige Sauveterrian, recent phase, ca 6000 BC, agrees with S France complexes, see: Rouffignac 4a, GrN-2913 (R, 1972, v 14, p 59); Montclus 21F and 22, Ly-305 to 308 (R, 1971, v 13, p 62); Gramari C3A and C3B, Gif-752, 753 (R, 1971, v 13, p 219); Salzet, Gif-443 (R, 1970, v 12, p 423). R-1142-1145 ages, from ca 9260 to 8700 BP, *ie*, ca 7000 BC, refer to Sauveterrian complex, middle phase. R-1146 and -1147 ages, from ca 9900 to 9400 BP, place ancient phase of same complex in 1st half of 8th millennium BC, oldest dates so far available for Sauveterrian industries. Comparison with S France Sauveterrian same phase: Rouffignac 4b, 4e, 5a, and 5b, GrN-2895, 2880, 5513 and 5514, respectively (R, 1972, v 14, p 59); Fieux, Gif-1807 (R, 1974, v 16, p 26); Gramari C4, Gif-754 (R, 1971, v 13, p 219); Culoz E, Ly-286 (R, 1971, v 13, p 58).

**Riparo di Pradestel series**

In 1973 prehistoric deposit under small shelter, covered with large debris cone, was found by quarry work at Ischia Podetti, right side of Adige Valley, 6km N Trento, Trentino-Alto Adige (46° 07′ 07″ N, 11° 04′ 55″ E) at +225m. Excavations in deposit of detrital material, 15m above quarry plain, made in 1975 by G Bartolomei, A Broglio, and B Bagolini, latter of Mus Tridentino Sci Nat, Trento (Ist It P P, 1976), revealed Epipaleolithic or Mesolithic industries of Adige Valley sequence: Upper Layers A and B, Tardenoisian industry with trapezes together with pottery; C to E1, Tardenoisian industry complexes; E3-4 to M, Sauveterrian industries. Charcoal from Layers D, H, and L coll 1975 and subm 1976 by G Bartolomei, A Broglio, and B Bagolini.

**R-1148. Pradestel D1-3** **6870 ± 50**

$\delta^{13}C = -26.5‰$

Charcoal from Layer D1-3, Tardenoisian industry characterized by trapezes, rhomboids, and denticulate scrapers on blade.

**R-1149. Pradestel H-H2** **8200 ± 50**

$\delta^{13}C = -25.4‰$

Charcoal from Layer H-1-2, Sauveterrian industry.

**R-1150. Pradestel L1** **8240 ± 200**

Charcoal from Layer L1, Sauveterrian industry.

**R-1151. Pradestel L-7-8** **9320 ± 50**

$\delta^{13}C = -26.3‰$

Charcoal from Layer L7-7ab-8, Sauveterrian industry.

*General Comment*: R-1148 age agrees with middle level of Tardenoisian complex and suggests comparison with "Covoloni del Broion" R-892 date, see below; also agrees with dates available for "Castelnovian", the most similar Tardenoisian complex of Mediterranean France for > a millennium ca 5000 BC, see: Chateauneuf 7 and 8, Ly-447, 624, 448, and 438; Montclus, 8, 14, and 16, Ly-494, 495, 496, and 542 (R, 1973, v 15, p 526-527). Other similar dates for S France Tardenoisian industries: Rouffignac 3 and 2, GrN-2289 and 5512 (R, 1972, v 14, p 58-59). Range of R-1149-1151 dates, from ca 9370 to 8250 BP, is large for Pradestel Sauveterrian and could result longer after dating E3-4 and M Layers. At present, Pradestel dates fall inside Sauveterrian Romagnano III series; see above also for comparison with ages of S France Sauveterrian.

**R-892. Grottina dei Covoloni del Broion** **6930 ± 60**

$\delta^{13}C = -26.0‰$

"Grottina dei Covoloni del Broion" is small niche in rear of Covoloni shelter in limestone wall of Broion, Berici Mts, at La Vallà, Lumignano, Comm Longare, prov Vicenza, Veneto (45° 27′ 58″ N, 11° 35′ 22″ E) at ca +120m. In 1973-74 and 1976 Fondazione Ligabue, Venice, with Ist Geol, Paleont & Paleont Umana, Univ Ferrara, carried out excavations (Ligabue, 1973) in deposit formed by cyclic stalagmitic levels overlying clastic and aeolian-colluvial sediments, with limestone rubble at base. Cultural horizons revealed in upper Layers 3-4, Eneolithic or Bronze age with numerous human skeleton remains; Layer 6, Tardenoisian industry complex with trapezes, part of Epipaleolithic sequence; 7 to 7c, very scarce Sauveterrian industries attributable to Final Upper Paleolithic. Industry and pollen analyses as well as paleont and paleoanthropol studies in progress (Cattani, 1977). Charcoal from Layer 6, Sqs 2-5, 12-13, coll 1974 and subm 1976 by A Guerreschi, Ist Geol, Paleont & Paleont Umana, Univ Ferrara. *Comment*: R-892 date agrees, suggests intermediate age of trapeze Epipaleolithic industries, and is strictly comparable to R-1148 of Pradestel shelter, above.

**Grotta Benussi series**

From 1965 to 1972 Comm Grotte "E Boegan", Soc Alpina Giulie, Sez CAI Trieste, excavated Benussi cave deposit, on W slope of Sedlen Mt, a Cenomanian limestone hill NNW S Pelagio village, Comm Duino-Aurisina, prov Trieste, Venezia Giulia (45° 46′ 36″ N, 13° 41′ 34″ E) at ca +250m. Cave No. 4163 VG in "Catasto Grotte della Venezia Giulia". Deposit, average thickness ca 2m, contains Epipaleolithic levels with Sauveterrian and Tardenoisian industries, scarce Neolithic remains, Final Bronze and Middle Ages horizons (Andreolotti and Gerdol, 1973). Epipaleolithic fauna, Cuts 3 to 6, comprises large mammals, food refuse; bird, fish and marine mollusk shell remains also present (Riedel, 1976).

Charcoal and charred bones from Epipaleolithic levels coll 1972 and subm 1973 by S Andreolotti and R Gerdol, Comm Grotte "E Boegan".

**R-1043. Benussi 3** **7050 ± 60**

$\delta^{13}C = -25.0‰$

Charcoal from Cut 3, 15cm thick. Epipaleolithic, Tardenoisian phase with prevailing trapezes and rhomboids, almost absent bilaterally backed tools.

**R-1042. Benussi 3-4** **7230 ± 140**

$\delta^{13}C = -23.9‰$

Charred animal bones from Cuts 3-4.

