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LYON NATURAL RADIOCARBON MEASUREMENTS IX

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INTRODUCTION

This list includes most of the measurements made in 1979 through 1981 and some values obtained during preceding years. The reporting of results, their calculation (half-life: 5570 ± 0, standard ^{13}C correction only for bones), and the dilution ratios are as previously described in Lyon VIII (R, 1979, v 21, p 402-452).

The counting technique using proportional detectors has now been completely abandoned; only a few measurements on water samples and the Chassey series were measured in this way. Almost all analyses were made using the three Packard liquid scintillation spectrometers which were specially shielded with 5cm of lead and placed in an underground room beneath 3 to 4m of earth. Ca 30 glass counting vessels were selected. The differences in their backgrounds did not exceed 0.2cpm. The backgrounds of the 3 routine counters were, respectively: 1.9 ± 0.1, 2.2 ± 0.1, and 3.2 ± 0.2cpm. Adjustments to yields of ca 55% were made by the quenching correction of simultaneous counting on two channels corresponding to different window opening. For these conditions, 3ml of benzene from the oxalic acid standard gave an uncorrected counting rate of ca 17cpm.

Pretreatment of samples was according to the type of dating material, conforming to generally applied methods and particular archaeologic or geologic problems. We took into account some experiments made on specific dating materials (paleosoil, terrestial shells) (R, 1980, v 22, p 545-555, 919-929) which confirm previous studies made by other laboratories, the synthesis of which will soon be published (Evin, 1983). These studies demonstrated the often inadequate elimination of contamination by basic treatment or hydrolysis on organic material or by superficially acid washing of carbonaceous material. Pretreatment of bones, which seems satisfactory, remains the same and is uniformly applied, always following the procedure of Longin (1971).

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SAMPLE DESCRIPTIONS

I. EXPERIMENTAL SAMPLES

The following samples were measured often on laboratory request 1) to check laboratory adjustment with other laboratories (Ly-2224 and Chêne de Stolford series, 2) to verify reliability of some dating materials (Paléosol de Beylongue series, Ly-1884 and -2500), 3) to demonstrate utility and accuracy of ^{14}C measurements for commercial (Ly-2223 and aromatic components series) or artistic (Ly-1854 and -1907) purposes.

Ly-2224. Bois de Berne **2330 ± 90**

Wood from unknown origin subm 1980 by T Riesen, Radiocarbon Lab, Bern, Switzerland (5427 min count). *Comment*: agrees perfectly with Bern measurement: B-3499, 2220 ± 100.

Chêne de Stolford series, Wales

Wood from submerged forest coll 1979 by A Heyworth, Univ Aberystwyth and subm 1980 by M S Baxter, Univ Glasgow in participation with Lyon lab Internatl Tree-Ring Replicate Study. Results appear in table 1. Sampling of wood, selection of proposed material, and preparation procedures were previously pub with synthesis of results (Baxter, 1983).

TABLE 1
Chêne de Stolford

Sample no.	Wood ref	Counting time	Dilution ratio	Conventional age
Ly-2157	Stolford 147-156	6872 min	2/5	5070 ± 90
-2225	Stolford 118-127	3339 min	1	5120 ± 130
-2156	Stolford 88-89	10,161 min	1	5175 ± 60
-2226	Stolford 60-69	3878 min	14/15	5200 ± 160
-2155	Stolford 31-40	6503 min	2/5	5330 ± 100

General Comment: results agree in general with those obtained by 20 other labs. Comparison of counting times between different statistical margins shows that errors necessarily made during successive phases of preparation and counting of each sample (eg, errors in weighing sample, counting standard, background stability of purity corrections, etc) become preponderant with respect to statistics for counting times longer than 5000 minutes. Taking into account only counting statistics would lead to underestimate of error.

Paléosol de Beylongue series, Morcenx, Landes

Peaty sediments from Layer 5 in Beylongue geol sec (44° 00′ N, 0° 55′ W). Coll and subm 1971 by C Thibault and P Legigan, Univ Bordeaux. Layer is interstadial or interglacial paleosoil attributed to Würmian period. Measurement was made to strengthen conclusions of study on evolution of organic matter in soil and sample treatment methods of paleosoil datings (Gilet-Blain, Marien, and Evin, 1980).

Ly-1537. Hydrolysat **13,960 ± 360**

Soluble fraction of acid hydrolyse. (2/3 diluted sample)

Ly-1538. Reliquat **16,760 ± 440**

Insoluble fraction after several acid hydrolyse. (9/10 diluted sample)

General Comment: as suggested by general study, age is probably too young since last interstadial (long enough to form a paleosoil) occurred 17,000 yr ago. Both results indicate increasing age according to chemical evolution conditions of soil organic matter and only give min age for sediments (Evin *et al*, 1979).

Ly-1884. Trébous II D I, Deyme, Haute Garonne **29,200 +2800 −2000**

Shells and opercula of gastropods from silt (43° 29′ N, 1° 31′ E). Coll 1979 by J C Revel, Lab Pédol, Univ Toulouse. Sample from bottom of geol series of sediments, organic matter of which were dated by Monaco Lab (unpub) of ca 23,000 ± 1000 BP. *Comment* (JCR): date agrees with expected range of dates and indicates Late Würmian age but disagrees with results from organic matter. However, both values may be considered min ages. True age may be older and observed ^{14}C activities may come from contamination which can never be eliminated from such dating materials (Evin *et al*, 1980; Gilet-Blain, Marien, and Evin, 1980).

Ly-2500. Tombe 142, Casabianda, Aléria, Haute-Corse **2890 ± 120**

Hélix shells from inner wall of Grave 142 of Casabianda necropolis (42° 05′ N, 9° 30′ E). Coll 1971 by J and L Jehasse, preserved in Jérôme Carcopino Mus Aléria, and subm 1981 by J Evin. Graves were dug in sandy clays and precisely dated by assoc archaeol material from Greece at beginning of 5th century BC; snails are from this last period or a little younger. *Comment*: date is ca 500 yr too old and confirms previous findings (Evin *et al*, 1980) on impossibility of using shells of terrestrial gastropods for dating archaeol sites.

Ly-2223. Gypsum mine, Carcès, Var **2570 ± 130**

Wood found in gypsum mine (43° 29′ N, 6° 11′ E). Coll and subm 1980 by G Truc, Dept Geol, Univ Lyon. *Comment* (GT): recent age of wood indicates it came from ancient timbers and embedding sediments are collapse of ancient gallery.

Aromatic components series

Aromatic organic components are present in such products as perfume, aperitifs, alimentary adjuvants, etc, from various origins (synthetic or natural, homogeneous or mixed). Subm from 1978 to 1980 by industrial firms or fraud-control labs. All samples were very slowly burned in pure oxygen after placement on quartz wool (table 2).

TABLE 2
Aromatic components

Sample no.	Sample origin	Dilution ratio	$\delta^{13}C$/PDB	Activities dpmg	% modern
Ly-1629	Natural citral (*Cybopogon citratum*)	1	−11.6‰	20.1 ± 0.4	148.5% ± 2.1
-1630	Natural citral (*Litsea bubeba*)	1	−26.7‰	17.6 ± 0.4	123.9% ± 1.9
-1631	Natural citral (?)	1		19.3 ± 0.5	142.5% ± 2.3
-1632	Synthetic citral	1	−27.4‰	inf/=0.3	inf/=1.8%
-1800	Synthetic fennel	1	−33.4‰	inf/=0.2	inf/=1.5%
-1815	Synthetic fennel PM 1	1		14.3 ± 0.4	105.4% ± 1.5
-1816	Synthetic fennel RM 2	1		12.7 ± 0.4	93.4% ± 1.7
-1953	Anethol 1	1	−27.3‰	18.1 ± 0.4	133.4% ± 0.4
-1954	Anethol 2	1	−30.0‰	18.9 ± 0.4	139.6% ± 2.4
-1955	Anethol 3	1	−31.1‰	15.4 ± 0.3	113.9% ± 1.9
-1956	Anethol 4	1	−28.9‰	17.5 ± 0.3	129.1% ± 1.8
-1957	Anethol 5	1	−29.1‰	19.6 ± 0.5	144.8% ± 2.5
-2011	Oil of Badiane	7/10	−27.9‰	20.7 ± 0.5	152.9% ± 3.6
-2012	Synthetic estragol	1	−29.7‰	0.4 ± 0.1	2.6% ± 0.6
-2013	Vanilla extract from gaiacol	1/3	−29.3‰	inf/=0.3	inf/=2.0%
-2014	Synthetic vanilla	1	−28.5‰	inf/=0.3	inf/=2.0%
-2015	Vanilla from oil of resin	9/10	−20.8‰	18.6 ± 0.3	137.4% ± 2.4
-2016	Vanilla from estragol	1	−31.8‰	19.1 ± 0.3	141.1% ± 2.0
-2017	Anise seeds	1	−27.5‰	17.9 ± 0.3	131.7% ± 2.1
-2018	Badiane seeds	1	−26.9‰	19.5 ± 0.3	144.1% ± 2.3
-2019	Fennel seeds	1		19.0 ± 0.3	140.4% ± 2.0
-2020	Anethol from badiane 1st pt of preparation	21/30	−24.3‰	18.7 ± 0.4	138.1% ± 2.9
-2021	2nd pt of preparation	1	−25.5‰	18.4 ± 0.3	135.9% ± 1.9
-2022	3rd pt of preparation	5/6	−30.3‰	18.2 ± 0.3	133.9% ± 2.7
-2064	American anethol	2/3		19.7 ± 0.4	145.6% ± 2.8
-2065	Estragol from wood	1	−30.1‰	19.6 ± 0.3	144.7% ± 1.9
-2066	Anethol from badiane	9/10	−32.3‰	20.0 ± 0.4	147.2% ± 2.8
-2092	Vanilin from lignine	1/3	−26.4‰	18.2 ± 0.4	134.0% ± 3.1
-2093	Natural menthol	1/3		19.3 ± 0.5	142.0% ± 3.6
-2094	Synthetic menthol	1		inf/=0.2	inf/=1.2%

General Comment: differences among results indicate need for determining sample origins. Some samples have activities lower than 16dpmg which must represent mixing of natural components with synthetic chemical products. Some amounts may be measured but extracts are not distinguishable from seeds and woods. Three values for Ly-2020, -2021, and -2023 from several phases of same preparation indicate slight isotopic fractionation during operation of an industrial lab. Such differences are small but may be consistent enough to explain differences among products extracted from natural components grown in same year (Bricout & Koziet, 1978).

Ly-1854. Statuette de Crémieu **260 ± 150**

Wood from pedestal of statuette attributed by style to 11th or 12th century. Coll 1979 in Antiquities Market at Crémieu, Isère (45° 53′ N, 5° 15′ E), from unknown origin and subm 1979 by G Villedieu, Villeurbanne. Measurement made to authenticate artifact. *Comment* (GV): date much younger than expected and suggests statuette was sculpted in Middle-Age style from old wood.

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Ly-1907. Statuette chinoise de Tch'ang-cha, Hou-Nan, China **2370 ± 140**

Wood from Chinese statuette attributed to Han epoch (206-220 BC). Coll at Tch'ang-cha (28° 05′ N, 113° 01′ E). Subm 1979 by C T Loo, Paris. As such statuettes often were imitated, measurement was made to authenticate artifact. *Comment* (CTL): date agrees with expected old age and indicates beginning of Han period, but only gives age of wood on which statuette was sculpted.

II. GEOLOGIC SAMPLES

A. Samples from peat bogs

Ly-1940. Marais de Chautagne, Serrière-en-Chautagne, Savoie **1170 ± 140**

Peat from top of peaty layer several m thick in Chautagne peat bog (45° 53′ N, 5° 50′ E). Coll 1978 by Co Natle Rhône and subm 1979 by M Bornand, Inst Recherche Agronom, Montpellier. Layer overlies thick fluvio-glacial gravels. Dated to determine min age of gravels which blocked Le Bourget Lake outlet. *Comment* (MB): dates end of peat accumulation, and not formation of lake dam (Bornand & Guyon, 1979).

Ly-2298. Le Lit-au-Roi, Cressin, Ain **1900 ± 120**

Peat from base of peaty layer 1.5m thick in peat bog (45° 35′ N, 5° 43′ E). Coll and subm 1980 by R Vilain, Dept Geol, Univ Lyon. Peat bog formed at final stage of filling of glacial lake. *Comment* (RV): date, much younger than expected, indicates rapidity of peat formation and recent filling of lake.

Ly-2349. Saint-Paul-les-Durance, Bouches du Rhône **6870 ± 160**

Peaty slime from 10.6 to 10.9m depth in boring at point PK 4800 near bank of Durance Canal (49° 29′ N, 5° 42′ E). Coll 1967 and subm 1980 by J L de Beaulieu, Lab Bot Hist Palynol, Univ Marseille. Level was attributed to Riss-Würm interglacial period elsewhere called "Eemian" (Beaulieu, 1972; Bonifay, 1962). *Comment* (JL de B): date is much younger than expected, dating peaty formation to Holocene; *cf* another measurement on calcareous tufa lying close to peaty level, MC-2171: 7000 ± 100 (Farizier, 1980). Discrepancy between results and previous geol or palynol "Eemian" attribution is now under study.

Lago Zapano series, Lagonegro, Campania, Italy

Organic clay from three levels in basal sediments of Zapano Lake (40° 09′ N, 15° 50′ E). Coll and subm 1978 by M Reille, Lab Palynol, Univ Marseille. Pollen diagram indicates very recent age (end of Sub-Atlantic period) while clay facies suggest interglacial origin.

Ly-2253. II, 119-121cm **390 ± 150**

From bottom of a peaty layer in clays; presence of *Fagus* and cereal pollen. (11/30 diluted sample)

Ly-2254. II, 124-126cm **700 ± 170**

From top layer of clay; large amounts of *Fagus* and *Ablies.* (1/2 diluted sample)

Ly-2255. III, 143-147cm **1290 ± 170**

From mid-layer of clay; presence of leaf remains. (1/2 diluted sample)

General Comment (MR): as expected, peaty layer (Ly-2253) is very recent. Both other dates confirm absence of lacuna between organic clay and peaty layer and that, despite interglacial facies, clay is also recent.

Ly-1774. Lago Laceno, Bagnoli d'Irpino, Campania, Italy **2120 ± 230**

Organic clay from 380 to 387cm depth in lake sediments (40° 45′ N, 15° 7′ E). Coll 1977 and subm 1977 by M Reille. (5/6 diluted sample). *Comment* (MR): presence of *Fagus* and depth suggest either interglacial level (> 30,000 BP) or rapid sedimentation rate. Date confirms latter.

Ly-2319. Bourricos, Pontenx les Forges, Landes **2070 ± 130**

Peat from 30cm depth in compact peaty layer 80cm thick, outcropping in quarry (44° 09′ N, 0° 65′ W). Coll 1980 and subm 1981 by P Legigan, Univ Bordeaux. *Comment* (PL): palynol confirms entire layer formed between Sub-boreal and present.

Pré Maudit series, Gathemo, Manche

Peat or clay with organic matter from three levels of core (48° 45′ N, 0° 97′ W). Coll and subm 1981 by L Barthélemy, Centre Géog Phys, Univ Paris-X, Nanterre.

Ly-2407. 308 **6870 ± 170**

Peat from 331 to 334cm depth. Pollen indicates humidification phase with *Betula, Alnus,* and *Quercetum mixtum,* attributed to Atlantic period. (5/6 diluted sample)

Ly-2405. 307 **7450 ± 180**

Peat from ca 340cm depth. Decrease in pollen of *Corylus,* increase of *Betula, Quercetum mixtum, Alnus, Myrica* gale, *Salix,* attributed to beginning of Atlantic. (1/2 diluted sample)

Ly-2406. 305 **9250 ± 180**

Clay with organic matter from 353 to 357cm depth. Dominance of *Corylus,* assoc with *Alnus, Betula,* and increase of total arboreal pollen attributable to beginning of Atlantic period. (3/5 diluted sample)

General Comment (LB): Ly-2407 and -2405 confirm geomorphol and palynol conclusions. Ly-2406 corresponds to Pre-boreal period and suggests peat bog settled during Alleröd with sedimentation hiatus occurring during Boreal.

Seillons-Source d'Argens series, Var

Peat from three levels of peat bog 2.5km E of Seillons (43° 30′ N, 5° 52′ E). Coll 1979 and subm 1980 by H Triat-Laval, Lab Palynol, Univ Marseille (Triat-Laval, 1981).

Ly-2218. 110-120cm **2200 ± 100**

Pollen diagram indicates increase in deforestation which had begun previously; Sub-atlantic age expected.

Ly-2119. 190-200cm **4080 ± 130**

Pollen diagram indicates small clearing of wood at this level; Sub-boreal age expected.

Ly-2220. 330-340cm **4650 ± 110**

From base of peat bog at level where pollen diagram indicates forest of deciduous trees existed before start of deforestation: Atlantic age expected.

General Comment: three dates agree perfectly with expected range of dates. Only 600 yr and 1.3m sediment between Ly-2220 and -2219 indicates rapid sedimentation for beginning of filling.

Ly-1583. Praveille, La Versanne, Loire **7410 ± 190**

Peat from 1.2 to 1.3m depth at bottom of acid, raised peat bog on side of Pilat massif, near Le Grand-Bois pass (45° 19′ N, 4° 30′ E). Coll and subm 1977 by N Gilet and A M Domenach, Lab Ecol Végétale, Univ Lyon. Pollen diagram by H Méon shows extension of *Tilia* and presence of *Quercus* and *Alnus, ie,* beginning of relatively warm climate. *Comment* (AMD): date agrees with palynol as it shows beginning of Atlantic period when slight increase of temperature occurred.

Casabianda series, Aléria, Haute Corse

Peat from top and basal layers of a peaty horizon embedded in slimy basal sediments of pond (42° 15′ N, 7° 10′ E). Coll and subm 1980 by M Reille.

Ly-2257. Top **5650 ± 190**

From top of peaty layer just underlying layer in which *Quercus ilex, Olea* sp, and cereal pollen indicate Sub-atlantic period. (1/2 diluted sample)

Ly-2256. Base **5920 ± 190**

From base of peaty layer just overlying layer in which pollen clearly indicates Atlantic period. (3/5 diluted sample)

General Comment (MR): both dates confirm that peaty layer belongs to Atlantic period and sedimentation hiatus occurred on top of peat.

Bordure Nord du Massif du Cantal series, Cantal

Seven borings were made in four peat bogs (table 3) at ca 1200m alt in Cantal massif, and table 4 lists results of samples of peat and organic clay coll and subm by M Reille and J L de Beaulieu, Lab Palynol, Univ Marseille.

TABLE 3
Bordure Nord du Massif Cantal—sampling sites

Boring	Village	Loc	Colln yr	Subm yr
Le Joland I	Ségur les Villas	(45°12′N, 2°50′E)	1979	1980
Le Joland II	Ségur les Villas	(45°12′N, 2°50′E)	1981	1981
Brugeroux	Chastel sur Murat	(45°09′N, 2°50′E)	1978	1978
La Taphanel III	Riom es Montagne	(45°16′N, 2°41′E)	1978	1980
La Taphanel IV	Riom es Montagne	(45°16′N, 2°41′E)	1978	1981
La Taphanel II	Riom es Montagne	(45°16′N, 2°41′E)	1978	1982
Lastioules	Champs sur Tarentaise	(45°29′N, 2°39′E)	1979	1980

TABLE 4
Bordure Nord du Massif Cantal—samples

Sample no.	Boring	Depth	Expected climatic phase	Dilution ratio	Age BP
Ly-2494	Le Joland II	50-60cm	Post-Middle age	1/15	1280 ± 360
-2495	Le Joland II	90-100cm	Middle age	3/10	1030 ± 160
-2132	Le Joland I	230-240cm	Sub-atlantic	1/4	2850 ± 260
-2496	Le Joland II	150-160cm	End of Sub-boreal	1/2	2610 ± 150
-2133	Le Joland I	300-310cm	Sub-boreal	1/6	2670 ± 320
-2497	Le Joland II	250-260cm	Sub-boreal	11/30	4410 ± 210
-2498	Le Joland II	290-297cm	End of Atlantic	1/3	5880 ± 200
-2134	Le Joland I	440-450cm	End of Atlantic	2/3	5350 ± 210
-2447	Lastioules	40-45cm	End of Sub-boreal	1/6	2460 ± 210
-2448	Lastioules	128-135cm	Beginning of Sub-boreal	1/5	5060 ± 250
-2555	La Taphanel II	355-370cm	Sub-boreal	3/10	2800 ± 160
-2135	La Taphanel III	45-55cm	Sub-atlantic	3/5	2890 ± 180
-2136	La Taphanel III	105-110cm	Sub-boreal	1/2	4130 ± 190
-2137	La Taphanel III	135-140cm	Beginning of Sub-boreal	1	4860 ± 140
-2138	La Taphanel III	200-205cm	Middle Boreal	1	5850 ± 150
-2139	La Taphanel III	255-260cm	Beginning of Atlantic	1	7520 ± 150
-2140	La Taphanel III	335-340cm	Middle Atlantic	1	8440 ± 160
-2141	La Taphanel III	405-410cm	Beginning of Boreal	1/2	9700 ± 230
-2142	La Taphanel III	415-420cm	End of Pre-boreal	9/30	9530 ± 200
-2143	La Taphanel III	435-440cm	Beginning of Pre-boreal	2/5	10,040 ± 200
-2144	La Taphanel III	445-455cm	End of Late Dryas	7/15	10,390 ± 230
-2145	La Taphanel III	460-470cm	Late Dryas	1/3	10,450 ± 250
-2212	La Taphanel IV	565-576cm	Early Dryas	3/5	12,380 ± 210
-2361	La Taphanel IV	610-630cm	Early Dryas	7/30	10,780 ± 410
-2119	Brugeroux	350-360cm	Boreal	1/4	8310 ± 300
-2120	Brugeroux	450-500cm	Pre-boreal	3/8	9860 ± 280
-1855	Brugeroux	556-564cm	Beginning of Pre-boreal	7/15	10,310 ± 420
-1856	Brugeroux	575-585cm	Late Dryas	7/15	10,270 ± 430
-2121	Brugeroux	588-600cm	Alleröd	7/15	10,790 ± 240
-2122	Brugeroux	630-640cm	Beginning of Alleröd	1/2	11,450 ± 240
-2123	Brugeroux	645-655cm	Bölling	4/15	12,350 ± 360
-2124	Brugeroux	660-670cm	Early Dryas	1/20	11,610 ± 850

General Comment (MR & JL de B): Holocene results agree with values expected from pollen study. Late-glacial results are less accurate because of low carbon content of samples; these seem consistent, especially La Taphanel series from 435 to 470cm where they well define Late Dryas period. Ly-2122 and -2361 are too young for unknown reasons.

