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UNIVERSITY OF ROME CARBON-14 DATES VI

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The list includes age measurements carried out from December 1966 and November 1967. All samples both of archaeologic and geologic interest are drawn from Italian territory.

Chemical techniques have remained unchanged (Bella and Cortesi, 1960). Two counters have been used for dating: the 1st, of 1.5 L, already described (Bella and Cortesi, 1960; Alessio, Bella, and Cortesi, 1964), the 2nd, of 1 L, recently assembled, is identical to the previous 1 L counter (Alessio, Bella, and Cortesi, 1964), its anticoincidence system was realized by a plastic scintillator and photomultipliers. Background 6.15 $\pm$ 0.08 counts/min, counting rate for modern carbon 24.49 $\pm$ 0.15 counts/min. Higher efficiency of electronic recording was obtained by reducing pulse length and by a few other changes. All samples are usually measured by both counters.

The errors quoted, as in previous measurements, are 1σ statistical error. Age has been calculated using Libby's half-life of 5568 $\pm$ 30 yr, with 1950 as the standard year of reference. As in all previous measurements, the same modern wood, grown near Rome between 1949 and 1953, has been taken as modern standard: its activity has once again been carefully checked and judged satisfactory.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

Italy

Riparo Arma di Nasino series

Charcoal from Riparo Arma di Nasino deposit, Val Pennavaira, province of Savona, Liguria (44° 06′ 35″ N Lat, 8° 02′ 59″ E Long, 250 m above sea level) Cave No. 407 in "Catalogo Speleologico Ligure." Coll. 1962, 1963, 1966 and subm. 1965 and 1966 by M. Leale Anfossi. Deposit in small Arma di Nasino shelter, halfway up calcareous slope, on left side of Pennavaira creek, was discovered in 1961 by Leale Anfossi who, in 1962-64 and 1967, conducted excavations for Ist. Int. di Studi Liguri, Bordighera, and Soprintendenza alle Antichità della Liguria, Genova. Throughout deposit pottery and flint industry belonging

to various cultural horizons, not always showing typical features, were found together with bones of both domestic and wild fauna, food refuse, and several hearths. From surface 15 layers were distinguished, their average thickness and archaeological characteristics follow: I) 30 cm thick, modern pottery; II) 40 cm thick, upper level, pottery of Roman epoch (1st century A.D.), lower level, coarse pottery of Iron age, bones of prevailing domestic animals, food refuse, 2 hearths; III) 40 cm thick, atypical coarse pottery and some bronze objects (Bronze age?), bones of prevailing domestic animals, food refuse, 1 hearth and remains of a buried child; IV-V) 55 cm thick, atypical coarse corded pottery as in III, of difficult identification (Bronze age?), bones of both domestic and wild animals, food refuse, thick ash deposit and 2 hearths; VI) 45 cm thick, pottery attributed to Early Bronze age or Eneolithic, including bell-beakers of Iberia and Sardinia type, flint industry, very small implements and blades, bones of wild fauna (*Cervus, Bos, Sus*), food refuse, and various hearths; between Layers VI and VII, a sort of pavement formed by several large flat stones; VII) 20 cm thick, atypical printed pottery perhaps ascribable to Late Neolithic, bones of wild fauna, food refuse; VIII) 30 cm thick, atypical pottery and polished pottery of Lagozza type attributed to Late Neolithic, bones of wild fauna, food refuse and 1 hearth; IX) 25 cm thick, fine printed pottery, including square-mouthed pots, attributed to Middle-Early Neolithic, flint industry, bones of wild fauna and shells of marine molluscs (*Cardium*), food refuse, and burial of young man in crouching position, typically Neolithic; X) 30 cm thick, Early Neolithic pottery, printed and with cardial decoration, bones of cold fauna (*Ibex*), and some hearths; XI) 20 cm thick, flint industry of Romanellian type, bones of cold fauna, food refuse; XII) 15 cm thick, plentiful flint industry of Epigravettian type with factory debris prevailing over implements, bones of cold fauna, food refuse; XIII) 30 cm thick, flint industry of same Epigravettian type as XII, bones of cold fauna, food refuse; XIV) 70 cm thick, sterile gravels; XV) 30 cm thick, only bones, small bits, and scanty charcoal. Rock bottom of shelter has not been reached; presumably, it is at ca. 7.50 m depth (Leale Anfossi, 1962; and pers. commun.). Digging was difficult especially in the upper layers, as they were interlaced with tree-roots and partly disarranged by people and domestic animals who now frequent the shelter. Several samples dated from Layers II-X, were from different areas of deposit and are listed separately according to excavation campaigns. All charcoal was given standard pretreatment by 10% HCl; a few, α-labelled in list, were given additional leaching by 6% NH_4OH and 2 ages were measured.

Samples coll. during 1962 excavation in N end of deposit:

R-319. Arma di Nasino II-62 **1330 ± 50** **A.D. 620**

1745 ± 50

R-319α. Arma di Nasino II-62 **A.D. 205**

Charcoal from upper level of Layer II, 70 to 75 cm below surface, Sec. D-C. *Comment*: R-319 sample appears contaminated; true age R-319α agrees with Roman epoch.