**R-1044. Benussi 4** **7620 ± 150**

$\delta^{13}C = -24.3‰$

Charcoal from Cut 4, 15cm thick. Epipaleolithic, final Sauveterrian or Episauveterrian phase with trapezes.

**R-1045. Benussi 5** **8380 ± 60**

$\delta^{13}C = -24.1‰$

Charcoal from Cut 5, 15cm thick. Epipaleolithic, final-recent Sauveterrian phase as in Cut 6.

**R-1045A. Benussi 5-6** **8650 ± 70**

$\delta^{13}C = -24.0‰$

Charred bones and charcoal from Cuts 5-6. Epipaleolithic, final-recent Sauveterrian phase with hypermicrolithic and microlithic bilaterally or unilaterally retouched points along with truncated-and-backed bladelets, points, and scarce trapezes (Broglio, 1971).

*General Comment*: R-1043, Tardenoisian horizon, and R-1044, Episauveterrian complex, dates substantially agree with available ones for S France settlements and Vatte di Zambana, Adige Valley; *cf* R-1138, Romagnano III, above. R-1145 and -1145A dates approx for recent Sauveterrian phase at Romagnano III and S France, though in latter, trapezes are absent; *cf* R-1139-1141, Romagnano III *General Comment*, above.

**Grotta dei Ciclami series**

From 1959 to 1964 and in 1972 Comm Grotte "E Boegan, Soc Alpina Giulie, CAI Trieste, excavated Ciclami cave deposit, on S slope of Orsano Mt, 1km E Comm Monrupino, prov Trieste, Venezia Giulia (45° 42′ 24″ N, 13° 49′ 08″ E) at +324m. Cave No. 2433 VG in "Catasto Grotte della Venezia Giulia" (Legnani & Stradi, 1963; Legnani, 1967). First excavations 1925 by R Battaglia (1927, 1958-59). Deposit, ca 4m thick, reveals Epipaleolithic, Neolithic, Eneolithic Bronze and Iron age cultural Horizons. Fauna remains show large wild mammals in Epipaleolithic levels and domestic ones prevailing from Neolithic level upwards (Riedel, 1968). Charcoal from Cuts 4, 6, and 9 coll 1962 by F Stradi and F Legnani, Comm Grotte "E Boegan", and from Cut 8b coll 1972 and subm 1973 by S Andreolotti and R Gerdol.

**R-1037. Ciclami 4** **4160 ± 50**

$\delta^{13}C = -24.7‰$

Charcoal from Cut 4, 50cm thick. Early Bronze, decorated pottery of Ljubljana style. *Comment*: date only comparable with Layer 5 of Mitreo cave, Ljubljana culture, ca 300 yr younger.

**R-1038. Ciclami 6** **6290 ± 130**

$\delta^{13}C = -24.5‰$

Charcoal from Cut 6, 50cm thick. Upper Neolithic, scarce pottery of Brijuni-Skocian type (Barfield, 1971). *Comment*: date too old, if compared with available ones for Square-mouthed pot culture in N Italy at least partly coeval. See Romagnano III R-779$\alpha$, above.

**R-1040$\alpha$. Ciclami 8b** **6300 ± 60**

$\delta^{13}C = -25.0‰$

Charcoal from Cut 8b, 10cm thick. Middle Neolithic, Vlasca type pottery (Barfield, 1971). *Comment*: date comparable with available ones for Fiorano culture type pottery in N and Central Italy believed approx coeval. See Ripabianca di Monterado, R-598$\alpha$ and -599$\alpha$ (R, 1970, v 12, p 602-603) and Grotta dell'Orso di Sarteano, R-676 (R, 1973, v 15, p 168).

**R-1041$\alpha$. Ciclami 9** **8260 ± 60**

$\delta^{13}C = -24.4‰$

Charcoal from Cut 9, 30cm thick. Epipaleolithic with scarce and hardly significant trapezeless industry. *Comment*: date acceptable, similar to available ones for Sauveterrian industry, recent phase, at Romagnano III and at Grotta Benussi, see above, R-1139-1141, and R-1045, 1045A, respectively.

**Grotta del Mitreo series**

In 1965 excavations made by Soc Alpina Giulie (Andreolotti *et al*, 1966) uncovered remains of Mithra's temple in late Roman epoch upper layer of Mitreo cave deposit, ca 0.5km SE S Giovanni al Timavo, Comm Duino-Aurisina, prov Trieste, Venezia Giulia (45° 47′ 00″ N, 13° 31′ 20″ E) at ca +50m. Cave No. 4204 VG in "Catasto speleologico della Venezia Giulia" (Marini, 1965). In 1971-72 Centro Antichità Adriatiche, Head, G Stacul, dug trench, 5 × 3m wide, in W side. Through sec, over 4m deep, 8 stratigraphic layers with 4 main cultural horizons were id (Stacul, 1971-72, 1973, 1976). Charcoal from Layers 4, 5, and 8 coll 1971 and subm 1972 by G Stacul.

**R-902. Mitreo 4** **3820 ± 50**

$\delta^{13}C = -28.1‰$

Charcoal from basal level of Layer 4, ca 1m thick. *Comment*: all levels of Layer 4 contain similar industries. Upper levels yielded vases comparable to frequent ones in lowest cultural horizon of Castelliere Marchesetti deposit near Slivia, Trieste, dated 3430 ± 50 (R, 1973, v 15, p 166) (Stacul, 1972).

**R-903α. Mitreo 5** **3720 ± 50**

$\delta^{13}C = -24.7‰$

Charcoal from Layer 5, ca 70cm thick, with decorated pottery of Ljubljana style, Ig II phase, between Eneolithic and Bronze age (P Korošec and J Korošec, 1969).

**R-904. Mitreo 8** **5770 ± 60**

$\delta^{13}C = -25.8‰$

**R-904α. Mitreo 8** **5770 ± 50**

$\delta^{13}C = -26.1‰$

Charcoal from lowest cultural Layer 8, average thickness 80cm, and partly overlying rocky soil. Pottery infilled with red paste of Danilo culture style (J Korošec, 1959, 1964).

*General Comment*: previous archaeol excavations in other caves of Trieste Karst revealed same industry series as Mitreo cave (Radmilli, 1974). R-902 and -903α dates generally agree with expected ones for Ig II phase, Ljubljana culture, judged coeval to final Remedello and early Polada cultures (Korošec & Korošec, 1969), with influences of bell-beaker pottery style (Korošec, 1967) and typologic affinities with Dalmatia Hvar culture (Novak, 1955). Also R-904α date seems to agree with Danilo culture dated by comparison with others, 5300 to 4000 BC (Thomas, 1967; Alexander, 1972; Gimbutas, 1970, 1974). MASCA corrected dates can be used for this cultural comparison.