Le Cézalier Massif series, Puy de Dôme

Table 5 lists results obtained from clay with little organic content from several levels in cores from three neighboring sites at 1300m alt: Les Chastelets and Le Lac d'En Bas boring near La Godivelle (45° 23′ N, 2° 55′ E), and Jassy boring near Saint-Alyre-es-Montagne, (45° 23′ N, 2° 58′ E). Coll and subm 1979 by M Reille.

TABLE 5
Massif du Cézalier

Sample no.	Boring	Depth	Expected climatic phase	Dilution ratio	Age BP
Ly-2260	Les Chastelets	120-130cm	Sub-atlantic	2/15	2940 ± 210
-2261	Les Chastelets	190-200cm	Sub-atlantic	4/15	2600 ± 230
-2262	Les Chastelets	240-250cm	Sub-atlantic	7/30	3020 ± 240
-2263	Les Chastelets	850-860cm	Atlantic	1/15	19,400 ± 1560
-2117	Le Lac d'En Bas	680-690cm	Atlantic	1/9	5590 ± 410
-2118	Le Lac d'En Bas	800-810cm	Atlantic	2/13	6070 ± 320
-2446	Jassy	240-245cm	Atlantic	1/6	5040 ± 330

General Comment (MR): 1st 3 results of Les Chastelets series fit in expected range of dates despite large uncertainty and stratigraphic inversion. Ly-2261 is too young. Ly-2263 is aberrant and remains unexplained. Both results from Le Lac d'En Bas seem too old by ca 1000 yr compared with palynol data in region and Ly-2446 which seems to be most reliable of series. Small amounts of available carbon may cause discrepancies between results and expected values despite lengthening of counting times.

Massif de la Margeride series, Lozère et Haute-Loire

Peat from several borings at ca 1300m alt. Coll and subm 1980 by A Pons and M Reille.

Ly-2360. Mont-Chauvet I, Malzieu-Forain, Lozère **Modern**
$\Delta^{14}C = -1.6 \pm 1.2\%$

From 130 to 140cm depth (44° 55′ N, 1° 15′ E) (3/10 diluted sample). Pollen diagram indicates beginning of last extension of *Pinus* and cereals, *ie* very recent (ca 200 to 300 BP).

Ly-2356. Sainte-Eulalie, Lozère **2120 ± 170**

From 90 to 95cm depth (44° 47′ N, 1° 17′ E) (11/30 diluted sample). Pollen indicates last extension of *Fagus*, before beginning of extension of cultivation, expected during Sub-atlantic period.

Ly-2359. Chanaleilles, Haute-Loire **2660 ± 180**

From 65 to 70cm depth (44° 51′ N, 1° 17′ E) (7/15 diluted sample). Pollen indicates, as for Ly-2359, beginning of last regression of *Fagus*.

Ly-2357. Lestivalet I, 65 to 70, Malzieu-Forain, Lozère **1360 ± 160**

From 60 to 70cm depth (44° 51′ N, 1° 13′ E) (3/5 diluted sample). Pollen indicates, as for Ly-2360, extension of *Pinus* and cereals.

Ly-2358. Lestivalet I, 125 to 130, Malzieu-Forain, Lozère 8790 ± 220

From 125 to 130cm depth (1/2 diluted sample). Layer does not contain pollen, only charcoal. There seems to be sedimentation hiatus at overlying level.

Ly-2444. Lestivalet II, 146.5 to 154.5, Malzieu-Forain, Lozère 11,330 ± 280

From 146.5 to 154.5cm depth (11/30 diluted sample). Pollen indicates cold period with only 8% arboreal pollen.

Ly-2445. Lestivalet II, 156.5 to 159.5, Malzieu-Forain, Lozère 7300 ± 150

From 156.5 to 159.5cm depth (13/15 diluted sample). Pollen indicates temperate period with 15% arboreal pollen, mainly *Betula* and *Salix*.

General Comment (MR & AP): 4 more recent dates agree with expected values (Sub-atlantic) (Reille & Pons, 1982). Ly-2358 proves sedimentation hiatus occurred before Boreal. Ly-2444 is either too young or too old as it corresponds to generally accepted Alleröd age contrary to cold period indications by pollen; Ly-2445 is much too young for unknown reason.

Massif de l'Aubrac series, Lozère

Table 6 lists results from 2 borings in peat bogs at ca 1050m alt at Brameloup near Recoules d'Aubrac (44° 43′ N, 3° 04′ E) and at La Chaumette near Brion (44° 43′ N, 3° 05′ E). Coll 1979 and subm 1980 (Ly-2604 and -2605) by M Reille.

TABLE 6
Massif de l'Aubrac

Sample no.	Boring	Depth	Expected climatic phase	Dilution ratio	Age BP
Ly-2440	Brameloup	80-95cm	Sub-atlantic	3/10	820 ± 180
-2441	Brameloup	135-170cm	Sub-boreal	1/2	2660 ± 190
-2442	Brameloup	180-195cm	Sub-boreal	23/30	4010 ± 170
-2443	Brameloup	230-245cm	End of Atlantic	1/10	5770 ± 480
-2604	Brameloup	300-320cm	Atlantic	1/3	6110 ± 210
-2605	Brameloup	410-435cm	Beginning of Atlantic	2/3	6990 ± 160
-2110	La Chaumette	20-27cm	Sub-atlantic	1/2	4300 ± 180
-2111	La Chaumette	55-62cm	Sub-boreal	2/5	4670 ± 190
-2112	La Chaumette	142-150cm	Beginning Atlantic	3/5	6880 ± 200
-2113	La Chaumette	177-185cm	Boreal	1/3	7980 ± 260
-2114	La Chaumette	292-300cm	Pre-boreal	1/8	10,430 ± 570
-1857	La Chaumette	339-347cm	Alleröd	5/6	10,910 ± 360
-1858	La Chaumette	403-413cm	Bölling	1	12,370 ± 340
-2115	La Chaumette	413-423cm	Bölling	1	11,490 ± 170
-2116	La Chaumette	423-433cm	Bölling	4/5	12,810 ± 250

General Comment (MR): Brameloup series agrees with palynol. Ly-2441 seems a little too young but may indicate sedimentation hiatus. Chaumette series is also consistent except Ly-2115 which looks ca 1000 yr too young. Ly-1858 and -2116 are 1st 2 dates of Bölling period in Central Massif and correspond with beginning of *Juniperus* phase.

Peyrebeille series, La Villate, Ardèche

Table 7 lists results obtained from peat from several levels in peat bog at 1265m alt (44° 35′ N, 3° 58′ E). Coll and subm 1979 by M Couteaux, Lab Palynol, Univ Marseille.

TABLE 7
Peyrebeille

Sample no.	Boring	Depth	Pollen event	Expected climatic phase	Dilution ratio	Age BP
Ly-2203	Peyrebeille I	45-49cm	Beginning of *Abies* extent	Sub-atlantic	1	3310 ± 120
-2201	Peyrebeille II	52-58cm	Beginning of *Abies* extent	Sub-atlantic	1	3200 ± 120
-2204	Peyrebeille I	50-58cm	2nd extent of *Fagus*	Sub-boreal	2/11	4160 ± 310
-2202	Peyrebeille II	59-64cm	1st extent of *Fagus*	Sub-boreal	1	4360 ± 130
-2205	Peyrebeille I	58-66cm	1st extent of *Fagus*	Sub-boreal	1	3800 ± 110
-2206	Peyrebeille I	79-85cm	Before 1st increase of *Fagus*	End of Atlantic	7/10	4740 ± 170
-2207	Peyrebeille I	87-94cm		End of Atlantic	1/2	5340 ± 190
-2208	Peyrebeille I	105-118cm		Beginning of Atlantic	1	5810 ± 140
-2209	Peyrebeille I	119-134cm		Beginning of Atlantic	1	6910 ± 140
-2210	Peyrebeille I	139-143cm	1st max of *Quercus*	Late Boreal	3/5	7240 ± 170
-2211	Peyrebeille I	143-146cm	1st max of *Corylus*	Early Boreal	1/2	8550 ± 240

General Comment (MC): dates agree well with expected range of values of palynol zones. Agreement between Ly-2203 and -2201 proves that *Abies* developed as early as end of Sub-boreal and not only during Sub-atlantic (Couteaux, 1978). Comparison of Ly-2202 and -2204 vs Ly-2205 shows that last result is ca 550 yr too young.

Lac de Siguret series, Saint-André d'Embrun, Hautes Alpes

Table 8 lists results obtained from clay with organic matter from boring 78 SM at ca 1000m alt in lake sediments (44° 37′ N, 6° 33′ E). Coll 1979 and subm 1981 by J L de Beaulieu.

TABLE 8
Lac de Siguret

Sample no.	Depth	Expected climatic phase	Dilution ratio	Age BP
Ly-2125	335-345cm	Atlantic	1/10	7110 ± 420
-2126	355-360cm	Late Dryas	1/15	10,820 ± 810
-2127	390-400cm	Late Dryas	2/5	12,930 ± 380
-2128	437-442cm	Middle Dryas	2/5	13,540 ± 350
-2129	460-468cm	Middle Dryas	1/2	17,800 ± 450
-2130	480-490cm	Early Dryas	1	17,410 ± 220
-2131	504-520cm	Würmian III	1	20,770 ± 620

General Comment (JL de B): previous results obtained by Louvain lab on same site was pub (de Beaulieu, 1977): upper levels attributed to the Sub-atlantic, from 215 to 220cm, Lv-709: 2920 ± 70 and to Sub-boreal, from 275 to 290cm, Lv-710: 3660 ± 75. Another result from deeper level, 430 to 440cm, Lv-712: 13,190 ± 260 fits well with Ly-2128 from same depth. However, all values except Ly-2125 and -2128 which are in expected date range because of large statistical margins, are too old for palynol data: Ly-2127 seems ca 2000 yr too old, Ly-2128 (Lv-712) ca 1000 yr, and Ly-2129, at least 4000 yr. In comparison with Pelléautier profile (below; R, 1979, v 21, p 414-416) Ly-2130 should also be ca 3000 yr too old while rather old date of Ly-2131 remains questionable.

Pelléautier series, Hautes Alpes

Gray clay from two deep layers in "La Motte-qui-Tremble" peat bog (44° 31′ N, 6° 11′ E). Coll 1976 and subm 1979 by J L de Beaulieu, Univ Marseille. Samples subm to check relatively old age obtained from lowest level of 18 results of previously pub series (R, 1979, v 21, p 414-416).

Ly-1942. VI, 670-678cm **19,700 $^{+4100}_{-2700}$**

Clay with very little organic matter. (7/60 diluted sample)

Ly-1943. VI, 678-690cm **15,920 ± 700**

Brown clay. (3/7 diluted sample)

General Comment (JL de B): three dates of previous series dated 600 to 635cm level between 14,500 and 15,500 BP, close to Ly-1943; but Ly-1796: 23,700 $^{+1900}_{-1500}$ previously obtained for 700cm level also fits with Ly-1942. Thus, because of lack of more data, discrepancy between Ly-1942 and -1943 remains unexplained and fairly old age of Ly-1796 is still questionable.

Haut Dauphiné series, Isère

Tables 9 and 9A list results of measurements of peat and clay from several levels of borings in high alt peat bog ponds. Coll by M Couteaux.

TABLE 9
Haut Dauphiné

Sites	Village	Alt	Loc	Colln yr
Vallon de Lavey	La Muande, St-Christophe en Oisan	2050m	(44°58′N, 6°13′E)	1980
La Tourbière	Muzelle, Vénosc	2140m	(44°57′N, 6°06′E)	1978
Draye de Pertu	Les Etages, St-Christophe en Oisan	1590m	(45°53′N, 6°15′E)	1980
Côte Brune	Les Deux Alpes, Mont de Lans	1646m	(45°00′N, 6°07′E)	1980

TABLE 9A

Sample no.	Boring	Depth	Expected climatic phase	Dilution ratio	Age BP
Ly-2374	Muande I-B	35-39cm	End of Sub-boreal	2/5	2320 ± 190
-2375	Muande I-A	51-56cm	End of Sub-boreal	8/15	2570 ± 170
-2376	Muande I-A	71-75cm	End of Sub-boreal	13/30	5150 ± 200
-2394	Muzelle I-808	280-290cm	Sub-atlantic	4/5	2060 ± 130
-2395	Muzelle I-809	305-315cm	Sub-boreal	1	3040 ± 120
-2396	Muzelle I-8010	345-355cm	Sub-boreal	11/15	4440 ± 180
-2397	Muzelle I-8011	370-380cm	Atlantic	1	5320 ± 140
-2402	Muzelle I-8012	665-670cm	Beginning of Atlantic	1	8430 ± 150
-2403	Muzelle I-8013	680-684cm	Boreal	3/5	10,540 ± 190
-2404	Muzelle I-8014	684-690cm	Beginning of Boreal	4/5	10,410 ± 200
-2398	Muzelle II-804	490-500cm	Boreal	14/15	8420 ± 160
-2399	Muzelle II-805	505-511cm	Boreal	1	9480 ± 180
-2400	Muzelle II-806	519-527cm	Beginning of Boreal	14/15	10,920 ± 200
-2401	Muzelle II-807	536-542cm	Late Dryas	3/10	13,460 ± 390
-2148	Draye de Pertu I	6m	Late Dryas	1/3	7130 ± 240
-2146	Côte Brune	Top		1	12,310 ± 150
-2147	Côte Brune	Base		1	12,890 ± 180

General Comment (MC): comparison between results from La Muande neighboring borings for same pollen event establishes boundary between Sub-boreal and Sub-atlantic periods when *Pinus mugo* Torr gave way to *Pinus cembra* L. This boundary is rarely seen in pollen diagrams from high alt sites (Couteaux, 1981). At La Muzelle, dates are older than expected for pollen phases, which may be explained by presence of carbonaceous secondary carboniferous sediments in samples. La Draye de Pertu date differs from expected one. Dated level actually was Atlantic fire level, sparse remaining pollen of which wrongly suggested cold climate vegetation. Both La Côte Brune dates are, as expected, before Alleröd but are too young because of introduction of roots (Couteaux and Evin, 1981).

B. Bone samples from grottoes

Ly-2171. Ours de Forsyth-Major, Monte Estremo, Corsica 200 ± 90

Bone fragments from ribs of bear skeleton, coll 1906 by C Forsyth Major in Inferno grotto (42° 22′ N, 8° 49′ E). Preserved since colln in Paleontol Lab, Mus Hist Nat Paris and subm 1979 by F Poplin, Paris. *Comment* (FP): despite apparently young aspect of bones (Forsyth-Major, 1930) skeleton was believed to represent presence of bears in Corsica early in Pleistocene times. Date disproved this and demonstrated that animal was brought onto island by man.

Ly-2311. Le Mont Terret, Vallée du Perthuis, Thorens-Glières, Haute Savoie 1280 ± 150

Ursus arctos bones from small grotto that opens onto slope of mt (45° 57′ N, 6° 15′ E). Coll 1979 by G Fontana, Belley; studied and subm 1980 by R Ballesio, Geol Dept, Univ Lyon (29/30 diluted sample). *Comment* (RB): date suggests relatively recent age for brown bears in Préalps

mts, while they only disappear from high part of W Alps at beginning of 20th century.

Ly-1805. Grottes Glacée, Bechloul, Bouira, Algeria 9620 ± 200

Bear bones from clayey fill of "Grotte Glacée" (36° 30′ N, 4° 00′ E). Coll 1977 by P Gillon and P E Coiffait, Univ Constantine, and subm 1978 by G Auboire, Joinville, France. *Comment* (GA): paleontol study still in process will probably confirm bear is *Ursus spelaeus*, who presumably disappeared from Algeria during Neolithic. Date is compatible with this hypothesis and attributes Holocene age to grotto filling.

Grotte Zawalona series, Mnikow, Krakow Province, Poland

Bone of large mammifera from last loess layer mixed with cryoclastic rock rubble of Zawalona grotto (51° 52′ N, 19° 40′ E). Coll and subm 1978 by J L Kozlowski, Inst Archaeol, Univ Jagellon, Krakow.

Ly-2270. Top 14,060 ± 340

From top of layer, just underlying uncharacteristic industry (probably Magdalenian); result is average of two measurements on 2/3 and 14/15, respectively, diluted samples.

Ly-2271. Base 15,380 ± 340

From base of layer, assoc with uncharacteristic Gravettian industry.

General Comment (JKK): both dates offer precise chronology to series of loess and cryoclastic sediments very often found in fill of Polish grottoes; period following main phase of loess sedimentation may be dated to 16,000 or 15,000 BP. This questions hypothesis of contemporaneity between late upper loess and loessic and cryoclastic upper sediments of Polish grottoes.

Ly-2277. Aven Bouët, Les Matelles, Hérault 15,460 ± 380

Bones from fill of karstic fossil system (43° 44′ N, 3° 49′ E). Coll 1979 by J P Brigal and subm 1980 by J L Vernet, Univ Montpellier. Assoc with expected Late Pleistocene fauna containing small feline resembling present-day lion. *Comment* (JLV): date confirms faunal attribution to Late Würmian period.

Ly-2416. Aven des Cervidés, Cournonterral, Hérault 15,700 ± 430

Bones (*Cervus elephas*) from surface of clayey filling in bottom of Les Cervidés aven (43° 41′ N, 3° 41′ E). Coll 1978 by X Gutherz and subm 1980 by A Bonnet, Nîmes. Assoc with fauna of great red deer, horse, bovine, and small capridae, probably from Würmian interstadial or postglacial period. (1/3 diluted sample). *Comment* (AB): dates fauna to Würmian IV when climate fitted well with such fauna.

Ly-2452. Grotte des Bisons, Lurbe-Saint-Christau, Pyrénées Atlantiques 20,830 ± 710

Bones from upper level of fill of grotto, small cavity in karstic system (43° 07′ N, 0° 35′ W). Coll 1977 and subm 1981 by G Marsan, Inst

Quaternaire, Univ Bordeaux. (3/10 diluted sample). *Comment* (GM): dates fauna to Late Würmian with dominance of *Bison priscus, Equus caballus,* and presence of *Ursus spelaeus, Rangifer tarandus,* and *Rupicapra rupicapra,* which also fits paleontol data.

Ly-2102. Grotte de Bos, Caniac du Causse, Lot 21,460 ± 480

Bones from 15 upper cm of gallery fill in small grotto (44° 38′ N, 1° 40′ E). Coll 1978 and subm 1980 by R Séronie-Vivien, Le Bouscat, Gironde. No assoc industry. *Comment* (RS-V): no definite age was expected, but date agrees with value obtained for base of Layer 9b in Pégourié site, Ly-1835: 24,200 ± 1100 (below) and with relatively recent ages previously found in numerous karstic fills of Causse de Gramat region (Philippe, Mourer, & Evin, 1981).

Ly-2415. La Baume Longue, Dions, Gard 26,500 ± 1000

Bones (*Ursus spelaeus*) from base of fill in bottom of "Grand Puits" pit (43° 56′ N, 4° 18′ E). Coll 1970 and subm 1980 by A Bonnet. Assoc with *Ursus spelaeus* and *Crocuta spelaea* probably from Early Würmian. Dates confirm previous measurements from La Sartanette site (Ly-1591: 22,700 ± 1700 and Ly-1590: 21,900 ± 1500, R, 1979, v 21, p 418-419) and from Grotte Latrone (Ly-1966, below) and suggest that cavern bear only disappeared during last part of Würmian in Europe.

Ly-2251. Grotte du Castellas, Dourgne, Tarn 26,400 ± 700

Bones from one of filled levels (43° 29′ N, 2° 09′ E). Coll 1979 by P M de la Morsanglière and subm 1980 by F Prat, Univ Bordeaux. Assoc with tall mammals and Upper Paleolithic industry. (13/15 diluted sample). *Comment* (PMdelaM): dates sediments to Würmian III age in agreement with fauna and archaeol.

Grotte de Bourdette series, Sainte-Colombe en Bruilhois, Lot et Garonne

Bones from several levels (44° 12′ N, 0° 24′ W). Coll 1979 by J Chagneau and subm 1980 by F Prat.

Ly-2345. Couche 1a 32,000 ± 1400

From Layer 1a under 1 to 2.5cm of clay, presumably from Middle or Late Würmian. (13/15 diluted sample)

Ly-2346. Couche 3 inf 30,300 ± 1200

From base of Layer 3, presumably Middle Würmian. (17/30 diluted sample)

Ly-2347. Couche 8 30,400 ± 1000

From Layer 8 at ca 2m deeper than Layer 1a, presumably from Early Würmian. (23/30 diluted sample)

General Comment (JC): three dates attribute fill to same age. Some detected activity suggests contamination, origin of which remains unknown because of overlying clayey sediment. Series could be considered min age

of ⩾ 29,000 BP; the only certain conclusion should be that grotto fill was deposited before Würmian III period.

Ly-1966. Grotte de Latrone, Sainte Anastasie, Gard 29,600 ± 1100

Bone (*Ursus spelaeus*) from soil of gallery at bottom of pit at Russan, (43° 56′ N, 4° 20′ E). Coll 1948 by R Jeantet, preserved in mus and subm 1978 by A Bonnet. Expected date: Early Würm. *Comment* (AB): dates sample to beginning of Würm III and agrees with previous measurement from neighboring site, La Sartanette, Ly-1591: 22,700 BP ± 1700, (R, 1979, v 21, p 48) and from Baume Longue at Dions, Ly-2415 (above). Results confirm *Ursus spelaeus* is present at least up to late Würmian.