2325 ± 50

R-321. Arma di Nasino IIa-62 **375 B.C**

2195 ± 50

R-321α. Arma di Nasino IIa-62 **245 B.C.**

2295 ± 50

R-322. Arma di Nasino IIb-62 **345 B.C.**

Charcoal from lower level of Layer II, 0.95 to 1.20 m below surface, Sec. D-C. *Comment*: R-321 sample appears uncontaminated, R-321 and R-321α ages being consistent. All dates agree with Iron age of layer.

2295 ± 50

R-325. Arma di Nasino IV-62 **345 B.C.**

2540 ± 50

R-326. Arma di Nasino IVa-62 **590 B.C.**

Charcoal from Layer IV, 1.40 to 1.60 m below surface, various secs., and from 1 hearth. *Comment*: ages agree with Iron age; atypical pottery was found.

2925 ± 50

R-328. Arma di Nasino V-62 **975 B.C.**

Charcoal from Layer V, 1.60 to 1.80 m below surface, Sec. D-C. *Comment*: date belongs to Late Bronze age; atypical pottery was found.

3430 ± 50

R-329. Arma di Nasino VI-62 **1480 B.C.**

3600 ± 50

R-329α. Arma di Nasino VI-62 **1650 B.C.**

3490 ± 50

R-330. Arma di Nasino VIa-62 **1540 B.C.**

Charcoal from Layer VI, 1.90 to 2.00 m below surface, several secs. *Comment*: R-329 and R-329α ages are very close and R-329 and R-330 considered uncontaminated. They date "bell-beaker level."

3645 ± 70

R-331α. Arma di Nasino VII-62 **1695 B.C.**

Charcoal from Layer VII, 2.20 to 2.35 m below surface, various secs. *Comment*: date agrees with presumed age of layer: synchronous or slightly older than Layer VI.

4705 ± 70
R-332. Arma di Nasino VIII-62 **2755 B.C.**

Charcoal from Layer VIII, 2.50 m below surface, G-F and F-G secs., and from hearth. *Comment*: age agrees with presence of Lagozza-type pottery in layer along with atypical pottery.

5980 ± 85
R-333. Arma di Nasino X-62 **4030 B.C.**

Charcoal from Layer X, 3.50 to 3.70 m below surface, various secs. *Comment*: age agrees with presence in the layer of printed pottery attributed to Early Neolithic.

Samples coll. during 1963 excavation in central area of deposit:

2025 ± 65
R-253. Arma di Nasino II-63 **75 B.C.**

Charcoal from upper level of Layer II, 60 to 90 cm below surface, various secs. *Comment*: age agrees with Roman epoch or Late Iron age indicated by stratigraphy.

1785 ± 65
R-255. Arma di Nasino III-63 **A.D. 165**

Charcoal from Layer III, depth not recorded, Sec. L-O. *Comment*: age too young, probable contamination of sample with younger material.

3255 ± 70
R-256. Arma di Nasino IV-63 **1305 B.C.**

Charcoal from Layer IV, 1.60 to 1.75 m below surface, Zone B-C-L-O. *Comment*: date shows Late Bronze age; atypical pottery was found in layer.

3525 ± 65
R-257. Arma di Nasino V-63 **1575 B.C.**

3390 ± 90
R-258. Arma di Nasino Va-63 **1440 B.C.**

Charcoal from Layer V, 1.60 to 1.70 m below surface, various zones. *Comment*: dates show Bronze age; atypical pottery was found in layer.

3340 ± 90
R-259. Arma di Nasino VI-63 **1390 B.C.**

3680 ± 95
R-260. Arma di Nasino VIa-63 **1730 B.C.**

Charcoal from Layer VI, 1.70 to 1.90 m below surface, various zones. *Comment*: R-260 date agrees better with presence of pottery including bell-beakers (Cf. R-329 and R-330).

4680 ± 100
R-261. Arma di Nasino VII-63 **2730 B.C.**

Charcoal from Layer VII; 2.30 to 2.50 m below surface, various zones. *Comment*: in this area Layer VII appears to belong to Eneolithic horizon and is much older than at 1962 excavation area, (Cf. R-331α).

4220 ± 90

R-262. Arma di Nasino VIII-63 **2270 B.C.**

Charcoal from Layer VIII among stones of hearth, depth not recorded. *Comment*: age too young; probable disarrangement of deposit.

6140 ± 110

R-263. Arma di Nasino VIIIa-63 **4190 B.C.**

Charcoal from Layer VIII, 2.60 to 2.85 m below surface, Zones B-C-G and B-C. *Comment*: Layer VIII in this area, as well as in W area (Cf. R-313), appears to belong to Lower Neolithic age and to be much older than in N end excav. area (Cf. R-332).

6280 ± 120

R265. Arma di Nasino IXs-63 **4330 B.C.**

Charcoal from upper level of Layer IX, 2.80 to 3.00 m below surface, Zones B-C-L-O and B-C-G-M. *Comment*: date confirms Lower Neolithic age of layer (Cf. also R-315 and R-316 dates for this layer).

6470 ± 120

R-267. Arma di Nasino IXi-63 **4520 B.C.**

Charcoal from lower level of Layer IX, 3.00 to 3.30 m below surface, various zones. *Comment*: R-267 date agrees with R-265 and dates layer as Lower Neolithic.

Samples coll. during 1966 excavation in W and E sides of deposit:

3045 ± 50

R-306. Arma di Nasino IIIs-66 **1095 B.C.**

Charcoal from upper level of Layer III, Zone A-B-W. *Comment*: date shows Late Bronze age; atypical pottery was found in layer.