**R-886α. Duomo di Monza** **460 ± 50**

$\delta^{13}C = -27.3‰$

Slightly damaged and worm-eaten wood fragment found 1941 inside marble sarcophagus of Queen Theodolinda, now behind small neogothic altar in left apsis Teodolinda chapel, cathedral of Monza, prov Milan, Lombardy (Merati, 1962). Wood, in cathedral store since 1941, subm 1975 by A Merati and L Pozzo, Monza. *Comment*: sample carefully chosen, portion pulverized by worms was discarded. In January 1941 all founds in sarcophagus were recovered including objects of Longobard style and impaired wood fragments possibly from 2 coffins into which mortal remains of Queen Theodolinda, presumably dead AD 628, and her husband King Agilulph, formerly interred, were transferred AD 1308 to be put into marble sarcophagus, according to necrological calendar of Monza cathedral (Frisi, 1794; Merati, 1975). R-886α $^{14}C$ age and MASCA corrected date, AD 390 to 440, slightly later.

**R-1105. Buca dei Ladri** **>28,000**

Collagen of animal bones from bone breccia sticking to vault of bottom chamber of Ladri cavity, an interstratum cave, ca 130m deep to bottom lake, downhill ca 34m below entrance, on limestone S slope of Pisano Mt near Agnano, Comm S Giuliano Terme, prov Pisa, Tuscany (43° 44′ 15″ N, 10° 28′ 30″ E) at +40m. Coll 1973 by G P Pianucci and

subm 1975 by A M Radmilli, Ist Antropol & Paleont Umana, Univ Pisa. Cave bottom partly covered with debris cone overlying crumbled limestone blocks with bones from breccia comprising *Cervus* prevailing over *Bos, Equus, Lepus Vulpes,* and *Martes martes,* latter confirming cold climate phase, and bird remains; 4 implements attributable to Upper Paleolithic industry also found. *Comment*: $^{14}C$ date a) refutes inferred correlation between bone breccia and industry; b) gives minimum age only for bone breccia and, thus, for similar ones of Pisano Mt; c) refutes correlation with basal deposit in nearby Leone cave containing Epipaleolithic industry. If bone breccias of Pisano Mt are coeval, they might belong to an old Würmian phase.

**R-878. Fossacesia 1, B-IV, 9-10** **5430 ± 120**

$\delta^{13}C = -25.8‰$

Charcoal and carbonaceous earth from Hut 1, Sec B, Sq IV, Cuts 9-10, of Neolithic village of Fossacesia near Chieti, Abruzzo (42° 12′ 20″ N, 14° 29′ 18″ E). Coll 1971 by G Cremonesi, Ist Paletnol, Univ Lecce, and subm 1971 by A M Radmilli. Sample from brown clay level mottled by ashes and charcoal and containing scarce potsherds. *Comment*: archaeol materials in Hut 1, various cuts, belong to final phase of Ripoli culture showing some influences of Diana culture, a handle of Serra d'Alto type also present (Cremonesi, 1973). $^{14}C$ date agrees with age of Sec B, Cut 1 of same Hut, Fi-30, 5420 ± 210 (R, 1973, v 15, p 484), both believed too old for final phase of Ripoli culture and its relations with others. Available dates for Ripoli culture at Ripoli village: R-665 and -664 (R, 1971, v 13, p 397); Fi-31 (R, 1973, v 15, p 848); Pi (unpub), 5100 ± 120 (Cremonesi, 1965). Besides, Grotta dei Piccioni, Ripoli horizon, with Lagozza and Diana types, Pi-49 (R, 1961, v 3, p 100-101 (Cremonesi, 1976).

**Taurisano series**

In 1964 construction uncovered prehistoric settlement underlying ground of surrounding plain at Pietra L'aia, ca 0.5km NW Comm Taurisano, prov Lecce, Apulia (39° 57′ 34″ N, 18° 12′ 31″ E), originally probably shelter deposit in marine calcareous tufa "carparo" local formation, which crumbled afterwards. Excavations 1964 made by late L Cardini and P Cassoli, Ist It Paleont Umana, Roma, for Sopr Antichità Puglie, Taranto (Cardini & Biddittu, 1967). Trench, 9m² wide and ca 4.2m deep, revealed under vegetal soil and terra rossa reworked layer, ca 1.5m thick, archaeol deposit, average thickness ca 2.7m: Cuts, 10cm thick, 1 to 23, "terra bruna" mixed with carparo fragments containing Epigravettian industry and abundant animal charred bones and teeths, some uncharred, mainly *Equus caballus, Equus hydruntinus, Bos,* and *Cervus*; Cuts 24 to 27, mainly carparo blocks with little reddish earth, Epigravettian industry and scarce charred bone remains belonging to same fauna as Cuts 1-23, in any case insufficient for dating. Bones and charred bones from

Cuts 4 to 22 coll 1964 by P Cassoli and subm 1973 by A Bietti, Ist It Paleont Umana.

**R-1061. Taurisano Tl 4-5** **15,500 ± 150**

$\delta^{13}C = -21.7‰$

Charred animal bones and small amount of collagen of uncharred bones from Cuts 4 and 5.

**R-1062. Taurisano Tl 6-9** **16,050 ± 160**

$\delta^{13}C = -21.7‰$

Charred animal bones and small amount of collagen of uncharred bones from Cuts 6 to 9.

**R-1063. Taurisano Tl 10-12** **15,600 ± 120**

$\delta^{13}C = -22.5‰$

Charred animal bones and small amount of collagen of uncharred bones from Cuts 10 to 12.

**R-1064. Taurisano Tl 18-22** **16,000 ± 150**

$\delta^{13}C = -23.0‰$

Charred animal bones and small amount of collagen of uncharred bones from Cuts 18 to 22.

*General Comment*: charcoal from charred bones was extracted by boiling with 15% HCl and collagen from uncharred bones by method already described (Alessio *et al*, 1976). In 1964 G Laplace analyzed Taurisano Epigravettian industry attributing Cuts 1 to 5 to Final Epigravettian and 6 to 23 to Ancient Epigravettian, owing to presence of "à cran" tools (Laplace, 1964, 1966). $^{14}C$ dates seem to disagree with Laplace analysis, showing no hiatus or discontinuity as suggested by above interpretation. Taurisano industry is being studied by A Bietti—a sharp typologic discontinuity seems to exist only between Cuts 1-23 and 24-27 complexes. Latter not dated for lack of bone remains.