Ly-2309. Grotte du Coustal, Noailles, Corrèze ⩾30,000

Bones from fill of Coustal grotto karstic system (45° 05′ N, 1° 20′ E). Coll 1980 by J P Raynal and subm 1981 by M Philippe, Mus Hist Nat Lyon. Assoc with presumed Rissian fauna which may also be Würmian. (1/3 diluted sample). *Comment* (MP): date confirms 1st attribution; it is not Late Würmian and agrees with many other results in Causse de Martel calcareous region (Philippe, Mourer, & Evin, 1981).

Ly-2278. Gouffre de Moustayous, Saint-Pé de Bigorre, Hautes Pyrénées ⩾36,000

Bones (*Lynx lynx*) from surface of gallery fill in karstic system (43° 01′ N, 0° 10′ W). Coll and subm 1980 by A Clot, Bordères sur Echez, Hautes Pyrénées. (1/6 diluted sample). *Comment* (AC): bone does not belong to Late Würmian (Clot, 1982).

C. Samples from fluviatile sediments

Ly-2190. Berge du File, Milly-Lamartine, Saône et Loire Modern $\Delta^{14}C = -2.2 \pm 1.6‰$

Wood from lowest level of sediment series from side of Le File Stream (46° 21′ N, 4° 43′ E). Coll 1979 and subm 1980 by A J Argant, Bron. *Comment* (AJA): date confirms sediment series probably is fill of mill reservoir. Deposit consists of alternating pebbly and clayey sediments overlying rubble; series suggests postglacial deposit overlying Late glacial sediment. ^{14}C date negates need for pollen analyses.

Ly-2299. Larche, Corrèze Modern $\Delta^{14}C = 1.6 \pm 1.4‰$

Bones from low terrace of La Vézère R (45° 8′ N, 1° 26′ E). Coll 1979 by P Y Demars and subm 1980 by J P Raynal, Inst Quaternaire, Univ Bordeaux. Measured to date formation of upper part of terrace. *Comment* (JPR): younger than expected: date only indicates redeposition of sediments and does not give max age to 1st deposition of alluvia on top of terrace.

Bernalda and Pomarico series, Basilicates, Italy

Charcoal from paleosoils in sands of alluvia of coastal rivers between Bernalda and Pomarico near Matera (40° 26′ N, 16° 39′ E). Coll and subm 1978 by S Tazioli, Univ Bari, Italy.

Ly-1852. Paléosol supérieur **840 ± 190**

From 4m depth.

Ly-1851. Paléosol inférieur **1550 ± 350**

From 9m depth. (11/20 diluted sample)

General Comment (ST): both dates agree with expected age of assoc potsherds (Nébois, 1974) and indicate sedimentation rate of alluvia.

Villers-le-Lac series, Doubs

Vegetal remains coll by borings from four levels in deep alluvia lying in local deepening in Le Doubs R valley, upstream from Chaillexon Lake (47° 04′ N, 6° 40′ E). Coll and subm 1977 by M Campy, Dept Géol, Univ Besançon. (9/10 diluted sample for Ly-2027 and -2028).

Ly-2025. 13.75m **2970 ± 130**

Ly-2026. 15.5m **3130 ± 120**

Ly-2027. 18.5m **3220 ± 170**

Ly-2028. 23.5m **4000 ± 160**

General Comment (MC): ages in larger time range were expected. Closer and relatively recent ages obtained prove large Holocene filling, due to rapid lacustrine sedimentation after slide of cliffs into valley (Campy, 1980).

Anglefort series, Ain

Wood from ca 14m depth in Rhône R alluvia, found during laying of foundation of generating sta (45° 55′ N, 5° 50′ E). Coll 1978 by Co Natle Rhône (CNR) and subm 1978 by R Vilain (Ly-1976 and -1977), Dept Géol, Univ Lyon, and 1980 by CNR (Ly-2187).

Ly-1976. No. 1 **2890 ± 150**

Ly-2187. CNR **3550 ± 120**

Ly-1977. No. 6 **6090 ± 160**

General Comment (RV): Ly-1976 is very close to Ly-135: 2880 ± 220 (R, 1971, v 13, p 55), from "Chêne de la Balme" wood found 20km downstream in same alluvia. Expected range of dates was older because of depth. Differences among three samples prove that several deposits of flattened wood occurred at same loc because of meandering main channel in alluvial plain.

Ly-1961. Sion, Valais, Switzerland **3650 ± 140**

Wood from 16m depth in alluvia of Rhône R valley at alt 480m (46° 14′ N, 7° 20′ E). Coll by M Eschbach and subm 1979 by A Bezinge, Sté Grande Dixence, Sion. *Comment* (AB): dates rapid filling of alluvial valley; many assoc artifacts from Roman times.

Blanchon series, Saint-Jean-le-Vieux, Ain

Wood from sandy layer embedded in alluvia of Ain R valley (46° 03′ N, 6° 21′ E). Coll and subm 1978 by A Billard, Inst Geog, Univ Paris.

Ly-2085. No. 1 **7010 ± 130**

Ly-2086. No. 2 **6790 ± 130**

Ly-2087. No. 3 **7060 ± 140**

Ly-2088. No. 4 **7440 ± 130**

General Comment (AB): similar ages of four samples indicate homogeneous deposit. They agree with expected Holocene age of embedding alluvia and show that lowest terrace of river cannot be older than Atlantic period.

Ly-2001. Le Fontanil, Isère **9900 ± 250**

Charcoal from single layer of vegetal material in alluvia of dejection cone underlying alluvia with frost-cracked stones (45° 15′ N, 5° 20′ E). Coll 1969 by M Colardelle and subm 1969 by A Bosquet, Centre Documentation Préhist Alpine, Grenoble. *Comment* (AB): at sampling, embedding sediment was thought to be from interstadial and expected deduced age > 30,000 yr. Date is much younger but still possible if overlying sediment was deposited during very cold phase of Late Dryas period.

Les Torrents du Bochaine series, Hautes-Alpes

Wood from tree trunks rooted in silt and gravel of sloping banks of Bochaine region, Le Buëch R basin, near Aspres-sur-Buëch. Coll 1977 and subm 1978 by M Archambault, Geog Dept, Univ Orléans. Samples listed in table 10.

TABLE 10
Les Torrents du Bochaine

Sample no.	Valley	Village	Loc	Depth	Age BP
Ly-1900	Torrent des Richardets	St Auban d'Oze	(44°30′N, 5°51′E)	−7m	3790 ± 140
-1901	Torrent de Bourdoutane	St Pierre d'Argençon	(44°31′N, 5°43′E)	−2.5m	7150 ± 260
-1899	Torrent Bachassette	Oze	(44°31′N, 5°48′E)	−8m	8820 ± 240
-1902	Torrent Barnèche	Le Saix	(44°29′N, 5°48′E)	−5m	10,040 ± 260

General Comment (MA): last three results agree well with many other tree trunks in region (Archambault, 1967). They all confirm Holocene age of youngest sloping banks. Ly-1900 (R, 1973, v 15, p 516) is younger than expected and may correspond with phase of detrital accumulation after sloping banks' edification period.

Muret series, Haute-Garonne

Wood from 4m depth in alluvia of lowest terrace of La Garonne R 3km SW of Muret (43° 27′ N, 1° 18′ E). Coll and subm 1979 by J C Revel, Lab Pédol, Univ Toulouse.

Ly-2172. No. 1, gravels **9790 ± 170**

Ly-2173. No. 82, sands **9320 ± 200**

General Comment (JCR): both dates confirm chronol homogeneity of sediments and rapid sedimentation rate in valley as samples come from distance of 1.5km of actual river bed. They also confirm Holocene age attributed to terrace and are close to other results from sample found in same alluvia ca 150km downstream at Golfech near Valence d'Agen, Gif-2338: 8900 ± 160 (R, 1974, v 16, p 62).

Pugère du Rocher series, Sénas, Bouches du Rhône

Samples from several levels in alluvial cone lying on one of terraces of La Durance R (43° 45′ N, 5° 13′ E). Coll 1976 by G Clauzon, Inst Geog, Univ Aix-en Provence.

Ly-1917. A-142 **10,440 ± 460**

Bones from upper level of cone, assoc with Epipaleolithic industry (Escalon de Fonton, 1976). (1/3 diluted sample)

Ly-1972. A-142 bis **34,800 $^{+3300}_{-2300}$**

Small bits of charcoal scattered in same levels as Ly-1917.

Ly-2320. A-231 **≥28,200**

Terrestrial gastropod shells from lower level of cone. (1/10 diluted sample)

General Comment (GC): Ly-1917 agrees with age of Montadian (Epipaleolithic) assoc industry attributed by previous measurement on sample from Layer 3 of neighboring La Montagne site (Escalon de Fonton, 1976), MC-1159: 9000 ± 100. This value also dates end of cone formation while Ly-1972 proves redeposit of ancient materials previously dated at Vautubières to ca 31,000 BP, Ly-769 (R, 1975, v 17, p 9) and Ly-1002 (R, 1976, v 18, p 65). Ly-2320 gives min age for bottom of alluvial cone and therefore to River terrace, as terrace was deposited after La Durance capture by Le Rhône R; Ly-2320 also proves that capture occurred before Late Würmian.

Ly-2103. Polignac, Haute-Loire **33,000 ± 1000**

Horse bones (45° 4′ N, 3° 52′ E). Coll 1979 by R Séguy, Le Puy, and subm 1979 by J P Raynal, Inst Géol Quaternaire, Univ Bordeaux. No assoc industry. (2/3 diluted sample). *Comment* (JPR): comparable with Ly-1988 (below) from lowest levels of Les Riveaux site in which same horse was discovered. Both dates agree well with expected Würmian III.

Ly-1988. Les Rivaux Loc 1 base, Espaly-Saint-Marcel, Haute-Loire **30,600 $^{+1600}_{-1300}$**

Horse bones from base of B unit, Levels 312 and 316, Loc 1, (45° 3′ N, 3° 51′ E). Coll 1977 by J P Raynal and subm 1978. *Comment* (JPR):

date agrees with sedimentol, paleontol, and archeol data which attribute Würmian III age to base of Unit B (Raynal *et al*, 1980).

Erquighem-sur-la-Lys series, Nord

Silt with vegetal debris from several levels of boring in deep alluvia of La Lys R (50° 40′ N, 2° 50′ E). Coll 1977 by Bur Recherches Géol Min and subm 1979 by J Sommé, Univ Lille.

Ly-2029. 46 **20,640 ± 750**

From 7.5 to 7.75m depth. Pollen diagram indicates 40% of arboreal pollen with dominance of *Pinus* and presence of *Corylus, Alnus,* and *Picea.* Attributed to Weichselian interstadial. (1/3 diluted sample)

Ly-2030. 45 **24,000 ± 600**

From 7.8 to 7.95m depth. Pollen diagram indicates 20% arboreal pollen with dominance of *Pinus* and *Corylus* and presence of *Alnus.* Attributed to Weichselian interstadial. (2/3 diluted sample)

Ly-2031. 28 **35,000 $^{+1700}_{-1500}$**

From 13.5 to 13.75m depth. Pollen diagram indicates 90% arboreal pollen with dominance of *Corylus* and presence of *Alnus, Quercus, Ulmus,* and *Fraxinus.* Attributed to 2nd part of Middle Eemian interglacial. (9/10 diluted sample)

Ly-2032. 26 **29,000 ± 700**

From 14 to 14.25m depth. Pollen diagram indicates same data as Ly-2031.

General Comment (JS): Ly-2031 and -2032 must be considered min ages, detected low activity from contamination not eliminated by chemical pretreatment. Ly-2029 and -2030 agree with Weichselian attribution, but slightly older dates corresponding to interstadials generally dated from 40,000 to 30,000 BP were expected. Some contamination may be present.

D. Samples from various continental sediments

Massif forestier d'Osseja series, Pyrénées Orientales

Charcoal from sub-surface sediments in SE Osseja (42° 22′ N, 2° 07′ E). Coll by J N Puig and subm 1980 by J L Vernet, Univ Montpellier, to date min age of underlying soil, to evaluate age of colluvia contemporaneous with charcoal, and to establish evolution of vegetation. Table 11 lists results.

TABLE 11
Massif forestier d'Osseja

Sample no.	Sample ref	Colln date	Dilution ratio	Age BP
Ly-2412	80026 Le Puig	1980	1/3	280 ± 190
-2413	80022 Couronnes	1980	1/6	1380 ± 240
-2414	8195 Rhodoraie	1978	2/5	1410 ± 180

General Comment (JLV): dates prove that different periods of clearing of sub-alpine and mountainous forests occurred from 4th to 8th centuries and from 15th and 19th centuries.

Forêt domaniale de Bédoin series, Vaucluse

Very small amount of charcoal from several levels of pedologic profile at 820m alt in Bédoin forest (44° 09′ N, 5° 13′ E). Coll and subm 1978 by M Thinon, Lab Bot, Marseille. Table 12 lists results.

TABLE 12
Forêt domaniale de Bédoin

Sample no.	Sample ref	Depth	Dilution ratio	Age BP
Ly-1693	Bédoin 3	30cm	1/10	710 ± 500
-1692	Bédoin 2	50cm	1/10	1540 ± 470
-1691	Bédoin 1	1m	1/6	1830 ± 440

General Comment (MY): despite large uncertainty margins due to small amounts of available material, three results confirm botanic study of charcoal which suggests recent anthropogenic deforestation and substitution of *Quercus* sp and *Taxus baccata* by *Quercus ilex* (Thinon, 1978).

Ly-2000. Bois du Spitzberg **2200 ± 130**

Fragment of black tree trunk from Spitzberg (78° 00′ N, 17° 00′ E). Coll 1965 by J Corbel, Caluire, preserved in ^{14}C lab and measured 1978. *Comment*: date is comparable with values often found on such ice-floating wood which probably come far from S continent, see eg, Lu-241: 2650 ± 55 BP from Adventdalen, Spitzberg (R, 1970, v 12, p 546).

Ly-1960. Glacier de Tzeudet, Valais, Switzerland **8110 ± 180**

Fragment of tree trunk found at 2460m alt on moraine surface of Tzeudet glacier, on slope of Vélan Mt near Bourg-Saint-Pierre (45° 53′ N, 7° 11′ E). Coll by M May and subm 1979 by A Bezinge, Sté Grande Dixence, Sion. *Comment* (AB): date corresponds well with many other measurements on moraine wood from region, eg, from Arolla glacier, Ly-749: 8400 ± 200; Z'Mutt glacier, Ly-681: 7590 ± 180 (both in R, 1975, v 17, p 7, 8); Gorner glacier, Ly-298: 8160 ± 220 (R, 1972, v 15, p 135). These dates indicate very high uplift of timber line at end of Boreal period (Vivian, 1975; Bezinge & Vivian, 1976).

Ly-2294. Glacier de Thorens, Saint-Martin-de-Belleville, Savoie **3920 ± 100**

Fragment of tree trunk from 2200m alt in Thorens glacial moraine (45° 22′ N, 6° 30′ E). Coll and subm 1980 by R Vivian, Inst Geog Alpine, Univ Grenoble. *Comment* (RV): date agrees with those of similar trees of Belleville region at alt > 2000m, which is presently above timber line. Dates indicate that forest grew at this alt during end of Atlantic period and probably disappeared at beginning of Sub-boreal.

Creissels series, Aveyron

Calcareous tufa from two tufa cliffs rising above Tarn R valley (44° 05′ N, 1° 35′ E). Coll and subm 1978 by A Tavoso, Univ Marseille.

Ly-2316. Tuf des cascades **24,000 ± 500**

Ly-2315. Tuf des Roches du Château **32,500 ± 1000**

General Comment: despite uncertainty of this material, both dates agree with geol interpretations of age formation of both tufas: one is attributed to Late Würmian, other to Würmian interstadial. Ly-2315 should be considered min age (Ambert & Tavoso, 1981).

E. Samples from marine and lagoonal sediments

Lac Tanma series, Cayar region, Sénégal

Table 13 lists samples of gray or black clay with vegetal remains from several levels in borings from sediments of Tanma coastal lake (14° 54′ N, 17° 05′ W). Coll and subm 1979 by J Médus, Lab Bot Hist, Univ Marseille.

TABLE 13
Lac Tanma

Sample no.	Boring	Depth	Dilution ratio	Age BP
Ly-2264	S 4	7m	1/3	7610 ± 260
-1911	S 4	8m	3/20	5990 ± 530
-2265	S 4	12m	11/15	7790 ± 190
-2057	S 4	15m	1	7790 ± 150
-2058	S 4	17m	1/7	9550 ± 480
-1893	S 4	20m	1/5	10,640 ± 600
-1973	S 4 ?	45m	5/6	4070 ± 250
-2023	S 4 ?	48m	1/10	6080 ± 450
-2024	S 4 ?	49m	3/20	7170 ± 400
-2266	S 2	12m	13/30	7760 ± 240
-2267	S 2	19m	7/30	7830 ± 260
-2268	F 5	2m	1/6	1560 ± 240
-2269	F 5	12m	14/15	7510 ± 150

General Comment (JM): Ly-1893, -1973, and -2029 remain unexplained. For all other samples, dates fit well with depths and sea-level fluctuation curve drawn from other data (Faure & Elouard, 1967), mainly from Mauritania coast (Einsele *et al,* 1977). Ly-2058 and -1893 correspond with short transgression which rose again ca 8000 BP (6 results) and reached max with Ly-1911. Ly-2268 indicates that Tanma Lake was lagoon up to recent period, like previously dated Retba Lake (R, 1976, v 18, p 68).

Delta du Sénégal series, Sénégal

Table 14 lists samples of marine shells from several geol secs of sediments of Sénégal R delta near Saint-Louis. Coll and subm 1978 to 1980 by J Monteillet, Dept Geol, Inst Fondamental Afrique Noire, Dakar.

TABLE 14
Delta du Sénégal

Sample no.	Site ref	Loc	Sample	Dilution ratio	Age BP
Ly-2158	Gandon (I-A bis)	(16°56′N, 16°26′W)	*Anadara senilis*	1	5200 ± 120
-2039	Piste Dahra-Linguère (8021)	(15°27′N, 15°15′W)	*Limnicolaria chudeanei*	1/2	660 ± 150
-1931	Ndig (2a)	(16°17′N, 16°19′W)	*Pachymelania aurita*	1/2	1080 ± 210
-2045	Mbodiène (8027)	(16°12′N, 16°15′W)	*Pachymalania aurita*	1	1440 ± 120
-2042	Boubene I (8024)	(16°07′N, 16°23′W)	*Pachymelania aurita*	3/5	1490 ± 180
-2043	Djeus Boubene (8025)	(16°08′N, 16°23′W)	*Pachymelania aurita*	1/2	1580 ± 160
-1928	Guembeul (K G 2)	(15°55′N, 16°28′W)	*Anadara senilis*	1	1290 ± 130
-1927	Guembeul (K G 1)	(15°55′N, 16°28′W)	*Anadara senilis*	1	1530 ± 130
-1926	Khant (KTM 2a)	(16°02′N, 16°22′W)	*Pachymelania aurita*	4/15	1650 ± 280
-1925	Khant (KTM 1b)	(16°03′N, 16°21′W)	*Anadara senilis*	1	2760 ± 120
-2041	Dialame (8023)	(16°08′N, 16°20′W)	*Pachymelania aurita*	2/3	3280 ± 150
-2044	Savoigne 3 (8026)	(16°12′N, 16°17′W)	*Pachymelania aurita*	4/5	3230 ± 170
-1932	Savoigne (SV-Ic)	(16°12′N, 16°18′W)	*Anadara senilis*	14/15	5310 ± 240
-1933	Savoigne (SV-4b)	(16°13′N, 16°17′W)	*Anadara senilis*	1	5640 ± 190
-2040	Makhana puits DD2 (8022)	(16°05′N, 16°23′W)	*Anadara senilis*	1	5770 ± 130
-1930	Dialam Dia	(16°08′N, 16°20′W)	*Tourbe*	1	6060 ± 150
-1929	Djeus boubene (Dj. B C)	(16°08′N, 16°23′W)	*Anadara senilis*	1	6080 ± 190
-1918	Niaodoum (S)	(16°03′N, 16°24′W)	*Pachymelania aurita*	1	2150 ± 130
-1919	Ndiael (1)	(16°17′N, 16°01′W)	*Typanotonus fuscatus*	1	4450 ± 140
-1923	Tieng-To (10-11m)	(16°18′N, 16°21′W)	*Anadara senilis*	1	6980 ± 190
-1920	Diama Do (2-3m)		*Pachymelania sp*	3/10	1690 ± 220
-1924	Tieng T 5 (21-22m)	(16°18′N, 16°21′W)	*Pachymelania tympanotonus*	1/10	7320 ± 600
-1922	Diama Do (10m)	(16°11′N, 16°25′W)	*Anadara senilis*	1	6990 ± 180
-1921	Diama Do (11.5 à 12m)	(16°11′N, 16°25′W)	*Anadara senilis*	1	⩾33,700

General Comment (JM): Ly-2158 confirms previously pub result, Ly-1346: 5200 ± 210 (R, 1979, v 21, p 426). These two series establish local variation curve of sea level from 8000 BP to present and amount of continental flexure during last transgression (Faure *et al*, 1980). They also indicate wet climatic phase between 2000 and 3000 BP.

Salinas series, Alicante prov, Spain

Clay with very low organic content from two depths in upper sediments of shallow pond at Salinas near Elda (38° 27′ N, 0° 57′ W). Coll and subm 1978 by G Truc, Dept Geol, Univ Lyon. (4/15 diluted samples)

Ly-1654. 25cm **1850 ± 400**

Ly-1653. 45cm **1510 ± 390**

General Comment (GT): small amount of organic matter prevents distinction of two layers only separated by 20cm depth. Average value sug-

gests relatively high sedimentation rate of ca 20cm millennium for bottom sediments of basin which was formed by Triassic diapir and is still salt marsh.