3390 ± 50

R-307. Arma di Nasino IV-66 **1440 B.C.**

Charcoal from Layer IV, Zone A-B-W, found in hearth. *Comment*: date shows Late Bronze age; atypical pottery present in layer.

3550 ± 55

R-308. Arma di Nasino V-66 **1600 B.C.**

3690 ± 60

R-308α. Arma di Nasino V-66 **1740 B.C.**

Charcoal from Layer V, Zone A-B-W. *Comment*: sample appears uncontaminated, dates being satisfactorily consistent; they show Bronze age; atypical pottery present in layer.

4220 ± 55

R-309. Arma di Nasino VI-66 **2270 B.C.**

4110 ± 55

R-309α. Arma di Nasino VI-66 **2160 B.C.**

Charcoal from Layer VI, Zone A-B-W, found in hearths. *Comment*: sample appears uncontaminated, ages being consistent; Layer VI, con-

taining "bell-beaker level" shows somewhat older in this excavation area (Cf. R-329, R-330, and R-260).

R-311. Arma di Nasino VII-CI-66 **3765 ± 70**
1815 B.C.

Charcoal from Layer VII, corridor-entrance E area. *Comment*: (Cf. R-314).

R-314. Arma di Nasino VIII-CI-66 **4275 ± 65**
2325 B.C.

R-314α. Arma di Nasino VIII-CI-66 **4340 ± 60**
2390 B.C.

Charcoal from Layer VIII, corridor-entrance E area. *Comment*: Sample R-314 appears uncontaminated. In this E area (corridor and entrance) Layers VII and VIII were not clearly defined; they appear younger than W underanged A-B-W zone (see R-313); ages probably not reliable.

R-313. Arma di Nasino VIII-66 **6420 ± 65**
4470 B.C.

R-313α. Arma di Nasino VIII-66 **6400 ± 105**
4450 B.C.

Charcoal from lower level of Layer VIII, Zone A-B-W, found in hearth. *Comment*: sample uncontaminated dates layer to Lower Neolithic, (see also R-263).

R-315. Arma di Nasino IXs-66 **6280 ± 70**
4330 B.C.

Charcoal from upper level of Layer IX, Zone A-B-W, found in hearth (Cf. R-316).

R-316. Arma di Nasino IXm-66 **6015 ± 65**
4065 B.C.

R-316α. Arma di Nasino IXm-66 **5955 ± 65**
4005 B.C.

Charcoal from middle level of Layer IX, Zone A-B-W, found in hearth. *Comment*: R-316 appears uncontaminated. R-315 and R-316 date layer to Lower Neolithic, though age appears younger than overlying Layer VIII.

General Comment: C^{14} ages show the same well-defined chronological horizons in the 3 excavated areas, as well as a few stratigraphical and archaeologic discrepancies that can be summarized as follows, from present backwards: a) Dates ranging from 1800 to 2600 yr B.P., were obtained for the Roman epoch and Iron-age pottery present in deposit; in N end, 1962 excavation, this chronological horizon goes down to Layer IV. b) A number of dates are uniformly distributed between 3000 and 3700 yr B.P., within limit of Bronze age; typical artifacts of this age have not been identified, however (Layers III, IV, and V). Bell-beaker level,

Layer VI, of 3500-3700 yr B.P. was found in N (1962) and central (1963) excavated areas. c) Some samples measured from 4100 to 4800 yr B.P. which should be Eneolithic and Upper Neolithic; atypical coarse Neolithic pottery associated with these samples except in W (1966) excavated area where bell-beaker level appears older corresponding to ca. 4100-4200 yr. d) C^{14} dates within 6th millennium B.P. are lacking from whole deposit. e) Lower levels of deposit have yielded outstanding group of C^{14} dates between 5900 and 6600 yr B.P.; these agree with Lower Neolithic age of pottery id. in Layers IX and X, appearing to belong to this chronological horizon in the whole deposit. On the contrary, Layers VII and VIII have yielded various C^{14} dates not always corresponding to their archaeol. ages.

The above and some other minor inconsistencies existing between C^{14} dates and stratigraphy still need to be discussed. The excavation, particularly of still undated lower layers, is still in progress.

Lagozza di Besnate series

Since 1877, diggings in Holocene peat-bog covering dried up old intermorainal lacustrine basin of Lagozza di Besnate, 16 km ca. SSW Varese, W Lombardy (45° 42′ 11″ N Lat, 8° 46′ 20″ E Long) have yielded numerous archaeologic remains including flint industry, pottery, and wooden objects, presumably belonging to prehistoric lacustrine settlement, probably of lake-dwellings. Similar archaeologic artifacts were discovered in basin during 1st stratigraphic digging carried out by I. Regazzoni (Castelfranco, 1880; Regazzoni, 1887). Ca. 1940 culture ascribed to Upper Neolithic and named Lagozza culture was id. in W Lombardy and in nearby regions (Laviosa Zahbotti, 1939; 1939a; 1940). In 1953-54 further archaeol. excavations in peaty clayey lacustrine deposit at Lagozza di Besnate were made by O. Cornaggia Castiglioni; piles of lake dwellings, flint industry, and pottery of Lagozza culture were found (Cornaggia Castiglioni, 1955) and pollen analysis was made of peaty sediments (Pasa Durante and Pasa, 1956). Recently (1966-67) G. Guerreschi has carried out further studies on Lagozza culture.