A significant comparison exists with Layer 3 of Cipolliane caves C shelter for both industry of Evolute Epigravettian facies, similar to Taurisano ones, and $^{14}C$ dates: R-353, 15,000 ± 100, R-355, 15,250 ± 300, and R-356, 15,200 ± 100 (R, 1976, v 18, p 232-233) (Gambassini, 1970).

**R-1152. Grotta dei Giganti 5-6, 9-10** **>39,000**

$\delta^{13}C = -26.3‰$

Charred animal bones from Cuts 5-6, lower Hearth F4, and 9-10, basal Hearth F5, in deposit of Giganti cave in limestone cliff along Ionian coast rd, ca 2km from lighthouse W Capo S Maria di Leuca, prov Lecce, Apulia (39° 47′ 23″ N, 18° 20′ 23″ E) (Blanc, 1959; De Lorentiis, 1959). Excavations made 1974-75 by E Segre, P Cassoli and M Piperno, Ist It Paleont Umana, Rome, revealed from surface 5 superimposed Hearths F1-F5 with interbedded terra rossa levels. Industry, fauna, and stratigraphic data confirm rather late facies of Mousterian in

Salento. Sample coll and subm 1975 by M Piperno. *Comment*: $^{14}C$ minimum age somewhat older than expected if compared with available dates for Upper and Final Mousterian in Broion cave, Veneto, Italy (Leonardi and Broglio, 1966; R, 1967, v 9, p 117) and at La Quina, France, GrN-2526 (R, 1963, v 5, p 165) and GrN-4494 and -4449 (R, 1967, v 9, p 111-112). See also, Haua Fteah, Libya, Debba culture, GrN-2550 (R, 1963, v 5, p 171) and GrN-1486 (R, 1967, v 9, p 120).

*B. Sicily*

**Chiesa della Martorana, Palermo series**

Wood taken 1972 from "cupola" and "Telaio di Ruggero" in S Maria dell'Ammiraglio or della Martorana church, Palermo, by R Calandra, Ist Storia Architettura, Univ Palermo, on behalf of B Lavagnini, Ist Siciliano Studi Bizantini e Neoellenici, Palermo, and subm through M Marabini, Ist Centrale Restauro, Rome. Dates essential for architectural and mosaic studies being done by E Kitzinger, Harvard Univ.

**R-959. La Martorana 2, Telaio Ruggero** **190 ± 50**

$\delta^{13}C = -25.7‰$

Well-preserved wood from "Telaio di Ruggero", ie, wooden frame fixed to mosaic representing King Roger II crowned by Christ. *Comment*: MASCA corrected date, AD 1630 to 1670-1770, slightly younger than expected as frame was used for mosaic displacement possibly connected with lengthening of former square church attributable to late 16th century.

**R-960. La Martorana 1, Cupola** **720 ± 100**

$\delta^{13}C = -26.6‰$

Impaired and strongly worm-eaten reddish wood fragment with a few plaster bits adhering from wooden frame at dome base. *Comment*: sample carefully chosen: outer surface removed and portion pulverized by worms discarded as much as possible. $^{14}C$-conventional and MASCA-corrected date, 1130-1160 to 1325 AD, suggest frame coeval to church construction, AD 1143, by Georges of Antioch, Admiral of Roger II, as expected (B Lavagnino, written commun).

*C. Sardinia*

**Grotta di Sa 'Ucca de su Tintirriòlu series**

Charcoal from archaeol layers of deposit of Sa 'Ucca de su Tintirriòlu, karst cave 310m long, in Bonu Ighinu region, Comm Mara, prov Sassari (40° 27′ 13″ N, 8° 39′ 06″ E; 32TMK 707784) at +400m. Coll 1971 by R Loria, Sopr Antichità, Sassari and D H Trump, Univ Cambridge; subm 1971 by E Contu, Sopr Antichità, Sassari. Deposit revealed pottery of Roman epoch, Bronze age, Monteclaro culture, Eneolithic, S Michele culture, and Bonu Ighinu, newly attributed to Late Neolithic (Contu, 1970, 1971). Several vases of S Michele style with engravings of schematic woman figures, very rare for Sardinia Eneolithic, were found

(Loria, 1971; Loria and Trump, 1978). Human skeletons, animal bone remains and fresh-water and marine mollusk shells, food refuse, also present.

**R-882. Sa 'Ucca de su Tintirriòlu 1** **5680 ± 160**

$\delta^{13}C = -23.3‰$

Charcoal, Sample 1, Layer 4, Trench C, at 80cm depth below cave soil. Pottery attributed to Late Neolithic, Bonu Ighinu culture first id in site. *Comment*: R-882 date, so far the only available one for above culture, acceptable, as it is likely to bridge gap between impressed pottery, presumably of 5th millennium BC, and S Michele culture at end of 4th century BC; one can argue on typological grounds for continuity of the 3 cultures, and so far S Michele being indigenous, can not have been intrusive from Aegean (D H Trump, written commun; Loria and Trump, 1978).

**R-879. Sa 'Ucca de su Tintirriòlu 9** **4850 ± 50**

$\delta^{13}C = -24.0‰$

Charcoal, Sample 9, Layer 4, Trench F, at 35 to 40cm depth below cave soil and 35m from its entrance. Pottery of Bonu Ighinu culture. *Comment*: sample, assoc with abundant B I pottery, displaced, as $^{14}C$ date agrees with S Michele culture also represented in level only by several sherds believed accidentally introduced from above (D H Trump, written commun). See also R-884$\alpha$ above.

**R-883$\alpha$. Sa 'Ucca de su Tintirriòlu 2** **4930 ± 50**

$\delta^{13}C = -25.8‰$

Charcoal, Sample 2, Layer 4, Trench G, at 55 to 60cm depth below cave soil and 20m from its entrance. Eneolithic, pottery of S Michele culture. *Comment*: see R-884$\alpha$ below.

**R-884$\alpha$. Sa 'Ucca de su Tintirriòlu 8** **5090 ± 50**

$\delta^{13}C = -24.4‰$

Charcoal, Sample 8, Layer 5, Trench G, at 55 to 65cm depth below cave soil. Eneolithic, pottery of S Michele culture. *Comment*: R-879, -883$\alpha$ and -884$\alpha$ for S Michele culture remarkably consistent with each other and with available samples from same culture at Grotta del Guano, Oliena, see R-609-609$\alpha$ (R, 1971, v 13, p 399). According to D H Trump (written commun), start of S Michele culture by 3000 BC contradicts current beliefs, which will have to be readjusted.