Mas de Listel series, Le Grau du Roi, Gard

Marine shells from present surface of Listel-Ventadis, ancient offshore bar in SW part of Rhône R delta (43° 45′ N, 4° 10′ E). Coll and subm 1978 by J Archambault, Univ Orsay and A L'Homer, Bur Recherche Geol Min, Orléans, during study of offshore bar formations of Rhône delta.

Ly-1764. Coupe de Mondragon, J9 **1090 ± 200**

Tests of *Cerastoderma glaucum*, shells.

Ly-1765. Cordon de Listel-Ventadis, no. 21 **1880 ± 230**

Several spp of *Cardiaces* shells. (9/10 diluted sample)

General Comment (JA): both dates give Holocene age to Listel-Ventadis offshore bar, in agreement with general trend of coastal evolution deduced from other data (see, eg, Le Grau du Roi series, R, 1979, v 21, p 426; Bazile *et al,* 1981); this may be due to different chemical evolution of shells (Archambault-Guézou, in press).

Ly-2035. L'Aubette, Berre l'étang, Bouches du Rhône 1740 ± 430

Shells (*Chlamys glabra*) from remains of quarry (43° 27′ N, 5° 10′ E). Coll 1980 by E Colomb, Univ Marseille, and subm 1980 by A Prieur, Dept Geol, Univ Lyon. (1/5 diluted sample). *Comment* (AP): paleontol expected age, end of Quaternary. Recent age of shells suggest they did not come from geol terrace but were brought in by man.

Ly-2105. Corail de Uré, Ile des Pins, New Caledonia 19,490 ± 330

Calcium carbonate from cement of coral breccia found during digging of well at Uré in Kanuméra Bay (22° 40′ S, 167° 25′ E). Coll 1977 by D Frimigacci and subm 1980 by F Poplin, Mus Natl Hist Nat, Paris. Coral breccia contains *Sylviornis neocaledoniae* fauna. *Comment* (FP): main coral level in which Uré well was dated to > 100,000 yr by UTh dating method. ^{14}C date suggests coral breccia may assoc old coral and much younger material and cement but does not attribute age to fauna, as very low collagen content of bones prevents direct measurement of bones (Poplin, 1980).

La Mer Pélagienne series, Tunisia

Table 15 lists samples from borings, dredgings, and collns made 1976 and 1977 in deep sea, on continental plateau, and on continent in Pelagian Sea region (Gabès Gulf) during sedimentol study of continental platform of region by Co fr Pétroles and Soc Natle Elf-Aquitaine. 10% of 760 samples were dated by Lyon, Gif-sur-Yvette, and Monaco ^{14}C labs. Details of environment, sample descriptions, interpretations of results were pub (Burollet, Clairefond, & Winnock, 1979). Most measurements were made on total carbonate fraction of samples (except Ly-1753 and -1679) because

some preliminary assays showed that results obtained on organic fraction and those on carbonate fraction (eg, Ly-1753/1752, Ly-1679/1680) are close enough for purposes of study (Delibrias & Evin, 1979). As there was very little organic matter and almost no detrital carbonates, dates on total carbonate fraction was assumed sufficient.

TABLE 15
La Mer Pélagienne

Lab no.	Sample no.	Depth	Colln yr	Loc	Dilution ratio	$\delta^{13}C$ ‰	Age BP
			Gulf borings				
Ly-1717	KST-10	20-30cm	1976	(33°52′N, 10°26′E)	1	+2.29	21,250 ± 550
-1726	KST-19	150-162cm	1976	(31°14′N, 10°50′E)	4/5	+2.29	8580 ± 330
-1727	KST-19	325-327cm	1976	(31°14′N, 10°50′E)	1	+2.29	18,350 ± 440
-1728	KST-19	445-455cm	1976	(31°14′N, 10°50′E)	1	+2.29	27,200 ± 1000
-1718	KST-21	Surface	1976	(31°17′N, 11°05′E)	1	+2.29	4630 ± 160
-1711	KST-21	220-230cm	1976	(31°17′N, 11°05′E)	1	+2.29	9930 ± 210
-1677	KST-21	225-230cm	1976	(31°17′N, 11°05′E)	1	+2.29	9830 ± 230
-1678	KST-21	435-440cm	1976	(31°17′N, 11°05′E)	1	+2.0	27,100 ± 1000
-1712	KST-21	440-447cm	1976	(31°17′N, 11°05′E)	1	+1.5	31,200 ± 2000
-1713	KST-102	221-238cm	1976	(34°19′N, 11°52′E)	1/2	+3.6	12,600 ± 500
-1714	KST-102	458-479cm	1976	(34°19′N, 11°52′E)	1	+2.1	20,740 ± 550
-1725	KST-103	190-200cm	1976	(34°21′N, 12°07′E)	1		21,300 ± 500
-1679	KST-104	58-63cm	1976	(34°20′N, 12°22′E)	1/10	+9.90	11,200 ± 860
-1680	KST-104	58-63cm	1976	(34°20′N, 12°22′E)	1	+2.90	12,960 ± 260
-1681	KST-104	117-120cm	1976	(34°20′N, 12°22′E)	1/2	+2.90	18,300 ± 800
-1719	KST-106	10-20cm	1976	(34°20′N, 12°51′E)	5/6	+1.6	13,300 ± 350
-1682	KST-106	168-170cm	1976	(34°20′N, 12°51′E)	9/10	−1.6	12,850 ± 400
-1683	KST-106	170-172cm	1976	(34°20′N, 12°51′E)	2/3	−1.6	13,490 ± 550
-1684	KST-106	325-335cm	1976	(34°20′N, 12°51′E)	1	+1.3	13,650 ± 320
-1685	KST-107	32-36cm	1976	(34°27′N, 12°12′E)	1	+1.7	13,050 ± 260
-1686	KST-107	60-65cm	1976	(34°27′N, 12°12′E)	1	+1.7	17,200 ± 450
-1721	KST-110	225-240cm	1976	(34°40′N, 13°15′E)	2/3	+0.3	22,400 ± 800
-1720	KST-110	350-365cm	1976	(34°40′N, 13°15′E)	1	+0.1	23,300 ± 750
-1722	KST-118	445-458cm	1976	(34°46′N, 13°04′E)	1	+1.6	27,600 ± 1000
-1723	C-27	170-185cm	1977	(36°38′N, 12°18′E)	5/6	−0.1	18,020 ± 520
-1724	C-27	560-575cm	1977	(36°38′N, 12°18′E)	2/3	+0.4	20,100 ± 800
			Dredging and "Doris" boring in Gulf				
Ly-1687	DRT-16	0cm	1976	(31°10′N, 10°33′E)	1		1500 ± 140
-1715	DW-2	3245cm	1976	(34°26′N, 11°18′E)	1		30,500 ± 1700
-1716	DW-2	4296cm	1976	(34°26′N, 11°18′E)	1	+1.4	⩾35,000
			Sampling on continent and in Sebkhra region				
Ly-1757	HA-1	45-50cm	1977	(34°21′N, 10°19′E)	2/5	+2.4	5930 ± 340
-1707	HA-40	0cm	1977	(34°21′N, 10°13′E)	1/2	−1.5	8580 ± 360
-1708	KN-41	0cm	1977	(34°40′N, 11°08′E)	1	−4	34,500 ± 2000
-1705	KN-54	0cm	1977	(34°37′N, 11°03′E)	1		9730 ± 190
-1706	KN-60	0cm	1977	(34°47′N, 11°16′E)	1		17,760 ± 480
-2006	KSS		1977	(34°19′N, 10°18′E)	1		5140 ± 180
			Dredging in herbariums region				
Ly-1709	KK-7	20cm	1977	(34°42′N, 11°19′E)	1/2	+2.6	4420 ± 300
-1751	KK-24	120-130cm	1977	(34°40′N, 11°10′E)	1	+3.1	1830 ± 140
-1752	KK-29	90-100cm	1977	(34°44′N, 11°19′E)	1	+2.3	2430 ± 160
-1753	KK-29	90-100cm	1977	(34°44′N, 11°19′E)	9/10		1040 ± 250
-1754	KK-29	100-110cm	1977	(34°45′N, 11°19′E)	1	+4.1	1860 ± 150
-1710	KK-44	38cm	1977	(34°48′N, 11°20′E)	5/6	+2.2	5920 ± 260
-1755	KK-45	130-140cm	1977	(34°49′N, 11°18′E)	1		3450 ± 150
-1756	KK-46	125-135cm	1977	(34°49′N, 11°17′E)	1	+4.7	1150 ± 130

General Comment: 24 and 9 other results, respectively, were obtained by Gif and Monaco labs from same zone or same cores. All results agree perfectly with each other and all values were pub by CFP Soc and T Lajmi, Geol Survey Tunisia (Burollet, Clairefond, & Winnock, 1979). Conclusions drawn from ^{14}C analyses are described in Delibrias & Evin (1979). All results agree with data from other facets of study (palynol, sedimentol, and paleontol), demonstrating that carbonate sediments of Pelagian Sea were recently deposited either during Neotyrrhenian (Late Würmian) period or Versillian (Holocene) period.

Ly-2420. Oued Akarit, Tunisia **8240 ± 170**

Cardium shells from +10m alt in lagoonal layer embedded in Würmian terrace of Oued Akarit R, SE of Gabès (34° 07′ N, 7° 40′ E). Coll and subm 1981 by P Sanlaville, Univ Lyon. *Comment* (PS): date confirms other unpub measurements and suggests rise of shore of ca 20m in eight millennia.

Oued Karrouba series, Tunisia

Marine shells from offshore bars between mouths of Oued Ferd and Oued Saquiet el Karrouba R, SE of Gabès (33° 47′ N, 7° 54′ E). Coll 1981 by R Paskoff and P Sanlaville and subm 1981 by P Sanlaville, Univ Lyon.

Ly-2418. +3m **5530 ± 160**

Ly-2419. +4m **5490 ± 130**

General Comment (PS): both values confirm assumed Holocene age of offshore bars which redeposit materials from ancient Thyrennian offshore bars. They also confirm two unpub results from neighboring Oued Melah R site, MC-2155: 6420 ± 100; MC-2154: 6200 ± 100. These four dates indicate Holocene shore was higher than present sea levels in S Tunisia.

Tin Oueich series, Mauritania

Marine shells from two calcareous beds outcropping at Tin Oueich, 25km SE of Nouackchott (18° 4′ N, 15° 49′ W). Coll 1980 by J Evin et D Carité, Fr Tech assistance at Nouackchott (Carité, 1977).

Ly-2160. Plateau **35,800 $^{+1900}_{-1600}$**

Shells (*Anadar senilis*) from lumachelle layer at +4m.

Ly-2189. Zone base **29,900 ± 600**

Shells (*Crassostrea gasar*) from falun layer at +2m.

General Comment (DC): both layers are made of sediments deposited during transgressive phases. According to sediment facies, layer of lowest region of site was presumed to be deposited during Nouackchottian transgression which was dated many times (see, eg, Nouackchott series with Ly-350: 5510 ± 120, R, 1975, v 17, p 15). However, both results indicate two phases of single transgression in site; Inchirian transgression which

was also dated many times in region, eg, at Tafarit Cap, Ly-443: 31,400 $^{+2300}_{-1800}$ (R, 1975, v 17, p 16).

III. ARCHAEOLOGIC SAMPLES

A. Historic period

Ly-2274. Pirogue du Lac de Paladru, Lepin, Isère 580 ± 230

Wood from monoxyl barge found in mud of Paladru Lake (45° 27′ N, 5° 33′ E). Coll 1979 and subm 1980 by M Colardelle, Centre Archéol Hist, Grenoble. (2/5 diluted sample). *Comment* (MC): despite large uncertainty due to small sample size, date confirms historic period expected from iron nails fixed in wood (Laurent, 1968).

Ly-2252. Garnat sur Engièvre, Allier 900 ± 110

Wood from monoxyl barge from 2.5m depth in alluvium of channel of Loire R (46° 38′ N, 3° 42′ E). Coll and subm 1980 by M Sauget, Dir Antiquités Hist, Clermont-Ferrand. No assoc industry (Vertet, 1981). (9/10 diluted sample). *Comment* (JMS): date assigns medieval age to boat.

Ly-2199. Epervans, Saône 1 1260 ± 140

Fragments of monoxyl barge found at Epervans, Saône et Loire (46° 45′ N, 4° 55′ E). Coll and subm 1979 by L Bonnamour, Mus Denon, Châlon. Assoc mainly with Gallo-Roman ceramics but also with some Merovingian vases. *Comment* (LB): younger than expected, but date is not surprising for such a boat, shape of which remains fairly unchanged from Early Neolithic up to 19th century AD.

Ly-1845. La Tour des Chiens, Corenc, Isère 490 ± 160

Bark (*Picea* sp) found in mortar of stone wall (45° 14′ N, 5° 47′ E). Coll and subm 1978 by M Lafont, Corenc. *Comment* (ML): text certifies that "La Tour des Chiens" was already built in AD 1241; date indicates either wall was built after main bldg or was later repaired.

Bois de l'Abbaye de St Victor series, Marseille, Bouches du Rhône

Fragments of two pieces of wood from treasure of Saint Victor abbey (48° 18′ N, 5° 23′ E). Coll and subm Dec 1979 by A Pons, Lab Palynol, Marseille and measured in March 1980. According to old tradition, wood was considered relics from 1st century AD; they were brought to Marseille in 13th century, but disappeared for short time during French Revolution and beginning of 19th century. Three dates are possible: beginning of Christian era, Middle ages, or 19th century.

Ly-1990. Bois long 710 ± 150

Ly-1991. Bois court 750 ± 150

General Comment (AP): closeness of dates of both wood fragments which also belong to same sp (*Salix alba* L) confirms they are of same origin if not same tree. Dates are of Middle ages probably corresponding to Crusades. They also indicate that temporary disappearance of wood did not affect their relative authenticity.

Eglise de Viuz series, Faverges, Haute Savoie

Human bones and charcoal (Ly-1879) from grave in Saint-Jean-Baptiste Church (45° 45′ N, 6° 17′ E). Coll 1978 and subm 1979 by M Colardelle.

Ly-1877.	**150**	**490 ± 120**
Ly-1878.	**71**	**1010 ± 130**
Ly-1879.	**61**	**2210 ± 130**
Ly-1880.	**29**	**880 ± 140**

General Comment (MC): Ly-1879 may be too old because of vicinity of older archaeol layers. Three other values seem to confirm archaeol data that nobody was buried in church after 15th or 16th century (Colardelle, 1980).

Nécropole Saint-Girard series, Sainte-Croix, Drôme

Bones and charcoal (Ly-1874) from several graves in Saint-Girard necropolis (44° 46′ N, 5° 16′ E). Coll 1978 and subm 1979 by M Colardelle.

Ly-1871.	**Sépulture 29**	**870 ± 150**
Ly-1872.	**Sépulture 55**	**1010 ± 140**
Ly-1873.	**Sépulture à chambre**	**730 ± 130**

General Comment (MC): three dates establish chronology of 1st occupation period of necropolis.

Ly-2293. Les Bellets, Saint-Pancrasse, Isère 1610 ± 130

Charcoal from presumed lime-kiln excavation on Les Petites-Roches Plateau (45° 16′ N, 5° 53′ E). Coll 1978 by C Jail and subm 1979 by M Colardelle, Centre archéol Hist, Grenoble. Plateau was occupied since High Middle age. (5/6 diluted sample). *Comment* (MC): date is a little older than expected and suggests that lime kilns were occupied as soon as end of Roman times.

Ly-2306. Le Pusmin de Saint Armel, Sarzeau, Morbihan 380 ± 120

Wood fragment from lintel of door of house (47° 31′ N, 2° 48′ W). Coll and subm 1980 by P Gevin, Geol Dept, Univ Lyon. *Comment* (PG): previous date on timber of basement of house was much older: Ly-1626: 1250 ± 150 (R, 1979, v 21, p 428). Present date, ca AD 1570, exactly fits with inscription on another lintel of house.

Ly-2179. Sépulture 2, CD 258, Saint-Germain-des Fossés, Allier 1130 ± 120

Human bones from Sépulture 2 from graves at side of CD 258 rd (46° 12′ N, 3° 26′ E). Coll 1979 and subm 1980 by J P Daugas and L Magoga, Dir Antiquités Préhist Auvergne, Clermont-Ferrand, and J P Raynal, Inst Quaternaire Bordeaux, Talence. (2/5 diluted sample). *Comment*

(JPD & JPR): date confirms High Middle age sepulture close to Gallo-Roman archaeol site overlapping child's grave probably from Neolithic period.

Ly-1777. Mérignac, Gironde **1180 ± 190**

Bones from grave lying at level −1.6m in SE apse of old church of Saint-Vincent (44° 51′ N, 0° 39′ W). Coll and subm 1977 by J Sautreau, Léognan. This 1st Christian church at Mérignac was built on ruins of Roman bldg and became necropolis at beginning of Middle ages. *Comment* (JS): date confirms archaeol hypothesis that grave cannot belong to end of Roman times.

Brandes series, l'Alpes d'Huez, Isère

Bones from cemetery of ancient village of Brandes (45° 05′ N, 6° 05′ E). Coll 1978 by J Bruno and M C Bailly-Maître and subm 1979 by M Colardelle. Village was settled during 11th century near silver-lead mine and deserted during 15th century.

Ly-2272. Tombe NE **600 ± 120**

From NE grave, at 2.5m depth. (4/5 diluted sample)

Ly-2273. Tombe NC **610 ± 150**

From NC grave at 2.5m depth. (7/30 diluted sample)

General Comment (MC): both dates are mid-14th century and in expected range, confirming contemporaneity of graves.

Ly-1874. Eglise Saint-Martin, Saint-Julien-en-Genèvois, Haute Savoie **1080 ± 140**

Charcoal from grave in Saint-Martin Funerary basilica (46° 08′ N, 6° 05′ E). Coll 1978 and subm 1980 by M Colardelle. *Comment* (MC): date confirms fairly late use of basilica (Colardelle, 1980).

Roissard series, Isère

Charcoal from dwelling (Ly-1875) and necropolis (44° 53′ N, 5° 38′ E). Coll 1978 and subm 1979 by M Colardelle.

Ly-1875. Fond de cabane **1180 ± 130**

From hearth in cabin of presumed Merovingian dwelling.

Ly-1876. Sépulture 9 **1640 ± 140**

From Sépulture 9 of necropolis containing artifacts of High Middle ages. (1/2 diluted sample)

General Comment (MC): both dates agree with expected ages; Ly-1875 dates ca AD 770, very end of Merovingian times, and Ly-1876, ca AD 310, beginning of High Middle ages, considering uncertainty margin; necropolis must have been in use early.

Ly-1801. Le Champ des Pics, Saint-Yvoine, Puy de Dôme **1420 ± 200**

Human bones from Le Champ des Pics Cemetery (45° 35′ N, 3° 13′ E). Coll 1880 by M Millon and subm by A Cogoluehnes, Dept Geol, Univ

Lyon. *Comment* (AC): date indicates Middle age for tombs without assoc industry.

Les Valleyres series, Cussac-sur-Loire, Haute Loire

Samples from foot-hill sediments underlying rocks (44° 58′ N, 3° 55′ E). Coll 1979 and subm 1981 by A Crémillieux, Le Monastier-sur-Gazeille, Haute-Loire. Assoc with less characteristic industry and rich fauna (Crémillieux, 1979).

Ly-2437. 1 **1750 ± 160**

Charcoal. (23/30 diluted sample)

Ly-2439. 2 **1880 ± 220**

Bones. (4/15 diluted sample)

General Comment (AC): both dates are much younger than expected. Age of ca 30,000 yr was expected from regular stratification of sediment and presence of cut flints. Modern value cannot be explained without complete study of site.

Ly-2344. Font Carluze, Perols/Vézère, Corrèze **2020 ± 110**

Wood fragment from Gallo-Roman oak pipe from peat bog (45° 35′ N, 2° 02′ W). Coll 1969 and subm 1980 by G Lintz, Dir Antiquités Hist, Limoges. *Comment* (GL): dated to calibrate 1st dendrochronol curve in Limousin region. Date confirms expected Gallo-Roman period.

B. Protohistoric period

Kandiama series, Velingara, Haute Casamance, Sénégal

Table 16 lists samples of charcoal from fill of three galleries at a few m depth in soil (13° 10′ N, 13° 51′ W). Coll and subm 1979 by J Girard, Lab Ethnol, Univ Lyon II. Galleries are assumed troglodyte habitats or underground hiding places of ancient kingdom of Tekrour, destroyed ca AD 1350; they also might be drifts of ancient laterite mine.

TABLE 16
Kandiama

Sample no.	Gallery	Dilution ratio	$\delta^{13}C$ ‰	Conventional age
Ly-1993	Kandamia C'h	1	−0.1 ± 1.7	Modern
-1992	Kandamia C'm	1	+0.7 ± 1.8	Modern
-1994	Kandamia C'b	1	−0.2 ± 1.6	Modern
-1995	Kandamia C'b	2/3	+0.9 ± 2.2	Modern
-1996	Kandamia C'b	1	0.00 ± 1.8	Modern
-1997	Kandamia C'b	1	+2.4 ± 1.9	Modern

General Comment: if charcoal was actually embedded in sediments, fill of galleries is modern. Dates do not confirm expected age (6th-7th century) attributed to all galleries. Modern values suggest that previous pub results (Kandiama series, R, 1979, v 21, p 431) are either too old or are apparent age of burned wood. Thus, both series cannot be used to confirm ethnol hypothesis on origin of galleries (Girard, 1980).

Ly-2188. Mbaouane, Cayar, Sénégal **1410 ± 140**

Charcoal scattered in lowest levels of sandy dune (14° 44′ N, 17° 07′ W) containing potsherds and overlying Neolithic site. Coll and subm 1980 by J Evin and A Ravisé, IFAN, Dakar. *Comment* (AR): date is much younger than expected and proves recent change in loc of dune with transport of relatively heavy material. Charcoal cannot be considered contemporaneous with site.