R-78. Lagozza di Besnate 1 (remeasured) **4735 ± 50**
2785 B.C.

R-78A. Lagozza di Besnate 1a **4580 ± 50**
2630 B.C.

R-338. Lagozza di Besnate 1b **4980 ± 50**
3030 B.C.

Well-preserved wood, 3 fragments of pile (*Conifera* log, 12 cm in diam.) driven in bottom sediment of old lacustrine basin. It belonged to lower structure of lake-dwelling. Coll. 1953 and subm. 1956 and 1966 by O. Cornaggia Castiglioni, Soprintendenza ai Monumenti, Milano. *Comment*: wood was devoid of humic matter; R-78 new measurement agrees closely with Pisa date on 4th fragment of same pile, Pi-34, 4794

± 90 (Pisa II) and with culture present in deposit; 1st date for R-78 was: 4200 ± 300 (Rome II). R-78A date is consistent with preceding ones while R-338 date is somewhat older.

R-337. Lagozza di Besnate 2 **4805 ± 50**
2855 B.C.

Wood (*Conifera*) from "boomerang" fragment found ca. 1877 in lacustrine sediments, and since then housed in Cornaggia Castiglioni collection, Milano. Subm. 1966 by O. Cornaggia Castiglioni. This type implement well-known in lake-dwellings and in "bonifica" settlements of Upper Neolithic and Bronze ages, Lagozza and Polada cultures, throughout Po Plain, is now supposed to have been used as throwing-weapon and called "boomerang" for its similar shape (Cornaggia Castiglioni, 1959; 1960). *Comment*: wood slightly darkened but without humic matter. Date agrees with range of Lagozza culture.

General Comment: dates obtained at Pisa and Rome Labs for Lagozza culture in Lagozza di Besnate go from ca. 4700 to 5000 B.P. Levels 12-13 of Grotta delle Arene Candide deposit, Liguria, showing elements of Lagozza culture, were dated: R-104, 5075 ± 45 (Rome IV).

R-336. Lagozzetta di Besnate **4385 ± 50**
2435 B.C.

Wood from large cylindrical vessel, carved in root portion of log, found in 1872 while digging in Holocene peat-bog covering small intermorainal lacustrine basin of Lagozzetta di Besnate, 150 m SW Lagozza di Besnate, 16 km ca. SSW Varese, (45° 42′ 11″ N Lat, 8° 46′ 20″ E Long) (Caimi, 1877). Housed at Mus. Civico di Archaeol., Milano, labelled L236; subm. 1967 by O. Cornaggia Castiglioni. With vessel were found flint arrows, a handled wooden bowl, and several fir-tree trunks set in order, which presumably belonged to wooden stacked platform or "bonifica." According to Cornaggia, archaeologic specimens could belong typologically to 1st phase of Polada culture in W. Lombardy (Cornaggia Castiglioni, 1956). Typical Polada culture spreads into E Lombardy and Venetia. *Comment*: inner part of wood was well-preserved; impaired thin outer part was removed. According to Cornaggia Castiglioni, R-336 should date 1st appearance of Polada culture in W Lombardy (Cornaggia Castiglioni, 1956).

Typical Polada culture in Polada site and in several lake-dwellings scattered through E Lombardy has been dated many times in Rome and Pisa: dates ranging between 3200 and 3500 yr B.P. were obtained (see: Rome II p. 82; Rome III, p. 215; Rome V, p. 349, and Pisa II, p. 102).

R-339. Lago di Ledro B **950 ± 50**
A.D. 1000

Externally charred wood from large trunk belonging to wooden stacked packwork thought to be "bonifica," N shore of Lago di Ledro near road between Molina di Ledro and Pieve di Ledro, 7 km SE Riva

del Garda, province of Trento (45° 51′ 37″ N Lat, 10° 45′ 56″ E Long, 655 m above sea level; U.T.M. coordinate system, 32-T-PR-37108214). "Bonifica," showing evidence of fire, was found in superficial peaty layer, 70 cm thick, of now filled lacustrine bay. It overlay white sandy-clayey, thick, lacustrine deposit, and was underlain by *Cornus mas* seeds, bone bits, and potsherds which resemble pottery of Polada culture found in large lake-dwelling settlement situated in emissary Ponale area (Battaglia, 1943) at distance of 300 m and dated by Rome and Pisa Labs at 3100-3300 yr B.P. (see Rome II, p. 82; Pisa II, p. 102) (Cornaggia Castiglioni, 1955a). *Comment*: inner, unburnt wood appeared well-preserved and devoid of humic matter. Visible rootlets were carefully hand picked. Because of potsherds "bonifica" was supposed to be prehistoric. C^{14} date shows it to be medieval. Potsherds most probably came from Ponale lake dwellings.

8565 ± 80
6615 B.C.