**R-885. Sa 'Ucca de su Tintirriòlu 15** **1890 ± 50**

$\delta^{13}C = -24.8‰$

Charcoal, Sample 15, Layer 1-b, Trench C-8, at 8 to 10cm depth below cave soil. Bronze age, pottery of Monte Claro culture. *Comment*: sample assoc with above culture displaced; Monte Claro judged probably pure in level but this is uncertain because of difficulty in defining limits of animal disturbance; date probably refers R-885 to scarce Roman

sherds nearby (D H Trump, written commun). Monte Claro culture dated 1700 to 1800 BC at Acqua Calda cave, Cagliari, see R-677 (R, 1970, v 12, p 607).

*General Comment*: in conclusion, 3 further consistent dates are given for S Michele culture and 1st one for new Bonu Ighinu culture id in site.

**Su foxi 'e s'abba series**

In 1964 C Maxia, Ist Sci Antropol, Univ Cagliari, and his coworkers discovered Su foxi 'e s'abba cave at Lecorci, Comm Ulassai, Ogliastra, prov Nuoro (39° 48′ 50″ N, 9° 29′ 23″ E). Cave was id as votive place, probably an hypogean nuragic temple. In small cavity inside cave, votive pottery vases of nuragic type and 1 small wooden (*Quercus ilex*) vessel, the only one known for this time in Sardinia, were found. Charcoal from cave deposit and wood from small vessel coll and subm 1974 by C Maxia.

**R-1074$\alpha$. Su foxi 'e s'abba 1** **2910 ± 50**
$\delta^{13}C = -24.9‰$

Fairly well-preserved fragment sawed off bottom of small wooden vessel.

**R-1065. Su foxi 'e s'abba 2** **2650 ± 50**
$\delta^{13}C = -25.4‰$

**R-1065$\alpha$. Su foxi 'e s'abba 2** **2670 ± 50**
$\delta^{13}C = -26.1‰$

Charcoal from cave deposit.

*General Comment*: dates agree with presumed age of nuragic hypogean rites, 1st millennium BC but before Carthaginian invasion, 500 BC. Other nuragic hypogean temple, so called "Tempio ipogeo di Santadi" in ASI or Pirosu cave dated: R-492$\alpha$, 2680 ± 60 (R, 1970, v 12, p 606-607).

*D. Turkey*

**Porta bella di S Sofia, Istanbul, series**

Well-preserved wood (*Cedrus* sp), id by M Follieri, from back of wooden structure supporting bronze laminae of left shutter, 3.8m × 0.8m wide, S door of S Sophia, Istanbul, also called "clock door" or, according to old Byzantine sources, "porta bella" (beautiful door). Coll during restoration work and subm 1974 by L Vlad Borrelli, Ministero Beni Culturali e Ambientali, Rome.

**R-1070. Porta bella 14** **1890 ± 50**
$\delta^{13}C = -23.9‰$

**R-1070A. Porta bella 14** **1950 ± 50**
$\delta^{13}C = -22.5‰$

Wood fragments, Sample 14, from vertical frame supporting bronze lamina belonging to 1st oldest constructive phase. *Comment*: R-1070 pre-

treated with 5% HCl. MASCA corrected date, AD 50 to 110-130; R-1070A was given no pretreatment. MASCA corrected date AD 10 to 70.

**R-1071. Porta bella 15** **1900 ± 50**
$\delta^{13}C = -21.6‰$

**R-1071A. Porta bella 15** **1860 ± 50**
$\delta^{13}C = -22.5‰$

Wood fragments, Sample 15, from horizontal frame expected to belong to a 2nd newer constructive phase. *Comment*: R-1071 pretreated with 5% HCl; MASCA corrected date, AD 50 to 110-113. R-1071A was given no pretreatment; MASCA corrected date, AD 70 to 160. Unexpectedly, age and wood type resemble those of R-1070: 2 assumptions are possible, a) old wood of 1st construction phase was re-used; b) also R-1071 structure belongs to above phase; at any rate Sample 15 requires technical revision.

*General Comment*: according to scholars elements of at least 3 epochs form structures of 2 shutters of "porta bella": a) central oldest part of cedar wood covered with bronze laminae with cast frames, possibly of Hellenistic or, more probably, Roman age, or even from Constantinian Basilica, 2nd half 4th century AD; b) other cast bronze elements, same style as oldest ones, on wooden support, added during Justinian reconstruction; c) later interventions, 9th century AD, confirmed by imperial monograms and engraved dates. $^{14}C$ dates set oldest door construction between 1st and 2nd century AD, fairly consistent with decoration style attributable to mid-2nd century AD. Re-use of old wood might be inferred from unlikely door pertaining to Costantinian Basilica. Many ancient monuments were known to be despoiled to construct St Sophia (L Vlad Borrelli, written commun). For available dates for St Sophia see, SI-778-782 (R, 1973, v 15, p 399).

## *E. Iran*

### Shahr-i-Sokhta series

From 1967 to 1976 Italian Archaeol Mission of IsMEO in Iran, entrusted by G Tucci to M Tosi, excavated Shahr-i-Sokhta at Hilmand R ancient delta, Sistan, SE Iran near Afghan-Iranian border (30° 40′ N, 61° 25′ E) the largest, area ca 151ha, Chalcolithic—Bronze age proto-urban settlement of "Hilmand civilization" covering whole Indo-Iranian border, partly due to its favorable geog and ecol position. Its ruins form upper level, ca 7m thick, of tell, 12m above surrounding desert salt-clay plain and consist of superimposed bldg structures, mainly unbaked-clay brick walls; abundant charcoal, wood beams and collapsed wall bricks both burnt, suggest at least 2 destructive fires. Abundant pottery and other significant archaeol founds as well as animal bone remains indicate agric, cattle breeding, and trade mixed-economy of town

throughout 3rd millennium BC; since 2nd millennium shifting Hilmand delta depopulated S Sistan, making it a desert. So far Shahr-i-Sokhta general cultural sequence for entire mound, comprises IV to I main periods subdivided into 0 to 10 phases, each with well defined structures and cultural characteristics. Shahr-i-Sokhta sequence can be compared with Periods III and IV of Mundigak, 2nd main center of Hilmand civilization in E Afghanistan (Tosi, 1969,1971-1974; Lamberg-Karlovsky and Tosi, 1973; Biscione, 1974). Large graveyard, area 21.3ha, was discovered 1972 in SW tell sec and excavations made between 1972-1976 (Piperno and Tosi, 1975). Charcoal and charred wood from different cultural phases coll 1967-69 and subm 1968-69 and 1972 by M Tosi, IsMEO, id by L Costantini, Ist Bot, Univ Rome. Preliminary $H_2O$ boiling of samples detected abundant $Cl^-$ and $SO_4^{--}$, and a little $CO_3^{--}$, *ie,* soluble clorides, sulphates and carbonates; subsequent 5% HCl treatment revealed further $SO_4^{--}$, absent $Fe^{++}$ and $Fe^{+++}$ or traces. Samples for which .2N NaOH test did not disclose humic material were given no alkaline leaching.