Sintiou Bara series, Matam Dept, Sénégal

Table 17 lists samples of charcoal from several levels in three archaeol excavations in ancient village Sintiou Bara, near Ourossogui, le Fleuve region (15° 42′ N, 13° 24′ W). Coll 1977 and subm 1977 by G Thilmans, IFAN.

TABLE 17
Sintiou Bara

Lab no.	Sample ref	Excavation sq	Depth	Dilution ratio	Age BP
Ly-1741	IFAN 124	M 16	205cm	2/5	1470 ± 210
-1742	IFAN 126	O 16	160cm	4/7	970 ± 150
-1743	IFAN 127	K 16	96cm	3/5	1460 ± 220
-1744	IFAN 128	K 17	134cm	1	1090 ± 160
-1745	IFAN 129	K 16-17	165cm	1	1550 ± 140

General Comment (GT): results agree with archaeol data and other series from same type of site in region (Ogo, Saré Tioffi, and Tioubalel series, below). With three unpub results: Dak-192: 900 ± 110 (sq L 14, 225cm), Dak-155: 1363 ± 120 (sq M 18, 270cm), and Gif-4522: 920 ± 80 (sq X 16, 255cm), series suggests site occupation for at least 600 yr during 2nd half of 1st millennium AD and negates any relationship between depths and ages of layers.

Saré Tioffi series, Podor Dept, Sénégal

Samples from cut-off burial hillock in ancient village Saré Tioffi, le Fleuve region (16° 40′ N, 14° 58′ W). Coll 1976 and subm by B Chavane, Dakar.

Ly-2033. S-III 40cm **920 ± 100**

Charcoal from geol level with grave; subm 1979.

Ly-1937. S-III 95cm **1580 ± 130**

Charcoal from layer overlying grave; subm 1978.

Ly-1603. S-III 80cm **4830 ± 770**

Bones of intact skeleton found in grave; subm 1976. (1/4 diluted sample)

General Comment (BC): 1st two measurements date site occupation and agree well with expected value and Ogo and Sintiou Bara series from same Iron age culture of ancient Tekrour Kingdom (Chavane, 1980). Ly-1603 is obviously too old for unknown reason even with widest statistical margin.

Ogo series, Matam Dept, Sénégal

Samples from proto-historic Ogo village, Le Fleuve region (15° 34′ N, 13° 17′ W). Site is small hill with accumulation of cultural remains.

Ly-2034. Charbons de bois **790 ± 100**

Charcoal from 60 to 70cm depth in excavation sq S_2. Coll and subm 1979 by B Chavane. Assoc with iron metallurgy artifacts.

Ly-2159. Torchis **1910 ± 210**

Dried mud with much charred vegetal remains from wall of burned house at 50 to 70cm depth in sq S_2. Coll 1980 by J Evin to test use of sampling material (1/3 diluted sample) despite burning of 600g of dried black mud.

General Comment (BC): Ly-2034 agrees with expected date corresponding with end of village occupation and ancient kingdom of Tekrour (Chavane, 1980). Two unpub dates were obtained for deeper layers in site: Gif-4529: 910 ± 90 (55cm depth) and Gif-4530: 1020 ± 90 (2.55m depth). Thus, three charcoal dates suggest at least 200-yr range of site. Ly-2159 is obviously too old, establishing that elements of mud wall cannot be used as sample. In fact, it seems that measured carbon partly comes from remaining organic matter in clay used for wall, not only from vegetal remains added to clay as temper.

Tioubalel series, Matam Dept, Sénégal

Charcoal from two depths in excavation at site of ancient village lying along Senegal R (16° 16′ N, 13° 59′ W). Coll 1977 by G Thilmans and subm 1980 by IFAN. Assoc with potsherds and copper and iron artifacts (Thilmans & Ravisé, in press).

Ly-2049. IFAN 148 **1170 ± 90**

From 53cm depth; expected age: 600 BP.

Ly-2048. IFAN 147 **1960 ± 400**

From 117cm depth; expected age: 800 BP. (1/2 diluted sample)

General Comment (GT): both dates are older than expected but agree with those from other villages of same culture in Le Fleuve region (Saré-Tioffi, Sintiou-Bara, and Ogo series, above).

Fond-Brûlé series, Le Lorrain, Martinique

Charcoal from level of 1st Arawak period of Fond-Brûlé site (10° 30′ N, 61° 00′ W). Coll 1978 by M Mattioni and M Schvoerer and subm 1978 by M Schvoerer, Lab Physique Appl Archeol, Univ Bordeaux. Dated to cross-check dates by TL method. (1/6 diluted samples)

Ly-2196. BDX-177, Carré K3 **1630 ± 220**

Ly-2197. BDX-175, Carré 04-P2 **2200 ± 210**

General Comment (MS): TL dates from same level are BDX-156: 2010 ± 350 BP and BDX-161: 1840 ± 220 BP. Previous ^{14}C date for volcanic erup-

tion which ended 1st occupation period of site ca 1655 BP. These five dates agree very well and disagree with two unpub dates from Nancy, ca 2360 and 2660 BP for same level. Another TL date was obtained for 2nd Arawak occupation period (assoc with Carribean industries): BDX-154: 1110 ± 170 BP.

Sou and Sou Blama Radjil series, Logone et Cahri, Cameroun

Table 18 lists samples of charcoal from two open-air sites at Sou (12° 12′ N, 14° 42′ E) and Sou Blama Radjil (12° 13′ N, 14° 42′ E) near Afadé. Coll by J Rapp, Strasbourg and by J P Lebeuf, Paris. Assoc with industries of decorated ceramics and in some levels with metal, stone, or bone.

TABLE 18
Sou and Sou Blama Radjil

Lab no.	Site	Sample no.	Yr coll and subm	Layer	Depth	Dilution ratio	Age BP
Ly-2002	Sou (Pt XIX)	41.1407	1979	3	100-110cm	1	500 ± 130
-2003	Sou Blama R	168-277	1979	3	240-247cm	1	2310 ± 150
-2004	Sou Blama R	168-281	1979	3	260-267cm	1	2280 ± 170
-2005	Sou Blama R	168-296	1979	3	300-307cm	1	2530 ± 130
-2280	Sou Blama R	168-429	1980	2b	148cm	2/15	2570 ± 240
-2281	Sou Blama R	168-519	1980	4	304cm	1/5	2740 ± 210
-2282	Sou Blama R	168-539	1980	5	340cm	1/5	3200 ± 250
-2283	Sou Blama R	168-561	1980	7	405-407cm	7/30	2430 ± 250
-2284	Sou Blama R	168-563	1980	7	430-440cm	1/6	3280 ± 360

General Comment (JR): only date from Sou site, Ly-2002, agrees with expected age corresponding to youngest Sao cultural phase, later than 10th century AD. Except Ly-2283, which is obviously too young, all dates of Sou Blama site are consistent with stratigraphy despite large statistical margins of samples coll in 1980. Dates also agree with unpub result, Gif-4821: 2340 ± 100 for Layer 3 but agree with another unpub result: 2800 ± 110 for Layer 7. Dates indicate relatively long duration of earliest phase of Sao culture assoc with fine ceramics.

Ly-2104. Sanctuary Cybèle, Fourvière, Lyon, France 2100 ± 140

Charcoal from level rich in organic matter lying under SW angle of Cybèle sanctuary in Roman site (44° 46′ N, 4° 50′ E). Coll 1978 and subm 1979 by A Audin, Gallo-Roman Mus Fourvière, Lyon. (3/5 diluted sample). *Comment* (AA): date agrees with expected age, *ie,* just before Roman epoch as dated layer underlies 1st level of Roman bldg.

Tureng-Tepe series, Gorgan, Iran

Table 19 lists samples of charred wood from several fire levels indicating end of several occupation periods of Tureng Tepe tell (36° 55′ N, 54° 35′ E). Coll from 1969 to 1977 by J Deshayes and subm 1974 to 1978 by J Deshayes and S Cleuziou, Centre Recherche Archeol, Paris.

TABLE 19
Tureng-Tepe

Lab no.	Sample no.	Colln yr	Level and culture	Calibrated expected age	Dilution ratio	Age BP
Ly-1149	TT C-71-10	1971	VII	AD 700	1	1410 ± 140
-2248	TT 77-4	1977	Soil of Sassanide fortress	AD 500	1	1650 ± 100
-1065	TT C-71-9	1971	Soil of fortress	AD 500	1	1940 ± 80
-2249	TT 71-5	1977	VI	AD 500	1/5	3440 ± 220
-1147	TT C-69-1	1969	III C2 Bronze age	2000 BC*	1	3580 ± 130
-1148	TT C-71-2	1971	III C1 Bronze age	2300 BC*	2/3	3920 ± 250
-2302	TT 77-2	1977	III C High terrace	2200 BC*	1	3690 ± 130
-2301	TT 77-1	1977	III C Hissar	2200 BC*	1	3620 ± 130

* MASCA calibration curve

General Comment (SC): 1st three results of hist period are a little older than expected but may give apparent ages of wooden timbers. Ly-2249 is very different from expected date and may be explained either by re-use of old timber or by sampling problem. As dendrochronol correction of conventional ^{14}C dates was used for determining expected ages, Ly-1147 and -1148 agree with expected range of dates and with pub result, TUNC-42: 3625 ± 71 BP (R, 1973, v 15, p 596). These three results from level of low ancient town while Ly-2302 and -2301 deal with destruction of high terrace, also assumed from III C1/III C2 transition period. Results agree with expected ages and previous results (Deshayes, 1976). Another big timber, charred in same fire dated by Ly-2301 and -2302 gave Gif-3339: 4000 ± 110, which also fits if apparent age of biggest timber is considered older.

C. Iron age

Ly-1808. En Magne, Chavéria, Jura **1130 ± 430**

Human bone from sepulture under Tumulus XIV (46° 31′ N, 5° 33′ E). Coll 1969 and subm 1978 by D Vuaillat, Dir Antiquités Préhist, Besançon. Assoc with Bronze sword from Hallstatt period. (1/5 diluted sample). *Comment* (DV): for unknown reasons date is completely different from expected age. Stratigraphic data indicates no re-use or rehandling of sepulture occurred, and no contamination of sample may have modified result since it was obtained from only one bone.

Collondon series, Doucier, Jura

Samples from two places in Les Crevasses site (46° 38′ N, 5° 64′ E). Coll and subm by D Vuailliat.

Ly-2010. Tumulus 1 **Modern $\Delta^{14}C = +1.3\% \pm 2.3$**

Charcoal from lateral hearth, coll and subm 1979. Assoc with poor industry of Iron age. (1/2 diluted sample)

Ly-2009. Enclos carré **1640 ± 300**

Burned bones and charcoal from cremation area in middle of enclosure. Assoc with Iron age fibulae. (2/5 diluted sample)

General Comment (DV): both dates do not confirm age expected by assoc industries. Ly-2010 rather shows occupation of hearth just before excavation, embedded under colluvia. Ly-2009 indicates carbonaceous remains in enclosure are contaminated by rootlets.

Ly-2300. La Tourette, Pont-du-Château, Puy de Dôme 2060 ± 120

Charcoal from dwelling level of Early or beginning of Middle La Tène period (45° 37′ N, 3° 12′ E). Assoc with ceramics and metal artifacts such as Dux fibula, from ca 280 to 250 BC. Coll 1976 by F Malacher and subm 1980 by J P Daugas and F Malacher, Dir Antiquités Préhist Auvergne, Clermont-Ferrand. *Comment* (JPD): date is a little younger than expected suggesting that charcoal was introduced by colluvia.

Ly-2082. Baccarat, Les Laumes **2240 ± 160**

Charcoal from 1.4 to 1.7m depth in alluvia of Oze R, Côte d'Or (47° 32′ N, 4° 27′ E). Coll 1978 by M Ariente and subm 1978 by J J Puisségur, Inst Geol, Univ Dijon. Assoc with coarse potsherd attributed to Iron age. *Comment* (JJP): agrees with archaeol attribution.

Ly-1807. Lit de la Saône, Seurres, Côte d'Or **2510 ± 130**

Wood from leg of statuette of naked man found by dredging in channel of La Saône R (47° 00′ N, 5° 31′ E). Coll and subm 1977 by L Bonnamour, Mus Denon Châlon-sur-Saône. *Comment* (LM): conforms with expected age since such votive statues used to be thrown in fountains or rivers from Early Bronze age to end of Roman times, mainly at end of Hallstatt and during La Tène period, when person was represented naked. Late Hallstatt ceramics agrees perfectly with date.

Les Jiraudonnes series, Augères, Creuse

Charcoal from two tumuli (46° 05′ N, 1° 42′ E). Coll 1975 by P Léger and subm 1980 by G Mazière, Dir Antiquités Préhist, Limoges.

Ly-2353. Tumulus 1 **2150 ± 120**

From cremation tumulus containing Late Hallstatt industry.

Ly-2354. Tumulus 2 **2190 ± 250**

From tumulus with collective burial containing Late Hallstatt and Early La Tène industries. (11/30 diluted sample)

General Comment (GM): both dates agree with each other but ca 200 yr too young. They do not distinguish between two Iron age periods.

Ly-1862. Tumulus Tugayé I, Ger, Pyrénées Atlantiques **2470 ± 300**

Burned bones and charcoal from funerary urn in Tugayé I (43° 15′ N, 0° 05′ W). Subm 1978 by Coquerel, Tarbes. *Comment* (RC): despite large dilution of sample (1/5) and large statistical margin, date confirms

expected age around transition between First and Second Iron ages, which seems to have been delayed in Central Pyrénées massif.

Ly-1971. La Forêt Basse, Saint-Pierre-de-Fursac, Creuse **2390 ± 120**

Charcoal and burned bones from central sepulture "cairn", 2m deep, of tumulus (46° 09′ N, 1° 28′ E). Coll and subm 1979 by G Mazière, Dir Antiquités Préhist d'Auvergne, Limousin. Assoc hillock contains potsherds, flints, and Early Iron age sepulture with Iron belt ring. *Comment* (GM): date indicates re-use of earth sepulture which also contains Neolithic and Bronze age remains.

Ly-2222. Camp de Larina, Annoisin et Chatelans, Isère **2420 ± 110**

Charcoal from hearth in Loc 3 of Camp de Larina site (45° 47′ N, 5° 18′ E). Coll and subm 1979 by H Chatain, Villefontaine, Isère. *Comment* (HC): date indicates end of Hallstatt period. Hearth, without typical archaeol material must be assoc with several artifacts of Hallstatt period from other areas of site. Ly-2222 is 1st and only date for settlement, which remained occupied from Neolithic to Merovingian times. It may be compared with Ly-880: 2450 ± 110 (R, 1976, v 18, p 72), from La Balme site at Sollières-Sardière, Savoie.

Ly-1912. Roja, Castifao, Haute-Corse **2420 ± 180**

Bones from 20cm depth in Roja rock shelter (42° 30′ N, 9° 07′ E). Coll 1976 by L Acquaviva, Nice, and subm 1979 by J Jehasse, Dir Antiquités, Corsica. Site is collective sepulture with fairly poor industry probably of First Iron age. *Comment* (JJ): dates sample at 1000 to 500 BC, and seems satisfactory.

Ly-2242. Cami Salié, Pau, Pyrénées Atlantiques **2650 ± 140**

Charcoal under funerary urn in Tumulus 1 (43° 19′ N, 0° 25′ W). Coll 1977 and subm 1978 by G Marsan, Lab Geol Quaternaire, Univ Bordeaux. Assoc with First or Second Iron age industry. *Comment* (GM): date agrees with possible range of dates for First Iron age (Hallstatt), but precise limit of Second Iron age (La Tène) is not well-defined in region.

Ly-2191. Beauverger, Villeneuve-les-Cerfs, Puy de Dôme **2370 ± 100**

Charcoal from 1m depth in clayey and sandy Tumulus 6 of Beauverger site (46° 02′ N, 3° 20′ E). Coll 1979 and subm 1980 by D Miallier, Centre Recherches Interdisciplinaires Archéol Anal, Univ Bordeaux. *Comment* (DM): according to regional context and some assoc potsherds, tumulus may belong to 1st Iron age in agreement with result. TL measurements on assoc potsherd are in process; provisional result, calibrated with well-dated samples, is BDX-328: 2384 ± 180 BP. Agreement between both dating methods seems perfect.

Fosse de Caramontron de Sinzelles series, Polignac, Haute Loire

Charcoal from fill of pit outcropping in rd bank (45° 04′ N, 3° 52′ E). Assoc with industry with mixed characteristics of Late Bronze III age and beginning of Iron age, similar to alpine coastal stas. Coll and subm 1978 by J J Houdré and J Vidal, Le Puy.

Ly-2036. 6th and 8th cleaning **2410 ± 130**

From 20 to 30cm depth in middle of pit.

Ly-2037. 10th cleaning **2520 ± 120**

From 50 to 55cm depth at base of pit.

General Comment (JJH&JV): both dates attribute Iron age to fill of pit and confirm lasting Late Bronze influences in region. They are much more recent than Late Bronze culture in alpine lakes: see, eg, Ly-17: 2700 ± 100 BP (R, 1969, v 11, p 115) from Châtillon coastal sta in Le Bourget lake.

D. Bronze age

Ly-2056. Sandgrube, Sierentz, Haut-Rhin **2550 ± 100**

Charcoal from 0.8 to 1.1m depth in cremation Sepulture 10 of open-air site Sandgrube (47° 40′ N, 7° 26′ E). Coll 1978 by J J Wolf and subm 1979 by A Thevenin, Dir Antiquités Préhist, Strasbourg (Wolf, 1978). *Comment* (AT): date only agrees with expected age of assoc Late Bronze III industry, ca 3000 to 2700 BP, if double standard deviation is used.

Ly-2053. Tumulus 22, Kirchlach, Schirrhein, Bas-Rhin **1490 ± 120**

Charcoal from 60cm depth in hearth (48° 48′ N, 7° 54′ E) assoc with poor ceramic industry attributed to Middle Bronze age. Coll and subm 1978 by A Thevenin. *Comment* (AT): date is obviously too young; it may indicate reuse of site for Middle age hearth or disturbance of layers by roots.

Kastenwald series, Appenwhir, Bas-Rhin

Charcoal from cremation sepultures underlying two neighboring hillocks in Kastenwald forest (48° 02′ N, 7° 27′ E). Coll by C Bonnet, S Pouin, and F Lambach and subm 1978 by A Thévenin (Bonnet & Plouin, 1979).

Ly-2055. Tombe 1 **2770 ± 130**

Coll 1975, from Sepulture 1 at 0.1m depth, assoc with Middle Bronze age III industry.

Ly-2054. Tombe 5 **2900 ± 130**

Coll 1974 from Sepulture 5 at 1m depth, assoc with Middle Bronze age III, a little more recent than Ly-2055.

General Comment (AT): dates confirm both hillocks are contemporaneous but were built during Late Bronze age contrary to archaeol attribution of assoc industry.

Ly-2325. Chemin de la Pêcherie BCP-55, Berry-au-Bac, Aisne 2770 ± 160

Bones from refuse pit of house of Late Bronze age village in Aisne R valley (see Neolithic series from same valley, below) (49° 24′ N, 3° 53′ E). Coll 1978 and subm 1979 by Unité Recherche Archéol no. 12, Inst Art Archéol, Paris. (11/15 diluted sample). *Comment* (URA 12): date seems a little too young because of attribution of site to Late Bronze IIb (Hallstatt A2 in German chronology), presumably 3000 to 2100 BP.

Ly-1951. Pirogue du Crèt de Chatillon, Sévrier, Haute-Savoie 2700 ± 140

Wood from monoxyl barge in oak found at 4m depth in Annecy Lake on coastal sta Le Crèt de Chatillon (45° 52′ N, 6° 08′ E). Coll 1979 by P Persond and subm 1979 by A Bocquet, Centre Préhist Documentation Alpine, Grenoble. *Comment* (AB): date indicates end of Bronze age in perfect agreement with archaeol material of coastal sta and previous dates from site, *ie*, Ly-17: 2700 ± 100 (R, 1969, v 11, p 115) and Ly-274: 2670 ± 110 (R, 1971, v 13, p 57).

Ly-1986. Salle des Gardes, Caen, Calvados 3030 ± 450

Human bones from excavation under so-called Salle des Gardes bldg in medieval castle (49° 10′ N, 0° 22′ W). Coll 1976 by C Pilet, Dir Antiquités Hist Caen, and subm 1979 by G Verron, Dir Antiquités Préhist, Caen. (1/2 diluted sample). *Comment* (GV): dates to Bronze age skeleton which was lying without assoc industry under level from beginning of Roman period (1st century BC).

Ly-1866. Grotto Linars, Rocamadour, Lot 3080 ± 240

Human bones from Linars sepulchral grotto (44° 48′ N, 1° 37′ E). Coll by L Genot, Leyme, Lot, and subm by A Cogoluenhes, Dept Geol, Univ Lyon. Assoc with ceramic industry of Les Champs d'Urnes culture of Late Bronze age. *Comment* (AC): date agrees with archaeol estimate and confirms that site was not disturbed as was previously thought.

Ly-2244. Le Verger, Saint-Romain, Côte d'Or 3540 ± 230

Charcoal from base of Early Bronze age layer (46° 59′ N, 4° 43′ E) (see also Neolithic layers of same site, below). Coll and subm 1979 by S Grappin, Dir Antiquités, Dijon. (2/5 diluted sample). *Comment* (SG): confirms archaeol attribution to Early Bronze age.

Ly-1773. Camp de Chassey, IL 56 TP, Chassey, Saône et Loire 3480 ± 140

Charcoal from piling hole of rampart of fortified plateau (45° 53′ N, 4° 46′ E). Rampart is not assoc with industry but is assumed to be from protohistoric period (Bronze or Hallstatt). Coll 1972 and subm 1978 by J P Thévenot, Dir Antiquités Préhist, Dijon. *Comment* (JPT): in expected range, dates rampart most probably to Middle Bronze age as confirmed by stratigraphy.