R-341. Riparo Blanc

Charcoal from Mesolithic layer of Riparo Blanc deposit at foot of W slope of Mt. Circeo promontory, Cava d'Alabastro locality, Comune of S. Felice Circeo, province of Latina, Latium (41° 13′ 45″ N Lat, 13° 02′ 36″ E Long, ca. 20 m above sea level). Coll. 1962 and subm. 1967 by M. Taschini, Soprintendenza alle Antichità Roma V. Excavations of small rock-shelter deposit were carried out in 1960-63 by Ist. Italiano di Paleontologia Umana, and directed by L. Cardini (Cardini and Taschini, 1958-61). Calcareous concretions formed by water percolating down slope through the deposit have acted partly to cement as well as to preserve them. Trench 4 m in depth was dug; rock bottom of shelter was not reached. Two archaeologic layers were identified. In lower one, of Pleistocene age, ca. 3 m thick, sparse Epigravettian industry and large mammal fauna (*Bos, Equus, Cervus,* etc.) were found. Upper layer, max. thickness ca. 90 cm, contained a particular Mesolithic flake industry made on small pebbles, including mainly denticulates, notched pieces, and perforators; very few wild mammal and micromammal bones (*Capreolus, Sus, Vulpes, Arvicola,* etc.), fish and crustacea remains, and plentiful shells of marine and fresh water molluscs, resulting both as food refuse (*Trochus, Patella, Cardium, Helix,* etc.) and personal ornaments (*Columella,* etc.). Mesolithic horizon unvaried through layer: charcoal was found in lower part (Taschini, 1962-65; 1964). *Comment*: R-341 date agrees, for what we yet know, with chronology of late Mesolithic cultures in Italy.

So far the following Mesolithic sites in S Italy and Levanzo Island (near NW Sicily coast) have been dated at Pisa and Rome Labs: Levanzo, Pi-119, 9694 ± 110 (Pisa II); Grotta La Porta (Positano), Pi-10, 8619 ± 200 (Pisa I); Grotta di Ortucchio (Avezzano), Early Mesolithic, Pi-23, 12,619 ± 410 (Pisa I); Grotta della Madonna (Praia a Mare), Mesolithic layer, R-187, 8735 ± 80; R-187α, 8875 ± 85; R-188, 9070 ± 80 (Rome IV). Levanzo, La Porta, and Ortucchio do not show as much specializa-

tion in either industry or economy as the Riparo Blanc Mesolithic deposit. Riparo Blanc and Grotta della Madonna appear similar in industry, though in Grotta della Madonna geometric microliths are also present. Economy differs, as people of Grotta della Madonna were not only mollusc gatherers, like those of Riparo Blanc, but also were large mammal hunters, as testified by presence of plentiful bone remains. Analogies can also be established between Mesolithic occupation of Riparo Blanc and some mesolithic sites on coast of Provence (Montadien) and in Pyrenees (Arudien).

R-191. Picture frame **<300**

Wood from picture-frame, subm. 1964 by owner, A. Mazzi, Rome, whose family kept it at Massa Carrara since 1840. *Comment*: wood tissue was not impaired but worm-eaten: sample carefully chosen from well-preserved part. Dating was required as frame was recently ascribed by restorer to medieval time, (ca. 11th century A.D.).

II. GEOLOGIC SAMPLES

Italy

R-158. Villar Dora, Val di Susa **9910 ± 75**
7960 B.C.

R-158A. Villar Dora, Val di Susa **10,000 ± 75**
8050 B.C.

Well-preserved wood, large fragment from trunk of *Pinuxylon* Gothan, ex *Pinus silvestris* L. (id. by G. Charrier, pers. commun.) found in lacustrine deposit 750 m S Villar Dora, Comune of Almese, Val di Susa, prov. of Turin, Piedmont (45° 06′ 26″ N Lat, 7° 22′ 43″ E Long, 349 m above sea level; coordinate system U.T.M. 32-TLQ-72609649). Coll. 1962 by L. Peretti, Ist. di Giacimenti Minerari, Politecnico of Turin; subm. 1963 by G. Charrier, Ist. di Giacimenti Minerari, Politecnico of Turin. In this locality, on left of Dora Riparia R., clay quarry section shows the following profile; soil surface to −1 m, recent pebble deposit by Dora Riparia R.; −1 to −1.80 m, reddish silty sediments containing shells of fresh water Gasteropoda; −1.80 to quarry bottom, ca. −4 m, bluish-gray silty-clay lacustrine deposit containing remains of herbaceous plants, fauna including *Ostracoda*, shells of *Lamellibranchiata*, some bones and numerous teeth of *Bos primigenius* Bojanus. Sample from −3.50 m. Other plant remains and fauna id. by G. Charrier. Drillings in other places show lacustrine deposit spreads over wide area in Lower Valle di Susa, underlying recent alluvium and confirms existence of ancient lacustrine basin filled by turbidity flows in Early Holocene; bottom has not been reached. *Comment*: wood well-preserved and devoid of carbonate and humic matter; R-158 was given pretreatment by 10% HCl, R-158A given no pretreatment. C^{14} age dates lacustrine formation as Early Preboreal. R-158 is related to sample R-52, 7780 ± 100 (Rome II) from Boreal/Atlantic transition in lacustrine

deposit a few km W of site. In Val di Susa and nearby valleys studies of Late Würm and Postglacial formations are being made by L. Peretti and G. Charrier.