*Period IV, 1969*

*A. Phase 0*

**R-901α. Shahr-i-Sokhta 83** **3540 ± 50**

$\delta^{13}C = -21.2‰$

Charcoal (*Populus, Tamarix, Haloxilon*) from Sec RWJ, Rm CXXI, Layer 2. In packed layer of sherds, salt crust. MASCA corrected date, 2110 to 1960 BC.

*B. Phase 1*

**R-898. Shahr-i-Sokhta 77** **3680 ± 50**

$\delta^{13}C = -27.0‰$

Charcoal (*Populus* sp) from Sec 1PF1, Rm CXXIII, staircase, Layer 3. Randomly coll in fill of loose mud-bricks following destruction of Phase 1 bldg. MASCA corrected date, 2170 to 2110 BC.

**R-900. Shahr-i-Sokhta 84** **3730 ± 50**

$\delta^{13}C = -25.7‰$

Charcoal (*Populus, Tamarix*) from Sec RWE, Rm CXX, Layer 4. Randomly coll in destruction layer of burnt bldg; brownish earth.

*Periods IV-III. Between Phases 1 and 3, 1969*

**R-899α. Shahr-i-Sokhta 73** **3800 ± 50**

$\delta^{13}C = -26.3‰$

Charcoal (*Tamarix* sp) from Sec 3PF4-2PFS, Rm CXXXIII, Layer 5. Coll on top of 1st floor occurring below structures of Phase 1 Burnt Bldg and destroyed by its foundation, brownish earth; uncertain attribution between Phases 1 and 3.

*Period II*

*A. Phase 5, 1968*

**R-637A. Shahr-i-Sokhta 16** **4000 ± 50**
$\delta^{13}C = -26.6‰$

Charcoal (*Tamarix*) from Sec XIG, Rms XXI, XXII, Cut 5. In fire-bowl of latest benched square-hearth. MASCA corrected date, 2630 to 2550 BC.

*B. Between Phases 5 and 6, 1967-1968*

**R-623. Shahr-i-Sokhta 2** **4050 ± 50**
$\delta^{13}C = -26.3‰$

Charcoal (*Populus* sp & *Tamarix* sp) from Sec RYL, Rm C, Cut 4. Coll 1968 inside fire-bowl of benched hearth.

**R-626. Shahr-i-Sokhta 9** **3890 ± 50**
$\delta^{13}C = -25.1‰$

Charcoal (*Tamarix*) from Sec RYL, Rm CIV, Cut 12. Coll 1968 inside fire-bowl of square-benched hearth. MASCA corrected date, 2560 to 2210 BC.

**R-628. Shahr-i-Sokhta 13** **4000 ± 50**
$\delta^{13}C = -26.0‰$

Charcoal (*Tamarix*) from Sec RYL, Rm CIV, Cut 15. Coll 1968 in small brick platform.

**R-627. Shahr-i-Sokhta 10** **4020 ± 50**
$\delta^{13}C = -23.9‰$

Charcoal (*Tamarix*) and uncharred wood (*Tamarix* sp) from Sec RYL, Rm CI, Cut 13. Coll 1968 inside hole in floor close to burned stone-cutter hoard.

**R-405α. Shahr-i-Sokhta II** **3960 ± 50**
$\delta^{13}C = -25.9‰$

Charcoal (*Populus, Tamarix*) from Sec XID, Cut 2. Coll 1967 in E residential zone.

**R-404α. Shahr-i-Sokhta I** **4100 ± 50**
$\delta^{13}C = -25.8‰$

Charcoal (*Populus, Tamarix*) from Sec XID, Cut 3 W. Coll 1967 in E residential zone.

*C. Phase 6, 1968*

**R-634α. Shahr-i-Sokhta 13bis** **3900 ± 50**
$\delta^{13}C = -26.1‰$

**R-634. Shahr-i-Sokhta 13bis** **4050 ± 50**

$\delta^{13}C = -25.8‰$

Charcoal (*Tamarix*) from Sec XIB, Rm XVIII, Cut 10. In side-slot of Kiln. R-634$\alpha$ MASCA corrected date, 2570 to 2340 BC.

**R-632. Shahr-i-Sokhta 23** **4100 ± 50**

$\delta^{13}C = -26.0‰$

Charcoal (*Tamarix*) from Sec XIG-H, Rm XX, Cut 15. Randomly coll above earliest floor of courtyard in House of stairs.

*D. Phase 7*

**R-641. Shahr-i-Sokhta 27** **4000 ± 50**

$\delta^{13}C = -25.0‰$

Charred (*Populus, Tamarix*) wood from Sec XIE-XDY, Rm LXIX, Cuts 3-6. Fragments from roof beam burnt and partly collapsed inside room.

*Periods II-I, between Phases 7 and 8, 1968*

**R-638. Shahr-i-Sokhta 26** **4150 ± 50**

$\delta^{13}C = -26.1‰$

Charcoal (*Populus, Tamarix*) from Sec XIG, Rms XXI-XXII, Cuts 16-17. Fill partly produced by establishment of earliest bldg of House of stairs. MASCA corrected date, 2940 to 2700 BC.

*Period I, Phases 8 and 9, 1968*

**R-633$\alpha$. Shahr-i-Sokhta 30** **4170 ± 50**

$\delta^{13}C = -25.6‰$

Charcoal (*Populus, Tamarix*) from Sec XIG-H, Rm XX, Cut 20. Cluster charcoal in Period I fill on top of great bone-pit. MASCA corrected date, 2960 to 2850 BC.

**R-629. Shahr-i-Sokhta 24** **4200 ± 50**

$\delta^{13}C = -25.4‰$

Charcoal (*Populus, Tamarix*) from Sec RYL, Rm CIV, Cut 28. Randomly spread below main N-S wall within thinly stratified silt. MASCA corrected date 2940 to 2700 BC.