Ly-1831. La grotte de Pégourié 1725, Caniac du Causse, Lot **3650 ± 250**

Charcoal from hearth found in one of upper layers of grotto fill (44° 37′ N, 1° 39′ E). Coll 1977 and subm 1978 by R Séronie-Vivien, Le Bouscat, Gironde. Presumably Chassean potsherds were found close to hearth, but site may have also been used during Middle or Early Bronze ages. (2/5 diluted sample). Many other dates were obtained from lowest layers of site (below). *Comment* (RS-V): as expected, dates boundary between Early and Middle Bronze ages. *Cf* unpub results from Les Claups grotto, Gif-3568: 3210 ± 110 and pub results from Layers 2 and 3 of Le Noyer grotto, Gif-1631: 3150 ± 110, and Gif-1159: 3250 ± 110 (R, 1972, v 14, p 288).

Stathmos Aggistas series, Serres, E Macedonia, Greece

Charcoal from two locs in N excavation of Stathmos Aggistas site (41° 00′ N, 23° 57′ E). Coll 1977 by Ch Koukouli-Chrysanthaki, Kavala Archaeol Mus, and subm 1978 by J Deshayes, Paris. Site is tell underlying tumulus of Macedonian grave. Tell presumably belongs to Macedonian culture of final Late Bronze age, 1400-1100 BC (Koukouli-Chrysanthaki, 1980). (1/2 and 3/5, respectively diluted samples)

Ly-1778. 2.8m, N sec **3700 ± 270**

Ly-1779. Pit 3, N sec **4300 ± 230**

General Comment (CKC): since MASCA calibration of both dates set them at end of 3rd millennium BC*, they are much older than expected. Oldest layer of site, that of Ly-1748, is archaeol dated by Mycenean vases to 14th century BC. Ly-1748 comes from more recent layer. Organic material found in Pit 3 (Ly-1749) was previously dated by Zentral Inst Berlin to 940 ± 65 BC (uncalibrated and unpub).

Ly-1806. Tumulus F 16, Lamarque-Pontacq, Hautes-Pyrénées **3730 ± 190**

Charcoal from cremation area of F 16 tumulus (43° 12′ N, 0° 07′ W). Coll 1966 and subm 1977 by R Coquerel, Tarbes. Although without assoc industry site may be compared with La Gourgue d'Asque site, Hautes-Pyrénées (Clot, Coquerel, & Omnès, 1978) previously dated by Ly-1053: 3800 ± 40 (R, 1978, v 20, p 40). *Comment* (RC): date confirms contemporaneity with Ly-1053; both dates indicate relatively old age of cremations in Central Pyrénées (Coquerel, 1966).

Ly-2180. Berges de l'Artière, Les Martres d'Artière, Puy de Dôme **4200 ± 160**

Animal bones from left bank of Artière R (45° 50′ N, 3° 04′ E). Coll 1978 and subm 1980 by J P Daugas, Dir Antiquités Préhist d'Auvergne, Clermont-Ferrand, and J P Raynal, Inst Quaternaire Bordeaux, Talence. (4/5 diluted sample). Outcropping sediments were formed by filling of ancient river channel. Level also contains "en barbelé" decorated ceramic, well-known in S France and attributed to beginning of Early Bronze age.

Comment (JPD&JPR): date is a little older than expected by assoc industry and shows ancient river channel was filled from Late Neolithic to Early Bronze ages.

Ly-1868. Grotte de l'Homme-Mort, Lomné, Hautes-Pyrénées **3760 ± 150**

Human bones from debris of ancient excavation in sepulchral gallery of Lomné grotto near Lannemezan (43° 0′ N, 0° 17′ E). Coll and subm 1979 by J Omnès, Lourdes. *Comment* (JO): date agrees with presumed Bronze age and assoc industry, stabber and nail-decorated ceramics (Omnès, 1981). *Cf* Ly-1904 from Artigaou grotto (below).

E. Chalcolithic/Neolithic

Dolmen de Mourioux series, Mourioux, Creuse

Charcoal from soil of dolmen in Bois de Mourioux (46° 04′ N, 1° 39′ E). Coll by R Credot and M Dominique and subm 1978 by G Mazière, Dir Prehist, Limoges. Assoc with Neolithic industry.

Ly-1968. No. 1 **240 ± 160**

Coll 1976. (9/10 diluted sample)

Ly-1969. No. 2 **2010 ± 130**

Coll 1977.

General Comment (GM): dates indicate re-use of sample as frequently happens in megalithic monuments, which therefore cannot be dated in this manner.

Santourin series, Billième, Savoie

Charcoal from two levels (45° 49′ N, 5° 23′ E) coll 1978 and subm 1979 by L Lagier-Bruno, Yenne, Savoie. Site is mainly stone circles which may have been sheepfolds or Neolithic dwellings (Lagier-Bruno, 1981). (Ca 1/5 diluted sample)

Ly-2287. Level II **3550 ± 220**

Ly-2288. Level III **4340 ± 290**

General Comment (LLB): previous date on Level I, Ly-1604: 2240 ± 260 (R, 1979, v 22, p 432) indicates dates are in stratigraphic order; also indicates Late-Neolithic/Early-Bronze transition in agreement with presumed ages of other megalithic monuments.

La Touvière series, Thoyes, Arbignieu, Ain

Samples from so-called La Couche Brune level at two locs in rock shelter (45° 45′ N, 5° 39′ E). Coll and subm 1978 and 1979 (Ly-2259) by R Vilain, Dept Geol, Univ Lyon. Assoc with uncharacteristic industry which may be Chalcolithic.

Ly-1974. F-4 **1010 ± 130**

Charcoal from Sq F-4 in front part of rock shelter.

Ly-1975. C-4-5 **2520 ± 200**

Charcoal from Sqs C-4 and C-5 in front part of rock shelter. (2/3 diluted sample)

Ly-2259. Sepulture **3210 ± 160**

Human bones from multiple sepulture in bottom of rock shelter. (7/10 diluted sample)

General Comment (RV): dates from charcoal are too young for assoc industry in level. They indicate extensive influence of modern hearth found near excavated sqs. Date on bones is plausible for assoc industry, which may either belong to Bronze age or, more probably, is older but redeposited by burials (Morelon, 1974).

Ly-2214. Frépestel, Meyrueis, Lozère **1660 ± 160**

Human bones from under flagstone-covered sepulture (44° 12′ N, 3° 27′ E), assoc with industry most probably from Chalcolithic. Coll 1979 by G Fagès and subm 1980 by A Cogoluènhes. (11/15 diluted sample). *Comment* (GF): much younger than expected; dates show disturbance in sepulture suspected from bone distribution.

Ly-2245. Hermanky, Ceska Lipa, Bohemia, Czechoslovakia **3820 ± 210**

Charcoal from Hermanky rock shelter (50° 43′ N, 14° 35′ E). Coll and subm 1979 by J Svoboda, Univ Brno. Samples were found in Neolithic living areas in rock shelter (Svoboda, 1979). (7/30 diluted sample). *Comment* (JS): date is much too young; may be contaminated by recent roots.

Ly-2295. Aven de Jacques, Lussac, Ardèche **3660 ± 130**

Human bones from Jacques sepulchral grotto-aven (44° 37′ N, 4° 29′ E). Coll 1979 and subm by A Cogoluènhes, Dept Geol, Univ Lyon. Assoc with Fontbouïse Chalcolithic industry. *Comment* (AC): date is younger than generally thought for Fontbouïse culture, but it may fit in usual range with double statistical margin.

Ly-1904. Grotte de Las Crouts d'Artigaou, Esparros, Hautes Pyrénées **3720 ± 140**

Human bones from sepulchral recess near Lannemezan (43° 02′ N, 0° 06′ E). Coll and subm 1978 by J Omnès, Lourdes. *Comment* (JO): date agrees with Chalcolithic age presumed by poor assoc ceramic industry. *Cf* Ly-1868 (above) from Lomné sepulchral grotto (Omnès, 1981).

Ly-1750. Bré-Sourbette, Veyreau, Aveyron **3800 ± 130**

Bones from sepulchral grotto (44° 06′ N, 3° 02′ E) assoc with Late Rodezian Chalcolithic or Chalcolithic with "Céramiques à triangles hachurés" industry and with fluted point lodged in bone (Fagès & Mourer-Chauviré, in press). Coll 1978 by G Fagès, Florac, and subm 1978 by C Mourer-Chauviré, Dept Geol, Univ Lyon I. *Comment* (GF&CMC): date is younger than expected from Late Neolithic assoc industry previously dated in La Treuille grotto: 3 Gif dates ca 4600 BP (R, 1974, v 16, p 25),

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but agrees with dates of other sites of same industry: Sargel grotto, Gif-328: 3710 ± 180 (R, 1970, v 12, p 423), Les Côtes of Roquefort, Gif-37: 3930 ± 150 (R, 1966, v 8, p 130), and La Fajole, Ly-2213 (below).

Ly-2213. La Fajole, Vebron, Lozère 3990 ± 110

Human bone from megalithic sepulture Galdri (44° 17′ N, 3° 32′ E) assoc with so-called Rodezian Chalcolithic/Early Bronze industry. Coll and subm by G Fagès and subm 1980 by A Cogoluènhes. *Comment* (GF): agrees with expected age and another date from same culture in region, Ly-1750 from Bré Sourbette site (above).

Ly-2305. Pirogue de Meimart, Brisson-Saint-Innocent, Savoie 3740 ± 130

Wood from monoxyl barge in oak found 2m deep on bottom of Le Bourget Lake (45° 44′ N, 5° 52′ E). Coll 1980 by R Castel and subm 1980 by A Bocquet, Centre Préhist Documentation alpine, Grenoble. *Comment* (AB): dates barge to Late Neolithic and three centuries later than fragment of wooden cup of Saône et Rhône culture from same site, Ly-190: 4060 ± 120 (R, 1971, v 13, p 57).

Ly-1989. Chapeau-Rouge, Menetrol, Puy-de-Dôme 3750 ± 240

Human bones from probable Neolithic sepulture (45° 52′ N, 3° 18′ E). Coll and subm 1979 by J P Daugas and J P Raynal. (2/3 diluted sample). *Comment* (JPD&JPR): date may be younger than expected because of chemical composition of embedding sediment, Terre Noire de Limagne, which is black earth rich in organic matter (Daniel *et al*, 1979).

Chalain lake series, Doucier, Jura

Wood from two foundation pilings of two eroded coastal stas of W side of Chalain Lake (46° 40′ N, 5° 48′ E). Coll and subm 1978 by D Vuaillat, Dir Antiquités, Préhist Centre, Besançon.

Ly-2007. Sta 5 4250 ± 130

Ly-2008. Sta 6 4170 ± 140

General Comment (DV): no artifacts remained in sta although three other sites were discovered and dated in E part of lake; 1st one from Middle Neolithic culture near Les Roseaux inlet, at Fontenu, Ny-143: 5790 ± 220 and Ny-144: 5850 ± 180 (R, 1974, v 16, p 120); others, stas 1 and 2 from Late Neolithic Saône et Loire culture, Gif-2637: 4220 ± 140 and Gif-2638: 4280 ± 180 (unpub). Dates confirm contemporaneity of stas 5 and 6 with stas 1 and 2 and exclude their attribution to Bronze age.

Ly-2078. Croix-Tombée cemetery, Pérouges, Ain 4060 ± 100

Human bones from grave of Gallo-Roman cemetery (45° 53′ N, 5° 11′ E). Coll 1979 by J L Challard and subm 1979 by A Cogoluenhes, Dept Geol, Univ Lyon. This grave was laid at lower level than other graves with different orientation. *Comment* (AC): date confirms expected old age of this isolated grave which may belong to Neolithic or Chalcolithic periods because of assoc flints.

Ly-2417. La Vallée, Girolles, Loiret 4010 ± 140

Charcoal from fill of small calcareous cavity on hill (48° 04′ N, 2° 53′ E). Coll 1977 and subm 1980 by A Aubourg, Amilly, Loiret. Assoc with uncharacteristic industry, maybe from Neolithic. (4/5 diluted sample). *Comment* (AA): dates cavity fill to Late Neolithic.

Ly-1903. Grotte du Castillet, Lourdes, Hautes-Pyrénées 4380 ± 140

Human bone from sepulchral gallery (43° 06′ N, 0° 07′ E). Coll and subm 1978 by J Omnès. *Comment* (JO): date agrees with Late Neolithic attribution with poor industry mainly of bone arrows and fingers or nail-decorated ceramics.

Ly-1962. Grotte de la Gardette, Labastide de Virac, Gard 4310 ± 130

Human bones from Late Neolithic or Chalcolithic sepulchral grotto, Ardèche (44° 21′ N, 4° 24′ E). Coll 1977 by P Perreve and subm 1978 by A Cogoluènhes. *Comment* (AC): agrees with expected age and comparable to other dates of Late Neolithic Ferrières in region, eg, in Traves grotto at Montclus, Gard, Gif-1909: 4260 ± 140 (R, 1974, v 16, p 31).

Ly-1963. Abauntz, Level b, Arraiz, Navarra, Spain 4240 ± 140

Charcoal from Level b in Abauntz grotto (43° 01′ N, 1° 42′ W). Coll 1976 and subm 1978 by P Utrilla-Miranda, Univ Zaragoza. Assoc with burned human bones and with Late Neolithic or Chalcolithic industry. *Comment* (PUM): date agrees with expected value; *cf* date from Level IIIB in Los Husos grotto at Elvillar, Alava, Spain, I-3985: 3920 ± 100 (unpub). Two other dates by Teledyne Isotope lab are from Neolithic Level b4, I-11,309: 5390 ± 120 and Level c, I-11,537: 6910 ± 450 (Utrilla-Miranda, 1980).

Ly-1941. Le Jas des Chèvres, Allan, Drôme 4390 ± 160

Charcoal from 40cm depth from open-air site (44° 28′ N, 4° 48′ E). Coll 1978 and subm 1979 by A Beeching, Dir Antiquités Préhist, Lyon. Assoc with a Pre-Campaniforme Chalcolithic industry (Beeching, 1980). (9/10 diluted sample). *Comment* (AB): agrees with expected age, indicating relatively old age for Chalcolithic industry, but compared with unpub result on charcoal from Bruyères site at Saint Julien de Peyroles, Gard, MC-976: 4225 ± 80 (Gilles, 1975).

Ly-2348. Beaulieu, Bardouville, Seine Maritime 4550 ± 130

Human bones from collective sepulture of Beaulieu quarry (49° 26′ N, 0° 51′ E). Coll 1966 by R Caillaud and E Lagnel and subm 1980 by G Verron and J Dastugue, Caen. Assoc with Late Neolithic industry, Seine-Oise-Marne (SOM) (Caillaud and Lagnel, 1967). *Comment* (GV): dates generally obtained for SOM culture are younger but those from Videlles site, GrN-4676: 4500 ± 50 and GrN-4675: 4500 ± 60 (R, 1967, v 9, p 133) are close to present one.

Ly-1738. La Pierre Godon, Tillay le Peneux, Eure et Loir **4550 ± 150**

Bones from 90cm depth under pavement of access passage of dolmen under tumulus at Soignolles (48° 10′ N, 1° 47′ E). Coll and subm 1978 by G Richard, Orléans. *Comment* (GR): date indicates 1st occupation of tumulus occurred during Late/Middle (Chassean) Neolithic period. *Cf* date from Fort Harrouard, nearby, Gsy-97: 4400 ± 135 (R, 1966, v 8, p 131); 2nd occupation of site occurred at end of Neolithic, from ca 4300 to 3800 BP, SOM culture with Campaniforme influences (Richard, 1980).

Le Fournet series, Montmaur, Drôme

Table 20 lists samples of human bones from several locs in sepulchral grotto (44° 41′ N, 5° 20′ E). Coll 1966 by A Heritier and subm by A Cogoluènhes.

TABLE 20
Le Fournet

Sample no.	Bone ref	Dilution ratio	Age BP
Ly-2433	11/1	1/2	3590 ± 180
-2431	10/17	1/3	3840 ± 190
-2432	6/1	9/10	4240 ± 160
-2434	10/1	1	5440 ± 130

General Comment (AC): from previous series of 4 dates from same site (R, 1979, v 21, p 436) ages at end of Neolithic were expected. These 4 new results show grotto was used from Middle Neolithic (Ly-2434) to Bronze age (Ly-2433). Assoc industry for whole bones is Chassean (agreeing, eg, with Ly-2434) or Chalcolithic (Ly-2431, -1178, -1733). Both series indicate need for many results to determine total duration of occupation (Cogoluènhes, 1977).

Ly-1688. Le Brudoux, Plan de Baix, Drôme **4710 ± 150**

Human bones from sepulchral grotto (44° 49′ N, 5° 10′ E). Coll by M C Haze and subm 1978 by A Cogoluènhes. Assoc with heterogeneous, poor industry of Chalcolithic. *Comment* (AC): date is too old for Chalcolithic but site was disturbed.

Ly-2518. La Montagne de Comin, Bourg-et-Comin, Aisne **4880 ± 120**

Charcoal from fire layer underlying Middle Neolithic (Chassean or Michelsberg) occupation level on spur at top of plateau (49° 25′ N, 3° 40′ E). Coll and subm 1981 by CNRS Unit 12. *Comment* (URA 12): dated to solve complex stratigraphic problem of clayey levels; date confirms fire layer is contemporaneous with Neolithic occupation since result is close to other results for Michelsberg industries in Aisne R Valley (Ly-2328 and -2334, below).

La Roberte series, Chateauneuf du Rhône, Drôme

Bones from two trenches of Chassean site (44° 32′ N, 4° 43′ E). Subm 1979 by A Beeching. This was open-air site presently covered by 10m of earth (Beeching & Thomas-Beeching, 1975).

Ly-2076. St 4, 72P **4830 ± 150**

From 60 to 65cm depth in Pit 4. Coll 1977 by J Thomas-Beeching, Lyon. (4/5 diluted sample)

Ly-2075. St 2, 1P **4970 ± 200**

From fill of Pit 2. Coll 1976 by M Lambert, Montélimar. (3/5 diluted sample)

General Comment (AB): both dates are in mutual statistical margins but some differences in Chassean typology suggest that Pit 2 (Ly-2075) should be a little older than Pit 4 (Ly-2076). Both dates are closer to generally obtained value for Middle Neolithic in region than those obtained in neighboring Chassean site, Francin, Savoie, Lv-389: 3870 ± 170 and Lv-390: 4300 ± 75 (R, 1970, v 12, p 554).

Chassey camp series, Chassey, Saône et Loire

Table 21 lists samples of charcoal from Neolithic Chassean layers (46° 53′ N, 4° 46′ E). Coll 1977 and subm 1978 by J P Thévenot.

TABLE 21
Chassey Camp

Sample no.	Sample	Sq and level	Age BP
Ly-1767	Chassey 1 XLII-56	F 8	5220 ± 140
-1771	Chassey 2 XLIII-54	F 8	5380 ± 160
-1768	Chassey 3 XLII-56	TC 9	5660 ± 150
-1769	Chassey 4 XLIII-56-57	A 9	5540 ± 120
-1770	Chassey 5 XLII-55	484 9	5380 ± 140
-1772	Chassey 6 L-56	Diaclase	5700 ± 150

General Comment (JPT): dates agree with stratigraphy and date Level 8 at ca 5300 BP and Level 9 at ca 5600 BP. Ly-1770 is ca 300 yr too young but sample contained large amount of roots. Ly-1772 comes from small zone containing intrusive sediments between two diaclases and industry may be either from Level 8 or 9 and re-used (Thévenot, 1978). Ly-1772 shows date of zone close to Level 9 and does not confirm re-use.

Ly-1791. Collective sepulture, Abri Moula, Soyons, Ardèche **5660 ± 140**

Human bones from remains of multiple sepulture embedded in sediments deposited on upper part of fill of Moula shelter (44° 53′ N, 4° 50′ E). Coll 1972 by Crouzet Archaeol Club and subm 1978 by P Payen, Valence, and A Cogoluènhes. Assoc with poor industry of ceramics and flint of Middle Neolithic. *Comment* (PP): Chassean date agrees with assoc industry.

Les Rivaux Loc 1 sommet, Espaly-Saint-Marcel, Haute-Loire

Table 22 lists samples of charcoal (all but Ly-2194, which is animal bones) from several stratigraphic units (hearths or dwelling levels) of Neolithic-Chassean open-air site (45° 03′ N, 3° 51′ E). Coll and subm by J P Daugas, Dir Antiquités Préhist Auvergne, Clermont-Ferrand.

TABLE 22
Les Rivaux

Sample no.	Strat unit	Colln date	Dilution ratio	Assoc industry	Age BP
Ly-2303	2e/2a	1971	2/5	Late Chassean	4240 ± 200
-1349	CCP 2	1974	1/3	Late Chassean	4540 ± 210
-2083	3	1970	1/2	Chassean	4670 ± 190
-2304	4b	1973	5/6	Chassean	4530 ± 140
-2289	4a	1973	1/6	Chassean	4790 ± 260
-2246	5	1973	2/3	Chassean	4740 ± 140
-2247	CAC	1973	7/30	Chassean	5020 ± 200
-2084	6	1973	2/5	Chassean	5340 ± 190
-1348	6.4/6.5/F.7	1974	1/3	Chassean	5600 ± 210
-2194	CM4	1973	1 (bone)	Chassean	5030 ± 100
-1596	BdF 1a	1974	1/2	Early Chassean	5200 ± 250
-1987	BdF 2	1974	3/20	Early Chassean	5310 ± 470

General Comment (JPD): despite small amount of material, series agrees with expected values. Deepest samples, Ly-1596 and -1987, assoc with Early Chassean were expected to be older but contamination by recent roots developed at this level, BdF, and Ly-1987 is possible, ca 6000 BP, taking into account 2σ statistical margin. Ly-2194 is also too young but it comes from pit which may have been mixed with heterogeneous material. All dates confirm long duration of site occupation (ca 1000 yr) and contemporaneity with eponymic Chassey site (above) (Daugas *et al*, 1980).

La Baume series, Arlempdes, Haute Loire

Charcoal from 1.5 to 1.8m depth in layers with Mesolithic industry at Fraycenet d'Arlempdes (44° 52′ N, 3° 54′ E). Coll and subm 1977 by A Cremillieux (1980).