Pontebba series

In 1965, partial sec. of postglacial formation was found at Pontebba, Fella Valley, E Alps, Udine prov., Friuli, (46° 30′ 20″ N Lat, 13° 19′ 48″ E Long, 568 m above sea level). From top downward: IV) alluvial gravels, thickness to 30 m, of Fella R. and of alluvial fan of its affluent Rio degli Uccelli; floated woods (boughs) imbedded in lower level; III) lacustrine clays, thickness 0 to 6 m, establishing existence of presumably small, lacustrine basin, as inferred by comparison with different sections, several trunks of *Larix* were found in growth position; II) lower fluvial gravels, thickness 0.20 to 1 m, with reddish paleosol on top; on these gravels forest of *Larix* had established; I) lower lacustrine clays, exposed for only a few cm, total thickness unknown. Floated woods from Layer IV and *Larix* trunk from Layer III coll. 1965 and subm. 1966 by M. Manzoni, Ist. di Geologia, Univ. of Bologna, on behalf of R. Selli, Director Ist. di Geologia, Univ. of Bologna.

R-280B. Pontebba IV — **9120 ± 175** / **7170 B.C.**

R-304. Pontebba IVa — **9130 ± 75** / **7180 B.C.**

R-304B. Pontebba IVb — **9160 ± 65** / **7210 B.C.**

Wood, floated boughs, 3 different fragments, from bottom of fluvial gravels IV in contact with underlying lacustrine clays III. *Comment*: wood had become soft and light; devoid of humic matter; all samples were given 10% HCl pretreatment.

R-303. Pontebba II-III — **9160 ± 75** / **7210 B.C.**

R-303A. Pontebba II-III. — **8975 ± 80** / **7025 B.C.**

Well-preserved wood from large trunk of *Larix* (id. by M. Manzoni, pers. commun.) from lacustrine clays III and belonging to forest grown on underlying fluvial gravels II. *Comment*: R-303 10% HCl pretreatment was given, R-303A no pretreatment was given.

General Comment: synchronous ages for both floated woods, R-280B, R-304, R-304A, and *Larix* trunk, R-303, R-303A, are suitable and indicate quick filling of small lacustrine basin and high rate of Fella R. alluvial transport. Dates accord with previously known ages assigned to stadial moraines of Fella glacier; transition to fluvial post-Würmian environment, closer to lacustrine event dated by C^{14}, correlates with transgression of Yoldia Sea in N Europe.

R-159. Cava Bentivoglio **5065 ± 50 / 3115 B.C.**

R-159A. Cava Bentivoglio **4930 ± 50 / 2980 B.C.**

R-159α. Cava Bentivoglio **5000 ± 60 / 3050 B.C.**

R-159β. Cava Bentivoglio **4820 ± 50 / 2870 B.C.**

Heavily darkened wood fragment from tree trunk at 11 m depth in Holocene formation at Casalone di S. Marino locality, ca. 6 km SSW Bentivoglio, prov. of Bologna, Emilia (44° 35′ 05″ N Lat, 11° 23′ 28″ E Long, 22 m above sea level). Coll. and subm. by M. Fornaseri, Ist. di Geochimica, Univ. of Rome. 18 m sec. in clay quarry of Industria Bolognese Laterizi shows following profile from surface downward: 0 to −7 m, clayey fine sand immediately under thin layer of agricultural soil; −7 to −9 m, clayey coarse sand with imbedded clayey lenses; −9 to −18 m bluish clay with imbedded sandy lenses, containing plant remains (twigs) and fresh water molluscs (*Unio*). In sandy layer at −11 m depth a few floated and darkened tree trunks, 35 to 40 cm in diam., have been recovered. Calcareous concretions, 2 to 10 cm in diam., (local name "calcinello") scattered through whole section, both in sand and clay layers. Lower limit of formation not reached: it is part of widespread alluvial Holocene deposit of Lower Po Plain. Presence of *Unio* indicates lacustrine-marsh environment. *Comment*: no $CaCO_3$ was present in evenly darkened wood. By boiling with dilute HCl CO_2 was evolved and large amount of Fe^{++} detected, probably ferrous carbonate and humate: by additional leaching with 6% NH_4OH a plentiful humic fraction was extracted. Because of deep impairment of wood and possible contamination, procedure of sample preparation was as follows: R-159A, no pretreatment; R-159, pretreatment by boiling dilute HCl until all CO_2 was evolved and Fe^{++} quantitatively dissolved; R-159β, humic fraction extracted by additional leaching with 6% NH_4OH and precipitated again by acidifying with dilute HCl; R-159α fraction insoluble in above 6% NH_4OH leaching. The 4 ages are not significantly different and show material was not contaminated. Lacustrine episode belongs to late Holocene time. Determination is 1st in this region for widespread deposits heretofore known only as Holocene.

Adriatic Sea series

In 1965 and 1966 2 cruises in Upper Adriatic Sea were made by Ist. di Geologia, Univ. of Bologna, under direction of R. Selli, for studying sedimentation environment of submarine part of Po R. delta and offshore area (Ciabatti, Colantoni, and Rabbi, 1965; 1966). Paleontological, mineralogical, chemical, and grain size distribution studies were made as well as physical and chemical analyses of both surface and

bottom waters, and studies on distribution of bottom organisms (Ciabatti and Colantoni, 1966; D'Onofrio, 1967; Gallignani and Rabbi, 1966; Tomadin, 1967). Area of 640 km^2 was covered by net system of 122 stations between Porto Celere and 5 km S Porto Volano, along coast and 15 km out (44° 45′ to 45° 06′ N Lat, 12° 16′ to 12° 45′ E Long). Core was taken at each station, water and bottom samples were coll., and density, temperature, pH measurements, etc. were determined. In 1966 cruise, further bottom samples and cores were taken. Samples coll. 1965 by M. Ciabatti and P. Colantoni, Ist. di Geologia, Univ. of Bologna, and subm. by R. Selli.