*Uncertain attribution, 1967*

**R-424. Shahr-i-Sokhta III** **3920 ± 50**

$\delta^{13}C = -25.3‰$

Charcoal (*Tamarix*) from Sec To, 4. Test Trench, Cut 5, on E slope of site, possibly related to Phase 5.

**R-425. Shahr-i-Sokhta IV** **3950 ± 50**

$\delta^{13}C = -26.4‰$

Charcoal (*Tamarix*) from Sec To, 4. Test Trench, Cut 6, on E slope of site, possibly related to Phase 5.

*General Comment*: $^{14}C$ date complex suggests for Shahr-i-Sokhta, Periods I to IV, Phases 9 to 0, time span from 4250 to 3500 BP; MASCA corrected dates from 2970-2880 to 2110-1960 BC in agreement with whole cultural sequence and with scarce available dates for comparable cultural horizons of Chalcolithic and Bronze sites in S Turkmenian SSR and Quetta and Indus valleys, Baluchistan, W Pakistan. Following comparisons are possible: Shahr-i-Sokhta Period IV, Phase 1, R-898, -900, with Namazga VI cultural horizon dated at Namazga Tepe, S Turkmenian, Kopet-Dag Mt N margin, LE-665 (R, 1970, v 12, p 142) (Romanova *et al*, 1972; Bovington *et al*, 1977). S S, Period III, Phases 3 and 4, with Namazga V dated at Altyn Tepe, S Turkmenian, Kopet-Dag Mt N margin, Bln-716-717 (R, 1970, v 12, p 17-18) (Bovington *et al*, 1977); also dates available for Rud-i-Biyaban Tepe, Sistan, ca 30km SE Shahr-i-Sokhta, can be related, Tunc-21-27 (R, 1973, v 15, p 593-594) (Bovington *et al*, 1977). S S, Period II, between Phases 5 and 6, R-637A, 623-26-27-28, 404$\alpha$, 432 and 434$\alpha$, seems, on most significant comparisons, connected with Namazga IV (Biscione, 1974; Tosi, 1973) dated at Altyn Tepe, LE-664, -769 (R, 1970, v 12, p 142; R, 1972, v 14, p 351) (Romanova *et al*, 1972) and at Uleg Tepe, S Turkmenian, Kopet-Dag Mt lower lands, Bln-714-715 (R, 1970, v 12, p 419) (Bovington *et al*, 1977). Finally S S Period I, between Phases 8 and 9, R-629, can be compared with both Damb-Sadaat I and II, Mian Gundai, Quetta Valley, N Baluchistan, L-180B, C, E (Broecker *et al*, 1956) and P-522-523 (R, 1963, v 5, p 94), and Kot Diji, Indus Valley, W Pakistan, P-196 (R, 1959, v 1, p 54) (Bovington *et al*, 1977). Dated series for Shahr-i-Sokhta has been made by Pennsylvania lab (R, 1977, v 19, p 204-207).

## II. GEOLOGIC SAMPLES

### *A. Italy*

**Conca di Forni series**

Peat, wood, and other vegetable remains from 2 Quaternary lacustrine basins cropping out in Conca di Forni, left side Tagliamento R high valley, prov Udine, Carnia. Coll and subm 1973 by B Martinis, Ist Geol, Univ Milano.

**R-1057$\alpha$. Forni di Sotto 1** **9850 ± 80**

$\delta^{13}C = -25.0‰$

Darkened wood fragment, diam 5cm, 20cm long, from gray-bluish clayey lacustrine level rich in vegetable remains exposed in left bank of Tagliamento R immediately S Comm Forni di Sotto, prov Udine (46° 23′ 29″ N, 12° 42′ 08″ E) at +695m, at base of deposit, ca 30m thick, mainly formed by interbedded clayey and sandy lacustrine sediments and coarse fluvial gravels in upper layers up to top. *Comment*: 5% HCl pretreatment disclosed abundant $Fe^{++}$, $Fe^{+++}$, and $SO_4^{--}$. $^{14}C$ Holocene age supports formation of barrier-lacustrine basin by postglacial landslide following ice tension release and fall from steep walls bounding Conca di Forni eastwards.

**R-1058. Forni di Sopra, Pian del Moro 2** **1270 ± 50**
$\delta^{13}C = -29.0‰$

**R-1058α. Forni di Sopra, Pian del Moro 2** **980 ± 50**
$\delta^{13}C = -28.6‰$

Peaty level, 3m thick, embedded in upper part of small lacustrine sequence cropping out in Pian del Moro incision near Comm Forni di Sopra, left side Tagliamento R, prov Udine (46° 24′ 51″ N, 12° 34′ 51″ E) at +995m, and resting on strongly cemented conglomerate of uncertain age widely cropping out in region. *Comment*: 5% HCl disclosed abundant $Fe^{++}$ and $Fe^{+++}$.

**R-1059α. Forni de Sopra, Pian del Moro 6** **>40,000**
$\delta^{13}C = -27.2‰$

Partly humified vegetable remains in grayish clay level, 4.5m thick, lower part of R-1058, above, lacustrine sequence, near basal conglomerate. *Comment*: 5% HCl pretreatment disclosed abundant $Fe^{++}$, $Fe^{+++}$, $S^{--}$, $SO_4^{--}$, and $CO_3^{--}$.

*General Comment*: R-1058α dates final phase of lake basin filling at ca 1000 BP; R-1059α minimum age excludes recent Würmian age for basal conglomerate.

**Firenze series**

Following dates contribute to paleogeog of Arno R plain. Project, in progress by both Ist Bot and Ist Geol Applicata, Univ Firenze, provides correlations among secs exposed in several gravel quarries by bot, palynol, and sedimentol studies.

**R-1135α. Viale Talenti, Firenze** **4870 ± 50**
$\delta^{13}C = -27.2‰$

Wood (*Quercus* sp) id by G Ciuffi, Ist Bot, Univ Firenze, fragments of transported trunks, diam 30 to 40cm, 4m long, from coarse sand layer interbedded with pebble and sand, 6.5m below surface, recovered during excavations near Viale Talenti, Arno R left bank, Firenze W suburbs, Tuscany (43° 47′ 00″ N, 11° 11′ 38″ E). Coll and subm 1975 by C Bini, Ist Geol Applicata, Univ Firenze. *Comment*: 5% HCl pretreatment disclosed abundant $Fe^{++}$ and $Fe^{+++}$ and abundant humic acids extracted by subsequent .2N NaOH leaching.