Ly-1864. 11 **5290 ± 300**

Sample from topmost level. (2/5 diluted sample)

Ly-1865. 13 **4560 ± 930**

Sample from deepest level. (1/15 very diluted sample)

General Comment (AC): dates do not fit assoc industry and show that charcoal came from upper level with Neolithic industry. Average date, Ly-1864/1865: 5180 ± 280 agrees with two dates in same region, La Roche Dumas, Arsac en Velay, Ly-1588: 5120 ± 320 and Le Chambon, Goudet, Ly-1549: 5160 ± 250 (R, 1979, v 21, p 437) of Chassean industry. *Cf* also Les Riveaux series (above).

La Vergentière series, Cohons, Haute-Marne

Samples from excavation pit S1 in fortified promontory of La Vergentière (47° 46′ N, 5° 20′ E). Assoc with Bourguignon Middle Neolithic

industry with Cortaillod and Michelsberg characteristics. Coll 1977 and subm 1978 by L Lepage, Saint-Dizier.

Ly-1859. S1-A8 **5230 ± 300**

Bones from level underlying archaeol layer. (1/3 diluted sample)

Ly-1860. S1-A17 **5350 ± 270**

Charcoal from level underlying limed central part of rampart of buttress. (1/2 diluted sample)

General Comment (LL): both dates are in statistical range of each other, weighted average, Ly-1859/1860: 5300 ± 210. Building of rampart was contemporaneous with Middle Neolithic occupation (Lepage, 1980).

Grotte de la Pyramide series, Penne, Tarn

Charcoal from two levels in Loc 3, which opens into archaeol fill of grotto at Le Travers de Janoye (44° 05′ N, 1° 43′ E). Coll and subm by J Lautier, Albi. Both levels contain Chassean industry (Lautier, 1982).

Ly-1867. Layer 6E **5490 ± 310**

From Layer 6E, Sq K8. Coll 1973, subm 1977. (3/10 diluted sample)

Ly-1408. Layer 6A **4750 ± 270**

From Layer 6A, Sq J11. Coll 1976, subm 1977. (1/3 diluted sample)

General Comment (JL): dates fit Chassean industry which lasted for at least 800 yr, but for unknown reason, sample from lowest layer gives younger result. *Cf* dates from two sites with same Chassean industry, Le Noyer grotto at Esclauzels, Lot, Gif-1633: 500 ± 130 (R, 1972, v 14, p 289) and Sargel grotto at Saint-Rome-de-Cernon, Aveyron, Gif-445: 4570 ± 150 (R, 1966, v 8, p 130).

Le Verger series, Saint-Romain, Côte d'Or

Charcoal from two neighboring sites in hearth area in Neolithic part of Le Verger site (46° 59′ N, 4° 43′ E), (see Ly-2244, above, from Bronze age layer of site). Coll and subm 1978 (Ly-1985) and 1979 (Ly-2243) by S Grappin, Dijon. Assoc with not well-defined Middle Neolithic industry.

Ly-1985. 1-2 **5590 ± 130**

Ly-2243. 3 **5860 ± 170**

General Comment (SG): Ly-1985 is contemporaneous with Middle Neolithic Chassey camp (above). Ly-2243 seems too old for Middle Neolithic industry in region.

Ly-2195. Grotte La Balme d'Epy, Jura **5640 ± 200**

Human bones from upper part of fill of grotto (46° 23′ N, 5° 25′ E). Coll 1975 and subm 1979 by A Cogoluènhes. Assoc with Chalcolithic industry. (1/5 diluted sample). *Comment* (AC): date is a little older than expected, but compatible with less characteristic industry. Previous date from same grotto dated to end of Würmian, Ly-362: 20,300 $^{+1900}_{-1600}$ (R, 1973, v 15, p 516).

Ly-2077. Grande Barme de Savigny, La Biolle, Savoie 5010 ± 140

Bones from Level IIb, 70cm deep in grotto (45° 44′ N, 5° 55′ E). Coll 1977 by J Thomas-Beeching and subm 1979 by A Beeching. Assoc with atypical industry of Early Neolithic/Middle Neolithic transition, presumed age of which is uncertain but may be same as Cortaillod culture (Beeching, 1979). *Comment* (AB): date is a little younger than expected but indicates range generally given for Middle Neolithic period in region.

Ly-1766. Port Renard, Vinneuf, Yonne 3130 ± 150

Charcoal from Hearth 29, Loc XIII (48° 31′ N, 3° 28′ E). Coll 1976 by A Carré and subm by J P Thévenot. Sample is from entrance of hearth in hut of Cerny culture (Middle Neolithic). *Comment* (JPT): date is much too young and may be explained by roots that penetrated archaeol level as it was close to surface.

Vallée de l'Aisne series, Aisne

Table 23 lists samples of bones from refuse pits of Early and Middle Neolithic villages in Aisne R valley. Coll from 1975 to 1981 and subm by Unité Recherche Archéol no. 12, Paris, at following sites: la Croix-Maigret (BCM) near Berry-au-Bac (49° 24′ N, 3° 53′ E), Les Jombras (CLJ) near Concevreux (49° 23′ N, 3° 48′ E), Les Fontenettes (CCF), near Cuiry-les-Chaudardes (49° 23′ N, 3° 45′ E), Derrière le Village (MDV) near Menneville (49° 25′ N, 4° 01′ E), les Grandes Grèves (VSG), near Villeneuve-St-Germain (49° 24′ N, 3° 22′ E).

TABLE 23
Aisne River Valley

Sample no.	Ref	Colln date	Dilution ratio	Assoc industry	Age BP
Ly-2370	BCM-206	1979	1	Late Roessen	5330 ± 130
-2326	BCM-100	1978	4/15	Menneville group	5530 ± 320
-2329	BCM-100	1979	11/15	Menneville group	5100 ± 160
-2371	BCM-202	1979	1	Late Roessen	5340 ± 130
-2327	BCM-124	1978	1	Recent Rubané	6030 ± 130
-2328	CLJ-6-15	1977	14/15	Michelsberg	4810 ± 120
-2334	CCF-359	1979	11/15	Michelsberg	5020 ± 150
-1826	CCF-25	1974	1/4	Recent Rubané	5360 ± 510
-1827	CCF-27	1974	2/5	Recent Rubané	5860 ± 300
-1828	CCF-52	1974	2/5	Recent Rubané	6580 ± 400
-1829	CCF-175	1975	4/5	Recent Rubané	5930 ± 190
-1737	CCF-246	1976	1	Recent Rubané	6220 ± 230
-1736	CCF-230	1976	1	Recent Rubané	6450 ± 160
-2321	CCF-295	1978	13/15	Recent Rubané	5960 ± 170
-2330	CCF-324-325	1978	1	Recent Rubané	5910 ± 130
-2331	CCF-311	1979	1	Recent Rubané	6000 ± 120
-2332	CCF-321	1979	29/30	Recent Rubané	5800 ± 170
-2333	CCF-357	1979	1	Recent Rubané	5980 ± 110
-2335	CCF-378-1	1980	1	Recent Rubané	5840 ± 140
-2336	CCF-375	1980	7/10	Recent Rubané	5960 ± 150
-1735	MDV-13	1976	1	Recent Rubané	6200 ± 190
-2324	MDV-13	1976	1	Recent Rubané	6110 ± 140
-2322	MDV-19	1977	1	Recent Rubané	6030 ± 130
-2323	MDV-39	1977	7/30	Recent Rubané	5860 ± 190
-1734	MDV-1	1976	4/5	Recent Rubané	6140 ± 210
-1824	VSG-70	1975	5/6	Neolithic post-Rubané	6130 ± 200
-1825	VSG-114	1976	4/5	Neolithic post-Rubané	6010 ± 220

General Comment (URA 12): disregarding Ly-1826 (much too young) and Ly-1828 and -1736 (too old), this important series of Recent Rubané of Paris Basin sites in Aisne R valley indicates that culture occupied region for ca 300 yr from 6100 to 5800 BP. Dates are contemporary with end Linear pottery culture of Rhine and Netherland regions and may be a little later. Dates of Villeneuve-Saint-Germain Neolithic, Ly-1824 and -1825 are contemporary with Recent Rubané, which is surprising because typologic evidence suggests younger age. Both Michelsberg dates agree with expected range. Late Röessen and Menneville group dates are 1st for these cultures in Paris Basin.

Ly-2463. Bois de Refuge, Misy sur Yonne, Seine et Marne **6050 ± 160**

Bones from Pit C (48° 21′ N, 3° 04′ E). Coll 1971 by C Mordant and J Bontillot; subm 1981 by C Mordant and D Mordant. Assoc with Late Recent Rubané industry (Mordant & Mordant, 1977). *Comment* (CM& DM): expected date agrees with many others from Aisne R valley, where same Recent Rubané industry was found (above).

Vallée de la Seine series, Seine et Marne

Bones from pits and trenches in Middle or Late Neolithic villages in La Seine R valley. Coll 1973 to 1980 by C Mordant and D Mordant; subm by D Mordant. Table 24A lists sites; Table 24B lists samples.

TABLE 24A
Seine Valley sites, Seine et Marne district

Site	Village	Loc	Ref
Le Gros Bois	Balloy	(48°24′N, 3°09′E)	Mordant (1967)
Maram	Catenay sur Seine	(48°25′N, 3°06′E)	
Chemin de la Tombe	Gravon	(48°24′N, 3°07′E)	
Les Roqueux	Grisy sur Seine	(48°26′N, 3°19′E)	
Le Haut des Nachères	Noyen sur Seine	(48°26′N, 3°21′E)	Mordant & Mordant (1977)

TABLE 24B
Seine Valley samples

Lab no.	Site	Loc	Colln date	Dilution ratio	Industry	Age BP
Ly-2460	Balloy	Pit 4	1965	1	Neolithic (middle-late)	4770 ± 160
-2459	Gravon	Pit FA 1	1979	1/5	Neolithic (middle-late)	4900 ± 210
-2457	Noyen/Seine I	Pit FD 3	1973	1	Neolithic (middle-late)	4870 ± 160
-2458	Noyen/Seine I	Pit FB	1973	1/4	Neolithic (middle-late)	5260 ± 200
-2461	Noyen/Seine I	Enclosure II	1979	4/5	Neolithic (middle-late)	4970 ± 140
-2462	Noyen/Seine I	ABC I	1979	1/3	Neolithic (middle-late)	5140 ± 170
-2456	Grisy sur Seine	Enclosure F 3	1980	3/10	Neolithic (middle-late)	5100 ± 180

General Comment (CM&DM): oldest dates are contemporaneous with unpub result for Chassean industry at Joncquières site, Oise, Gif-2919: 5120 ± 130. However, all these industries mainly come from N origin (Michelsberg) and ceramics of some sites are similar to Early Michelsberg style (MK I/II) in most of sites in Rhône Valley from 5500 to 5300 BP. Youngest dates indicate length of human occupation at Noyen site and *in situ* evolution of ceramic styles which remain contemporary with more recent ceramics of German MK (Mordant & Poitout, in press).

Ly-2464. Les Chappes, Molay, Yonne 4460 ± 110

Bones from silo pit in Late Neolithic site (47° 44′ N, 4° 56′ E). Coll 1980 and subm 1981 by C Mordant. *Comment* (CM): date seems a little too young because of similarity of assoc industry with Noyen industry, Ly-4810: 5260 ± 200 (above).

Ly-2455. Les Grèves de Frécul, Barbuise-Courtavant, Aube 5530 ± 150

Bones from Pit 23 of Cerny culture (Middle Neolithic) (48° 39′ N, 3° 32′ E). Coll 1970 by J Piette and subm 1970 by D Mordant and J Piette. (2/3 diluted sample). *Comment* (DM): date confirms site is contemporary with two sites with same Cerny industry previously dated by Gif-5002: 5510 ± 140 BP (unpub) at Jablines (Seine et Marne) and Gif-5005: 5630 ± 120 at Pincevent (Seine et Marne). Cerny culture seems to be homogeneous in E Ile de France region.

Ly-1944. Le Creux-Rouge, Clermont-Ferrand, Puy de Dôme 6070 ± 140

Human bones from grave in volcanic ash (45° 47′ N, 3° 5′ E). Coll 1973 and subm 1979 by J P Daugas and J P Raynal. *Comment* (JPD& JPR): date agrees with archaeol estimate of grave at Early Middle Neolithic of Auvergne region, *ie*, at limit between Pre-Chassean and Chassean cultures (Daugas & Malacher, 1978; Raynal & Daugas, 1979).

Ly-1797. La Chaise, Malesherbes, Loiret 6190 ± 210

Human bones from under flagstone-covered sepulture (48° 17′ N, 2° 23′ E). (3/5 diluted sample). Coll 1978 by J Vintrou and subm 1979 by G Richard, Orléans. *Comment* (GR): this type of sepulture which surely occurred before dolmens was never dated by industries. Date, oldest for all W central France, makes this monument oldest megalithic monument in France, which is contemporaneous with Recent Rubané culture in Aisne R Valley (above) (Richard & Vintrou, 1979).

Vieille Eglise series, La Balme de Thuy, Haute-Savoie

Bones of deer and boar from two levels of La Vieille Eglise rock shelter (45° 55′ N, 6° 17′ E). Coll 1977 and subm 1978 by J P Ginestet, Thones.

Ly-1934. Level 5A **5940 ± 210**

From Layer 5A, assoc with Chassean and Cortaillod ceramics and uncharacteristic flints. (7/9 diluted sample)

Ly-1935. Level 5B **6500 ± 230**

From Layer 5B, assoc with same ceramics as Ly-1934 but lithic industry shows Tardenoisian (Mesolithic) influence. (2/3 diluted sample)

General Comment (JPG): both dates agree with each other and confirm expected ages and fairly old age of Layer 5B with Mesolithic influences.

Ly-2198. Hassi Mouillah, Ouargla, Algeria **5660 ± 210**

Charcoal from level assoc with Neolithic of Capsian tradition in Hassi Mouillah site on side of Mellala Sebkha (31° 58′ N, 5° 22′ E). Coll 1977 by G Trécolle and subm 1978 by M Schvoerer, Lab Physique Appl Archaeol, Univ Bordeaux. Dated to cross-check dates by TL method. *Comment* (MS): date agrees fairly well with previous unpub result, Gif-438: ca 5280 BP, obtained from same level. Three TL dates from upper part of site gave following values: BDX-110: 7890 ± 680 BP, BDX-112: 6570 ± 560 BP, and BDX-114: 6270 ± 540 BP. Considering statistical margins of both methods and MASCA calibration of ^{14}C dates (which established true ages of ca 4400 BC*), agreement between both methods seems satisfactory.

Mehrgarh series, Baluchistan, Pakistan

Table 25 lists samples of charcoal from tell near Kachi (29° 20′ N, 66° 12′ E). Coll by French Archeol Mission Indus and subm by J F Jarrige, Mus Guimet, Paris.

TABLE 25
Mehrgarh

Lab no.	Sample no.	Loc and layer	Assoc industry	Colln yr	Dilution ratio	Age BP
Ly-1527	MRI-MRK 2B	Loc 93,—1m	Bronze age	1976	1	3570 ± 130
-1529	MR2-MRK 9H	Loc 204,—1.1m	Bronze age	1976	1	3960 ± 140
-1528	MR3-MRC 8I	Loc ? ,—3.5m	Bronze age	1976	1	4190 ± 140
-1945	MR4-F5F	Layer 4,—2.2m	Chalcolithic	1978	7/10	5360 ± 310
-1947	MR-3T 536	Layer 4,—3.5m	Neolithic	1979	1	5830 ± 190
-1946	MR3 AIA 433	Layer 3,—1.9m without humus	Neolithic	1979	1	33,000 ± 3000
-1950	MR3 AIA	Layer 3,—1.9 with humic fraction	Neolithic	1979	1	8440 ± 250
-1949	MR37 537	Layer X —3.7m only humic fraction	Neolithic	1979	1	5530 ± 180
-1948	MR37 537	Layer X —3.7m without humic fraction	Neolithic	1979	1/6	5720 ± 730

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General Comment: as site was probably occupied from 5500 to 3500 BP for Chalcolithic upper layers and ca 7500 BP for Neolithic lower layers, dates do not agree with expected ages and are either too young by at least 2000 yr, or obviously too old. For last two, Ly-1946 and -1950, old ages can be explained. Charcoal came from hearths where burned wicker baskets were treated with bitumen, which is found near site, at time of manufacture. Thus, dead carbon was introduced to sample and measured later with it. All other dates seem too young but sample cannot have been contaminated by modern organic soluble components as humic fraction, Ly-1949, and no humic fraction, Ly-1948, have same apparent age. Discrepancy with expected ages may be explained either by very large amount of ancient roots in layers, eg, because of deep cultivation at ca 5500 BP during temporary abandonment of site, or by fact that site is much younger than expected (Jarrige & Lechevalier, 1980). Many other dates from other ^{14}C labs from same site show same range of dates and suggest that revision of archaeol stratigraphic interpretation is necessary.

Ly-2483. Erg-Tihodaïn, Sahara occidental, Algeria 6010 ± 160

Ostrich egg fragments from black soil at Neolithic site of Capsian tradition, assoc with flint and human skeletons, on W border of Erg Tihodaïn, between Tassali and Hoggar in central Sahara desert (25° 19′ N, 6° 50′ E). Coll and subm 1980 by A Bonnet, Nîmes. *Comment* (AB): date agrees with expected value and others of Neolithic Capsian sites (Camps, Delibrias, & Thommeret, 1968). Result indicates suitability of this dating material. Another date, from 6km N of site, in black soil with ceramics, was previously pub, Ly-407: 6870 ± 150 (R, 1973, v 15, p 146).

Ly-2149. El Haroua II, Témara, Morocco 5900 ± 210

Bones from double Neolithic sepulture, Rabat region (33° 57′ N, 6° 56′ W). Coll 1978 by A Debénath, Prehist Paleontol Mission Morocco, and subm 1979 by A Debénath. Assoc with Neolithic industry. *Comment* (AD): date agrees with expected archaeol range; no other absolute dates from seashore of N Morocco (Debénath & Sbihi-Alaoui, 1979).

F. Mesolithic

Murchison R series, Australia

Table 26 lists samples from open-air sites or rock shelters in Murchison R Basin, near Mullewa (27° 30′ S, 115° 00′ E) at Billibilong Spring, Billily Claypan, Inguelba Shelter, Wail Outcamp, and Yallalong Sta, and in Sandford R Valley, near Cue (27° 20′ S, 117° 55′ E) at Walga Rock. Coll by C Dortch, W Australia Mus and F Bordes, J P Raynal, and C Thibault, Inst Quaternaire, Bordeaux, for Fr Archaeol Mission Australia; subm by F Bordes and J P Raynal.

TABLE 26
Murchison River Basin

Sample no.	Site & ref	Level depth	Sample	Colln yr	Dilution ratio	Age BP
Ly-1810	Billibilong 3	Unit 2 base	Charcoal	1978/1978	1/4	2030 ± 330
-1809	Billibilong 2	Unit 3 base	Charcoal	1978/1978	1	3590 ± 130
-2169	Billibilong 8	Unit 3 base	Charcoal	1979/1980	1/4	3810 ± 130
-2170	Billibilong 6	Unit 4 base	Charcoal	1979/1980	1/4	4000 ± 220
-2079	Billily 1	Unit 2 base	Charcoal	1979/1980	1	650 ± 110
-2366	Inguelba 1	10-15cm	Charcoal	1980/1980	19/30	270 ± 160
-2367	Inguelba 2	25-30cm	Charcoal	1980/1980	1/2	560 ± 160
-2168	Wail Outcamp 3	Unit 4 top	Charcoal	1979/1980	1	2420 ± 120
-2080	Wail Outcamp 4	Unit 4 top	Calcareous algae	1979/1980	1	4310 ± 110
-2081	Wail Outcamp 7	Unit 4 top	Shells	1979/1980	1/5	4650 ± 290
-2167	Yallalong 5	Unit 4 base	Shells	1979/1980	1	4210 ± 130
-2097	Walga Rock 3	70-75cm	Charcoal	1978/1979	2/3	790 ± 160
-2098	Walga Rock 4	57-80cm	Charcoal	1978/1979	1/3	1040 ± 180
-2099	Walga Rock 6	110-115cm	Charcoal	1978/1979	2/3	3820 ± 200
-1846	Walga Rock 1	110-115cm	Charcoal	1978/1978	2/5	7010 ± 350
-1847	Walga Rock 2	115-125cm	Charcoal	1978/1978	1/10	9950 ± 750

General Comment (JPR): dates establish chronology of recent lithic industries of Murchison R Basin. Period of occupations with non-microlithic industries is seen in Layer 11 of Walga Rock site. This layer is deeply channelled by subsequent humid period. Microlithic industries appear in Units 4 and 2 at Walga Rock, Billibilong, and Billily during semi-arid period with wind deposits, sedimentation, and colluvia. These microlithic industries last up to very recent period at Walga Rock and Ingulba Shelter.

Ly-2365. La Source, Cosnac, Corrèze 7270 ± 240

Charcoal from sandstone fill of rock shelter at Roche-Longue (45° 08′ N, 1° 35′ E). Coll 1980 by P Andrieu and P Chennebault, and subm 1980 by G Mazière, Dir Antiquités Préhist, Limoges. (11/30 diluted sample). *Comment* (GM): date is a little too young for Early or Middle Sauveterrian assoc industry; this may be due to downward infiltration of recent charcoal or rootlets.

Ly-2297. Abri des Cabônes, Ranchot, Jura 8730 ± 170

Bones from upper layer in Les Cabônes shelter. Coll 1980 by M Campy and S David, and subm 1980 by M Campy, Hist Geol Paleontol Lab, Besançon. Assoc with triangle Mesolithic industry. (3/5 diluted sample). *Comment* (MC): date agrees with typologic and palynologic attribution to Boreal period. *Cf* unpub Louvain date from Gigot shelter at Bretonvillers, Doubs, Lv-1112: 8500 ± 95 BP.