R-334. Adriatic Sea G.5-5 **8475 ± 60 6525 B.C.**

Bits of darkened wood and sapropelitic matter from core G.5, 107 cm long, from Sta. 47, 12 km E of shore (44° 57′ 54″ N Lat, 12° 42′ 03″ E Long), water depth 30.20 m; 90 cm below top of core.

R-335. Adriatic Sea G.5-2 **8000 ± 60 6050 B.C.**

Bits of darkened wood and sapropelitic matter from 30 cm below surface of same G.5 core.

General Comment: sedimentation appears much slower in more recent time. Erosion of bottom sediments or reduced or missed sedimentation caused by bottom current can be postulated or transport of older terrigenous organic materials by Po R. Available dates are insufficient for explanation.

Sapropelitic muds from 103 and 109 cm below top of core from Adriatic Sea at approx. same lat. (44° 58′ N Lat) and not too far E off (12° 54′ E Long) from G.5 core, water depth 33 m, were dated at Stockholm Lab: St-426, 9240 ± 80 and St-427, 8960 ± 170 (Stockholm III). Ages are consistent with core G.5 dates. According to K. Fredriksson, Geol. Survey of Sweden, who subm. samples, top of sediments may have been eroded.

R-340α. Monte li Santi **>42,000**

Heavily humified wood (probably *Fagus*) from diatomite at Monte li Santi locality, near Mazzano Romano, prov. of Rome (42° 12′ 14″ N Lat, 12° 24′ 52″ E Long). Coll. 1965 and subm. 1966 by M. Follieri and I. Napoleone, Ist. di Botanica, Univ. of Rome. Partial section through lacustrine deposit for quarry works, 12 m in depth, shows mainly diatomaceous sediments with interbedded lenses and layers of different thicknesses of volcanic materials. Pollen analysis of diatomite section shows 5 vegetation phases from bottom to soil surface: Pollen Zone A, 12 to 11.65 m below soil surface, Steppe; Pollen Zone B, 11.65 to 11.32 m, *Quercetum mixtum*; Pollen Zone C, 11.32 to 10.75 m, *Fagetum*; Pollen Zone D, 10.75 to 10.42 m, *Fagus* decreases; Pollen Zone E, 10.42 to 6.60 m, Cold Steppe; 6.60 m to soil surface, layers poor in pollen (Napoleone and Follieri, 1968). Wood was found at 11.24 m depth, in *Fagus*

culmination levels, *Fagetum* phase. *Comment*: sample was pretreated with 10% HCl: abundant Fe^{++} was detected, probably ferrous humate, since sample was devoid of CO_3^{--} and S^{--}. Additional leaching with 6% NH_4OH was given, though plentiful humic fraction of sample appears to be result of wood decomposition, rather than an external contamination, since diatomite is devoid of humus. Cold climate shown by basal pollen zone may indicate deposit to be Riss or Early Würm phase. Mindel glacial in Italy, with available knowledge, shows older vegetation features than this deposit, and on the other hand presence of *Zelkova* leads the authors to exclude Main and Late Würm or Postglacial phases. C^{14} date bears out given upper limit.

III. CROSS-CHECK SAMPLES

R-106. Usselo (remeasured) **11,740 ± 90 / 9790 B.C.**

Wood (*Betula*) found in peat from sec. near Usselo, Overijssel prov., Netherlands (52° 10′ N Lat, 6° 50′ E Long). Sample given to us by Hl. de Vries at Groningen in Nov. 1957. *Comment*: sample dated at Rome Lab. in 1962: R-106, 11,800 ± 280 (Rome II). Latter measurement, carried out for instrument control on CO_2 evolved from same $CaCO_3$ then prepared, agrees with preceding measurement. For sample significance and checking of ages obtained at different Labs, see Rome II, p. 79.

References

Date lists:

Pisa I	Ferrara, Reinharz, and Tongiorgi, 1959
Pisa II	Ferrara, Fornaca-Rinaldi, and Tongiorgi, 1961
Rome II	Alessio, Bella, and Cortesi, 1964
Rome III	Alessio, Bella, Bachechi, and Cortesi, 1965
Rome IV	Alessio, Bella, Bachechi, and Cortesi, 1966
Rome V	Alessio, Bella, Bachechi, and Cortesi, 1967
Stockholm III	Östlund and Engstrand, 1960

Alessio, M., Bella, F., Bachechi, F., and Cortesi, C., 1965, University of Rome carbon-14 dates III: Radiocarbon, v. 7, p. 213-222.

———— 1966, University of Rome carbon-14 dates IV: Radiocarbon, v. 8, p. 401-412.

———— 1967, University of Rome carbon-14 dates V: Radiocarbon, v. 9, p. 346-367.

Alessio, M., Bella, F., and Cortesi, C., 1964, University of Rome carbon-14 dates II: Radiocarbon, v. 6, p. 77-90.

Battaglia, R., 1943, La palafitta del Lago di Ledro nel Trentino: Memorie Mus. Storia naturale della Venezia Tridentina, v. 7, p. 3-63.