**R-999α. Isolotto, Firenze 1** **4000 ± 50**
$\delta^{13}C = -26.1‰$

**R-1000α. Isolotto, Firenze 2** **3960 ± 50**
$\delta^{13}C = -26.2‰$

Wood (*Quercus* sp) id by G Ciuffi, fragments of 2 large trunks coll 1970 and subm 1974 by G Ciuffi and E Francini Corti, Ist Bot, Univ Firenze. In 1970 after removal of upper layer of deposit, average thickness ca 2m, in Mr Cubattoli gravel quarry, left bank of Arno R, ca 4km

downstream from Firenze, Isolotto suburbs (43° 47′ 03″ N, 11° 12′ 07″ E) several dozens trunks, max diam 80cm, 5m long, probably transported, were found in pebbly-gravelly layer, and generally so well-preserved as to be used in antique restoring. *Comment*: see R-1135$\alpha$.

*General Comment*: 1st dates for Arno plain, of which detailed stratigraphy is known mainly through wells drilled for hydrogeol purposes (Capecchi *et al*, 1975). Trunks in coarse sediments show sedimentation from powerfully transporting waters. All samples for both stratigraphic position and field observations belong to 2 mature and meandering phases of Arno flow regime (Bini, oral commun); R-1135$\alpha$, according to stratigraphic position, dates older event.

**R-1020. Cetara** **>40,000**
$\delta^{13}C = -24.1‰$

**R-1020$\alpha$. Cetara** **>40,000**
$\delta^{13}C = -24.1‰$

**R-1020$\beta$. Cetara** **32,300 ± 1100**
$\delta^{13}C = -24.1‰$

Charred wood small fragments from basal level of humified layer, 1m thick, underlying pumices and overlying calcareous breccia in sec at Km 44 of State Rd 163, Amalfitana, ca 1km SW Cetara, prov Salerno, Campania (40° 38′ 23″ N, 14° 41′ 38″ E). Coll and subm by P Di Girolamo, Ist Min, Univ Napoli. Sec exposes from top: humified layer, 1.5m thick, pumices, 40cm thick, of unknown origin, overlying humified layer, 1m thick, resting on dubitatively Würm calcareous breccia. *Comment*: R-1020 was given only 5% HCl pretreatment; R-1020$\beta$, humic fraction (< 37%) extracted by additional leaching with .2N NaOH and precipitated again with dilute HCl, clearly contaminated; R-1020$\alpha$, wood fraction insoluble in above .2N NaOH leaching. Cetara charred wood belongs to event >40,000: no further geol data available.

**R-1056. Vallone di Acqualonga** **16,520 ± 130**
$\delta^{13}C = -25.9‰$

Humic acids from humified layer directly overlying Campanian Ignimbrite and underlying Mt Somma-Vesuvius volcano pumices in Vallone di Acqualonga sec at ca Km 69 of State Rd 7bis, Terra di Lavoro, prov Avellino, Campania (40° 54′ 45″ N, 14° 39′ 48″ E). Coll and subm 1974 by P Di Girolamo. Sec exposes from top: upper humified level, Mt Somma-Vesuvius pumices of presumably Plinian age overlying pumice layer attributed to Mt Somma old eruption and sampled humified layer, latter resting on Campanian Ignimbrite, gray facies (Di Girolamo, 1968). *Comment*: sample was pretreated with 8N HCl; humic acids extracted with .2N NaOH and precipitated again with dilute HCl. R-1056 is acceptable for pyroclasts of ancient Mt Somma eruption and agrees with field and petrographic data. For lab dating project of Mt Somma-Vesuvius volcano activity in progress, see, R-715$\alpha$ (R, 1973, v 15, p 171) and R-935 to -940 (R, 1974, v 16, p 364-366).

**Macchialonga, Fossiata series**

Well-preserved wood, fragments of 2 small subfossil trunks, diam 5 to 10cm, 1m long, (*Abies alba* Mill) id by C Ciampi, recovered at 1.45m depth from surface soil, in sand layer overlying granite gravel and pebbles at bottom of small old lacustrine basin, area ca 700m$^2$, at present filled by marshy silty-clayey sediments ca 1.4m thick, at Macchialonga, S slope of Pettinascura Mt, edge of Fossiata State forest, Sila Grande, prov Cosenza, Calabria (43° 58′ 07″ N, 19° 06′ 23″ E) at +1525m. Coll 1972 by E Ferrarini and subm 1973 by R Corti and C Ciampi, Ist Bot Agraria e Forestale, Univ Firenze. Pollen analysis of overlying filling sediments by E Ferrarini (written commun) shows: 3 to 15cm depth, *Pinus laricio* and *Fagus silvatica*, as present local vegetation; 15 to 90cm depth, *Abies alba* assoc to *Pinus laricio* and *Fagus* in amount varying with depth; 90 to 120, *Abies alba* prevailing on *Pinus*, no *Fagus*; 120 to 145, *Pinus* prevailing on *Abies* and *Fagus*. Comparable pollen analyses made nearby by Ferrarini and Padula (1969).

**R-957. Macchialonga 1** **1150 ± 50**

$\delta^{13}C = -24.3‰$

Wood, fragment of small subfossil trunk. *Comment*: test with .2N NaOH did not disclose humic acids.

**R-958. Macchialonga 2** **1080 ± 50**

$\delta^{13}C = -25.5‰$

Wood, fragment of small subfossil trunk. *Comment*: see R-957.

*General Comment*: $^{14}C$ dates restrict to last millennium forest vegetational variations found in pollen analysis, possibly also caused by man.

*B. Ischia Island*

**Arso series**

**R-1003α. Arso 1** **560 ± 50**

$\delta^{13}C = -24.5‰$

Charcoal in paleosol underlying Arso lava flow, S Michele, on right crossrd upwards Via G B Vico (40° 43′ 25″ N, 13° 57′ 12″ E). Coll and subm 1973 by M Fornaseri, Ist Geochimica, Univ Roma. *Comment*: MASCA corrected date, 1340 to 1400 AD.

**R-1004. Arso 2** **450 ± 50**

$\delta^{13}C = -25.7‰$

Charcoal in paleosol underlying Arso lava flow in foundation work sec, right side S Antuono to S Michele rd, near Civic No. 52 (40° 43′ 23″ N, 13° 56′ 55″ E). Coll and subm 1973 by M Fornaseri. *Comment*: test with .2N NaOH did not disclose humic materials. MASCA corrected date, AD 1410 to 1440.

*General Comment*: according to historic sources, Arso lava flow erupted AD 1302 from S wall of Costa del Lenzuolo, 800m SE Fondo Ferraro. R-1003α date agrees within errors; R-1004 seems too young.

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