Bella, F. and Cortesi, C., 1960, The CO_2-proportional counter of the carbon-14 dating Laboratory of the University of Rome: Ricerca Scientifica, v. 30, no. 12, p. 1969-1977.

Caimi, A., 1877, Recenti scoperte: Consulta Archeol. Mus. Storico Artistico di Milano Boll.; Appendice ad Archivio Storico Lombardo, v. 4, p. 42.

Cardini, L. and Taschini, M., 1958-61, Campagna di scavo al Riparo Blanc in località Cava d'Alabastro al M. Circeo: Quaternaria, v. 5, p. 353-354.

Castelfranco, P., 1880, Notizie intorno alla stazione lacustre della Lagozza nel Comune di Besnate: Soc. Ital. Sci. Nat. Atti, v. 23, p. 1-26.

Ciabatti, M. and Colantoni, P., 1966, Ricerche sui fondali antistanti il delta del Po: Gior. di Geol., s. 2, v. 34, p. 1-22.

Ciabatti, M., Colantoni, P., and Rabbi, E., 1965, Ricerche oceanografiche nell'Alto Adriatico antistante il delta del Po. Crociera estiva 1965: Gior. di Geol., s. 2, v. 33, p. 207-232.

———— 1966, Ricerche oceanografiche nell'Alto Adriatico. Crociera estiva 1966: Gior. di Geol., s. 2, v. 34, no. 2, in press.

Cornaggia Castiglioni, O., 1955, Nuove ricerche nella stazione palafitticola della Lagozza di Besnate: Sibrium, v. 2, p. 93-104.

———— 1955a, "Ledro B": Una nuova stazione preistorica sulle rive del Lago di Ledro nel Trentino: Natura, v. 46, p. 165-174.

———— 1956, La Lagozzetta di Besnate e gli insediamenti "Palustri" della civiltà di Polada: Studi in onore di Aristide Calderini e Roberto Paribeni, v. 3, p. 35-58.

———— 1959, Individuazione di una nuova arma da getto in uso presso i palafitticoli padani—Distribuzione e cronologia del bumerang nella Penisola Italiana: Soc. Ital. Sci. Nat. e del Mus. Civico di Storia Nat. in Milano Atti, v. 98, p. 328-344.

———— 1960, Paletnologia del bumerang nei giacimenti preistorici padani—Nota aggiuntiva con una carta di distribuzione: Natura, v. 51, p. 121-132.

D'Onofrio, S., 1967, Ricerche sui foraminiferi dei fondali antistanti il delta del Po: Gior. di Geol., v. 35, in press.

Ferrara, G., Fornaca-Rinaldi, G., and Tongiorgi, E., 1961, Carbon-14 dating in Pisa-II: Radiocarbon, v. 3, p. 99-104.

Ferrara, G., Reinharz, M., and Tongiorgi, E., 1959, Carbon-14 dating in Pisa: Am. Jour. Sci., Radioc. Supp., v. 1, p. 103-110.

Gallignani, P. and Rabbi, E., 1966, Distribuzione del ferro libero nei sedimenti marini antistanti il delta del Po: Gior. di Geol., s. 2, v. 34, no. 2, in press.

Guerreschi, G., 1966-67, La Lagozza di Besnate e il Neolitico superiore padano: Riv. Archeol. Comense, fasc. 148 and 149, p. 9-352.

Laviosa Zambotti, P., 1939, Civiltà palafitticole lombarde e civiltà di Golasecca: Riv. Archeol. Comense, fasc. 119 and 120.

———— 1939a, La ceramica della Lagozza e la civiltà palafitticola italiana vista nei suoi rapporti con le civiltà mediterranee ed europee: Bull. Paletn. It., n.s., v. 3, p. 61-112.

———— 1940, La ceramica della Lagozza e la civiltà palafitticola italiana vista nei suoi rapporti con le civiltà mediterranee ed europee: Bull Paletn. It. n.s., v. 4, p. 83-164.

Leale Anfossi, M., 1962, La scoperta dell' Arma di Nasino: Riv. Ingauna e Intemelia, n.s., v. 17, p. 3-8.

Napoleone, I. and Folleri, M., 1967, Pollen analysis of a diatomite near Mazzano (Roma): Rev. Palaeobotan. Palynol., v. 4, p. 143-148.

Östlund, H. G. and Engstrand, L. G., 1960, Stockholm natural radiocarbon measurements III: Am. Jour. Sci., Radioc. Supp., v. 2, p. 186-196.

Pasa Durante, M. V. and Pasa, A., 1956, Analisi polliniche e microstratigrafiche nella torbiera della Lagozza: Memorie del Mus. Civico di Storia Nat. di Verona, v. 5, p. 217-228.

Regazzoni, I., 1887, La stazione preistorica della Lagozza: Bull. Paletn. Ital., v. 13, nos. 1-2, p. 1-32.

Taschini, M., 1962-65, Nuovi orizzonti culturali nel Riparo Blanc al Monte Circeo: VI Congresso Int. delle Sci. Preistoriche e Protostoriche Atti, Roma, agosto-settembre 1962, v. 2, p. 143-144.

———— 1964, Il livello mesolitico del Riparo Blanc al Monte Circeo: Bull. Paletn. It., n.s. 15, v. 73, p. 65-88.

Tomadin, L., 1967, Minerali argillosi nei sedimenti recenti del delta del Po: Gior. di Geol., s. 2, v. 35, in press.