Ly-2200. Les Mians, Gordes, Vaucluse 8620 ± 380

Charcoal from Les Luquets rock shelter (43° 55′ N, 5° 11′ E). Coll and subm 1979 by M Livache. (1/5 diluted sample); assoc with Sauveterrian industry (Livache, 1976). *Comment* (ML): date is comparable to results from neighboring site Gramari, *ie*, with Levels 3B and 4C, respec-

tively, Gif-753: 8000 ± 190 and Gif-754: 9340 ± 220 (R, 1971, v 13, p 219). It also fits with other dates for this Sauveterrian industry in other regions in France.

La Pécoulette series, Lagorce, Ardèche

Table 27 lists samples from site lying at entrance to La Pécoulette grotto (44° 24′ N, 4° 19′ E). Coll 1977 and subm 1978 by D Philibert, Univ Lyon. Assoc with Sauveterrian (Epipaleolithic) industry (Philibert & Debard, 1977-78).

TABLE 27
La Pécoulette

Sample no.	Square	Depth	Sample	Dilution ratio	Age BP
Ly-2364	La Pécoulette A2	60-70cm	Bones	7/30	8450 ± 350
-2410	La Pécoulette A2	70-75cm	Charcoal	1/6	6280 ± 320
-1978	La Pécoulette ad	75-100cm	Bones	7/10	8570 ± 320
-2411	La Pécoulette A2	100-110cm	Bones	3/10	8740 ± 230
-1979	La Pécoulette A2	110-120cm	Bones	1/5	9060 ± 800
-1980	La Pécoulette A2	125-135cm	Bones	2/9	8200 ± 750

General Comment (DP): single charcoal date is too young probably because of roots and shallow level. Bone dates are in expected range for Epipaleolithic industry. Low collagen content and small sample size made statistical margins too large to check ages stratigraphically.

Ly-2107. La Madeleine des Albis, Penne, Tarn 8850 ± 190

Bones from 2.5m depth in small fissure filled with geol and archaeol sediments close to Magdalenian site (44° 05′ N, 1° 43′ E). Coll 1977 by H Bessac and subm 1978 by J Lautier, Albi. No assoc industry but upper part of fissure deposit contains potsherds from Middle ages. *Comment* (JL): date shows that bones are either Mesolithic or mixing of recent and other bones from neighboring Magdalenian sites previously dated at Ly-1109: 11,180 ± 300 and -1175: 10,110 ± 440 (R, 1978, v 20, p 46-47).

G. Paleolithic

Ly-1970. Pierre Magnat, Fromental, Haute-Vienne Modern $\Delta^{14}C = 1.1 \pm 2.3\%$

Charcoal from 60cm depth in foot-hill site (46° 09′ N, 1° 27′ E). Coll 1978 by R Crédot and M Dominique, and subm 1979 by G Mazière. Assoc with presumably Late Magdalenian industry. (3/5 diluted sample). *Comment* (GM): date indicates upper layers of site were re-used or disturbed by recent roots.

Ly-1605. Martinet, Sauveterre-La-Lemance, Lot et Garonne 12,600 ± 1100

Bones from Layer IV in Le Martinet site (44° 36′ N, 1° 01′ E). Coll during ancient excavation by L Coulonges and subm 1977 by J M Le Tensorer, Univ Bordeaux. *Comment* (JML): uncertainty margin of date is very large, because of small amount of collagen. Date may only be con-

sidered compatible with archaeol attribution to Magdalenian (Le Tensorer, 1980; 1981).

Abauntz series, Arrais, Navarre, Spain

Sample from Abauntz grotto (43° 01′ N, 1° 42′ W). Coll from 1976 to 1978 and subm 1979 by P Utrilla-Miranda, Univ Zaragoza.

Ly-1964. 19/20 **9530 ± 300**

Burned bones from Level "d" assoc with Azilian (Epipaleolithic) culture without geometrics. (2/5 diluted sample)

Ly-1965. 19/20 **15,800 ± 350**

Bones from Level "e" assoc with Early Magdalenian industry without harpoon.

General Comment (PU-M): dates agree with expected ages. Ly-1964 is comparable to dates from Zatoya site at Abaurrea Alta, Navarre, Levels I and II, Ly-1457: 8260 ± 550 and Ly-1398: 8150 ± 170 (R, 1979, v 21, p 442). Ly-1965 is contemporaneous with Altamira site at Santillana del Mar, Santander, M-829: 15,500 ± 700 (R, 1969, v 11, p 109), with Juyo at Igollo, Santander, M-830: 15,300 ± 700 (R, 1968, v 10, p 46) or with Pascano series, BM-1455: 16,560 ± 131, BM-1453: 15,988 ± 193, and BM-1452: 15,173 ± 160 (R, 1982, v 24, p 249-250) (Utrilla-Miranda, in press).

Le Calvaire series, Lourdes, Hautes-Pyrénées

Bone fragments from two geol secs (43° 06′ N, 0° 07′ E). Coll 1977 and subm 1978 by J Omnès.

Ly-1905. Left sec, level 0/0.30m **11,750 ± 430**

Ly-1906. Front sec, level 1.70/2.50m **12,450 ± 330**

General Comment (JO): Ly-1905 corresponds with little known microlithic industry which should be Epipaleolithic. As this is 1st find of its kind in region, date cannot be compared. Ly-1906 corresponds with Late Magdalenian industry and with other dates of region (Clot & Omnès, 1980) eg, at Espelugues, Ly-1406: 13,170 ± 260 (R, 1979, v 21, p 444).

Ly-2184. Fontanet Foyer, Ornalac-Ussat-Les- Bains, Ariège **12,770 ± 420**

Charcoal from hearth in Fontanet grotto (42° 49′ N, 1° 38′ E). Coll and subm 1979 by J Clottes, Dir Antiquités préhist, Foix. (2/11 diluted sample). *Comment* (JC): archaeol evidence suggests that grotto was occupied for only short periods of time. Date seems to confirm previous measurement, Ly-846: 13,810 ± 740 (R, 1975, v 17, p 23) considering statistical margins of both dates, average of which is Ly-846.2184: 13,020 ± 370.

Ly-2296. Abri des Cabônes, Ranchot, Jura **12,620 ± 250**

Bones from lower layer of les Cabônes shelter (47° 09′ N, 5° 44′ E). Coll 1980 by M Campy and S David, subm 1980 by M Campy. (13/15 diluted sample). Assoc with Late Magdalenian industry. *Comment* (MC): correspondence of date with generally accepted range of dates of Bölling

period is surprising for assoc Late Magdalenian industry in region but agrees with other dates from distant French sites such as Le Chamois-Boivin grotto at Blois/Seille, Ly-440: 12,040 ± 270 (R, 1973, v 15, p 168).

Enval series, Vic-le-Comte, Puy de Dôme

Charcoal from Durif shelter (45° 29′ N, 3° 14′ E), from so-called Sol de la Grange part of site. Sample corresponds to Magdalenian industry a little older than that of Fond de l'Abri part of site previously dated, Ly-425: 13,000 ± 300 (R, 1973, v 15, p 149) and Ly-727: 13,700 ± 380 (R, 1975, v 17, p 27). Coll 1973 and subm 1978 by Y Bourdelle, Clermont-Ferrand (Bourdelle, 1979).

Ly-2046. No. 304 **13,090 ± 270**

From Level D1. (2/3 diluted sample)

Ly-2047. No. 35 **6440 ± 350**

From Level B. (1/5 diluted sample)

General Comment (YB): despite expected older age, Ly-2046 indicates same range of date as previous results. Ly-2047 is aberrant and proves local contamination at site.

Comarque series, Sireuil, Dordogne

Bones from right part of small grotto (44° 57′ N, 1° 06′ E). Coll and subm 1979 by B Delluc and G Delluc, Périgueux. Assoc lithic industry may be defined as Magdalenian but without characteristic elements, and wall of grotto has engravings (Delluc & Delluc, 1981).

Ly-2154. 1 **13,370 ± 340**

Bones of miscellaneous animal spp. (2/3 diluted sample)

Ly-2355. 2 **12,710 ± 200**

Bones of reindeer.

General Comment (BD&GD): Ly-2355 confirms -2154 and homogeneity of bone material of grotto deposits. Average of both dates is Ly-2154/2355: 12,880 ± 170, agreeing with expected age according to style of engravings (Early Style IV, according to Leroi-Gourhan), assoc industry (Magdalenian III or IV), and vegetation (cold climatic phase indicated by pollen analysis). Occupation time of grotto may have occurred during last part of Early Dryas period.

Moulin Neuf, Saint Quentin de Baron, Gironde

Bone fragments from rock shelter (44° 38′ N, 0° 16′ W). Coll 1977 and subm 1979 by M Lenoir, Univ Bordeaux. Assoc with Late or Middle Magdalenian industry without harpoons (Lenoir, 1977).

Ly-2352. Cz a **13,570 ± 260**

From top of Layer 2. (2/3 diluted sample)

Ly-2275. Cz b **14,280 ± 440**

From base of Layer 2. (3/5 diluted sample)

General Comment (ML): both dates suggest that assoc industry belongs to Middle Magdalenian.

Ly-2100. La Marche, Lussac-les-Chateaux, Vienne 14,280 ± 160

Bones from only layer of La Marche grotto (46° 24′ N, 0° 43′ E). Coll 1957 and subm 1979 by L Pradel, Chatellerault. Assoc with Magdalenian III industry (Pradel, 1958, p 170-191). *Comment* (LP): date agrees with attribution to Pre-Bölling interstadial deduced from pollen analysis (Leroi-Gourhan, 1973). It is also similar to unpub date from Le Roc au Sorcier shelter, Grn-1913: 14,160 ± 100 (R, 1963, v 5, p 169) and Grn-1903: 13,920 ± 80.

Ly-1830. Grotte de la Bergerie, Caniac du Causse, Lot 15,830 ± 400

Bones from Layer 7 of Paleolithic site at base of grotto, at La Bergerie des Quatre chemins (44° 38′ N, 1° 40′ E). Assoc with atypical poor industry containing *pointe à cran* flint of Hamburgian type and bone tools (Seronie-Vivien, 1972). *Comment* (RS-V): date helps classify this poor industry into group of microlithic industries, with or without *scalène* triangles, of Middle Magdalenian. Such industries came before eponymic Magdalenian (Séronie-Vivien *et al*, 1979). Date comparable to similar levels at Fongaban, Ly-977: 14,300 ± 680, Le Flageolet II, Layer IX, Ly-918: 15,250 ± 320, Combe Cullier, Layer IX, Ly-978: 15,030 ± 330 (R, 1976, v 18, p 80), Ste-Eulalie, Gif-1745: 15,100 ± 270 and Gif-2194: 15,200 ± 300 (R, 1974, v 16, p 26).

La Grotte Maszycka series, Poland

Bones from Maszycka grotto near Maszyce, Krakow dist (50° 20′ N, 19° 40′ E). Coll 1883 by G Ossowski and subm 1981 by J K Kozłowski, Inst Archaeol, Univ Jagiellonski, Krakow. Assoc with Magdalenian with Navette industry similar to Fr Magdalenien à Navette industry (Kozłowski, 1962).

Ly-2453. Nos. 1 and 2 (incised) 14,600 ± 240

Ly-2454. No. 3, bones 15,490 ± 310

General Comment (JKK): although only incised bones are assoc with Magdalenian culture, both dates close to dates for same industry at Arlay, Jura, Ly-497: 15,320 ± 370, Ly-559: 15,770 ± 390 (R, 1973, v 15, p 520), and Le Grand Abri site, La Garenne, Saint Marcel, Indre, C-578: 15,847 ± 1220 (Libby, 1952).

Ly-1998. Abri de la Chaire à Calvin, Mouthiers, Charente 15,440 ± 440

Bone fragments from older Magdalenian Layer (54° 33′ N, 0° 07′ E). Coll 1969 and subm 1979 by J M Bouvier. Inst Quaternaire, Univ Bordeaux I. (5/6 diluted sample). *Comment* (JMB): date is older than expected and does not agree with Magdalenian facies without harpoons (Bouvier, 1969). It agrees with two unpub dates from Saint-Germain-La-

Rivière site, Gironde, with similar industries, Gif-5478: 15,300 ± 410 from Layer C2, and Gif-5479: 16,200 ± 600 from Layer C4.

Ly-2228. La Tannerie, Lussac-les-Chateaux, Vienne 18,020 ± 270

Bones from terrace in front of La Tannerie Grotto (46° 24′ N, 0° 43′ E). Coll 1950 and subm 1980 by L Pradel, Chatellerault. Assoc with Late Solutrean industry (Pradel, 1950). *Comment* (LP): dates agree with those of Zero Magdalenian industry from Layer 6, Abri Fritch site in same region, Ly-1124: 1124 ± 350 BP (R, 1978, v 20, p 50).

Grotte Pégourié series, Caniac du Causse, Lot

Table 28 lists samples of bones from Pégourié grotto (43° 37′ N, 1° 39′ E). Coll and subm by R Séronie-Vivien, Le Bouscat, Gironde.

TABLE 28
Grotte Pégourié

Lab no.	Layer	Sample no.	Assoc industry	Colln date	Dilution ratio	Age BP
Ly-1390	4	1209	Azilian	1976	2/3	11,290 ± 320
-1598	5 top	1210	Azilian	1976	4/5	13,980 ± 510
-1832	5	646	Azilian	1977	1	11,870 ± 290
-1391	5 middle	1211	Azilian	1976	2/3	11,680 ± 330
-1833	5	645	Azilian	1977	1	11,850 ± 280
-1392	5 base	1212	Azilian	1976	1/3	12,690 ± 530
-1393	6 top	1213	Azilian	1976	1/6	8730 ± 890
-1834	8 a	644	Early Magdalenian *à raclettes*	1977	1	17,400 ± 460
-1394	8 b	1220	Early Magdalenian *à raclettes*	1976	1/2	17,490 ± 520
-1836	9 a	642	Early Magdalenian *à raclettes*	1977	9/10	17,420 ± 390
-1835	9 b	643	Early Magdalenian *à raclettes*	1977	11/20	24,200 ± 1100

General Comment (RS-V): dates agree with expected ranges of both industries (Séronie-Vivien *et al*, 1979). As expected, Azilian industry occurred ca 11,500 BP, as in other regions, eg, Alsace at Rochedane, Ly-1192: 11,090 ± 200 (R, 1978, v 20, p 46) and Languedoc at Saint Remèze, Ly-320: 11,500 ± 380 (R, 1971, v 13, p 62). Early Magdalenian dates are also homogeneous ca 17,400, in agreement with those from Abri Pataud, 4 dates from 16,500 to 1800 BP (R, 1978, v 20, p 50) and at Laugerie Haute, Ly-972: 18,260 ± 360 (R, 1976, v 18, p 80). Ly-1835 was obtained from bones at base of grotto deposit that may belong to another depositional cycle (see Bos grotto, above). Ly-1393 may be compared with Ly-1837 and -1838 (R, 1980, v 22, p 547) and Gif-2568: 8450 ± 250 (unpub). These four dates, ca 8500 BP, are younger than expected and may indicate re-use assoc with climatic phenomena.

Las Caldas series, San-Juan-de-Prioro, Spain

Table 29 lists samples of bones from three loci in Las Caldos grotto Prov Oviedo (43° 20′ N, 5° 59′ W). Coll 1980 by M S Corchon and subm 1980 by F J Cerda, Prehist Dept, Univ Salamanca.

TABLE 29
Las Caldas

Sample no.	Ref	Area	Level	Industry	Age
Ly-2427	C II	Sala II	III-IV	Middle Magdalenian	13,400 ± 150
-2421	CI 1	El Pasillo	3	Upper Solutrean	18,250 ± 300
-2422	CI 2	El Pasillo	4	Upper Solutrean	17,050 ± 290
-2423	CI 5	El Pasillo	7	Typical Upper Solutrean	18,310 ± 260
-2424	CI 6	El Pasillo	9	Typical Upper Solutrean	19,390 ± 260
-2425	CI 12	El Pasillo	12 top	Middle Solutrean	19,030 ± 320
-2426	CI 9	El Pasillo	12 base	Middle Solutrean	19,480 ± 260
-2428	CE 15	Sala I	16	Middle Solutrean	19,510 ± 330
-2429	CE 16	Sala I	18	Middle Solutrean	19,000 ± 280

General Comment (FJC): dates agree with each other and with expected ages. They confirm correlations among three excavated secs are comparable to other dates from Spain or SW France. Ly-2428 corresponds to wet and cold climatic phase, attributed to Early Dryas, and agrees with other dates of Middle Magdalenian in France. Two dates of Late Solutrean agree with others of same industry from Chufin site, obtained but unpub by Madrid lab, CSIC-258: 17,420 ± 200. Their apparent inversion may be due to post-sedimentary inversion. All other results are consistent with two series from Oullins and Solutré sites, France. They confirm archaeol hypothesis of *in situ* evolution of Middle Solutrean industry in Layer 12 corresponding to Würmian III-IV interstadial phase, into typical Solutrean in Layers 9 and 7, corresponding to beginning of Early Dryas phase.

Ly-2279. Puy-Jarrige II, Brive-La-Gaillarde, Corrèze 19,310 ± 790

Bones from Sq LVI of Rockshelter II (45° 17′ N, 1° 28′ E). Coll and subm by G Mazière, Dir Antiquités Préhist, Limoges. (1/6 diluted sample). *Comment* (GM): date is too young for assoc industry (Perigordian IV with *Pointes de Bayac* generally dated ca 24,000 BP. Contamination may be due to Middle-age occupation of rockshelter.

Oullins series, La Bastide de Virac, Ardèche

Bones from La Baume d'Oullins site (44° 20′ N, 4° 32′ E). Coll and subm 1978 by F Bazile, Vauvert. Assoc with *à pointes à crans* Solutrean industry (Bazile & Bazile-Robert, 1981). (4/5 diluted sample)

Ly-1984. Level D 20,100 ± 500

Ly-1983. Level 9 20,060 ± 450

General Comment (FB): dates agree with expected ages of assoc industry in W Languedoc region. They disagree with two dates previously pub (R, 1975, v 17, p 22) and obviously too young, from two Early Solutrean layers in same site, Ly-779: 19,710 ± 400 for Layer 7 and Ly-798: 19,360 ± 420 for Layer 6. They agree with 5 dates ca 19,000 BP for Early *Salpétrian* (Early Magdalenian) industries and unpub Monaco Lab result from Early or Middle Solutrean industry, la Salpêtrière site at Remoulins

Gard, MC-2449: 21,600 ± 70. They also agree with Groningen series for same industry from Laugeric Haute site, Dordogne (R, 1967, v 9, p 116).

Ly-2101. Laraux, Lussac-les-Châteaux, Vienne 21,950 ± 350

Bones from Layer 3 in Laraux shelter (46° 24′ N, 0° 43′ E) (Pradel, 1979). Coll 1949 and subm 1981 by L Pradel. (29/30 diluted sample). *Comment* (LP): previous date from same layer, Ly-1739: 21,530 ± 910 (R, 1979, v 21, p 447). New measurement was made on larger sample which reduces uncertainty margin; average value of both measurements, Ly-1739/2101: 21,890 ± 330.

Ly-1863. La Mère Clochette, Rochefort-sur-Nenon, Jura 25,800 ± 700

Fragments of mammoth tusk from La Mère Clochette grotto (47° 9′ N, 5° 55′ E). Coll 1906 by J Feuvrier and subm 1979 by R Desbrosse, Blanzy. *Comment* (RD): collections of artifacts confirm existence of Mousterian, Aurignacian (points with split base) and Early Perigordian (Châtelperron and Les Cottés points) (Desbrosse, 1981). Ly-1863 indicates much younger age.

Ly-1861. Pech Merle, Cabrerets, Lot 11,200 ± 800

Charcoal from Excavation VII under so-called *La Frise noire* painting in Pech Merle grotto (44° 31′ N, 1° 38′ E). Coll and subm 1978 by M Lorblanchet, Centre Natl Recherche Sci, Gramat. (1/15 diluted sample). Parietal painting of grotto belongs to Magdalenian style (ca 15,000 BP). *Comment* (ML): even considering very large statistical margin, due to small sample size, date is much younger than expected and seems too recent to mark last occupation time of grotto which is surely contemporaneous with painting. Slight contamination by recent carbon may be responsible for this discrepancy.

Abri Moula series, Ardèche

Table 31 lists samples of bones from shelter deposit near Soyons (44° 52′ N, 4° 50′ E). Coll by Crouzet Archaeol Club and subm by P Payen, Valence. Assoc with scattered, presumed Late Mousterian industry.

TABLE 31
Abri Moula

Sample no.	Square	Depth	Colln date	Dilution ratio	Age BP
Ly-1595	F2,F3	0.7-2m	1976	1	$24{,}400\ ^{+2000}_{-1600}$
-2217	F3,F4,G3,G4	3.2-3.9m	1980	1	20,100 ± 310
-2488	F4,F5,G4,G5	4.1m	1980	1	33,200 ± 1500

General Comment (PP): only Ly-2488 agrees with expected age, relatively recent for end of Mousterian industries, which are, thus, contemporaneous with 1st early Late Paleolithic industries, as previously found in other sites; see, eg, Level VIII, Gigny/Suran, Ly-566: 29,500 ± 1400 (R, 1973, v 15, p 521) and Ly-789: 28,500 ± 1400 (R, 1975, v 17, p 83). Two other

dates are too young and suggest re-use in upper levels where Mousterian flints may have mixed with younger bones as stratigraphy and geol hist of sediments seem to be fairly complex.

Saint-Cesaire series, Charente-Maritime

Bones from La Roche à Pierrot site (45° 45′ N, 0° 31′ W). Coll and subm 1979 by F Lévêque, Dir Antiquités Préhist Poitiers (Lévêque & Vandermeersch, 1980).

Ly-2192. Ejo sup **21,100 ± 540**

From so-called *ensemble jaune-orange* upper layer, assoc with Proto-Aurignacian industry. (13/30 diluted sample)

Ly-2193. Ejop sup **22,960 ± 840**

From so-called *ensemble jaune-orange-pâle* upper layer, assoc with Castelperronian (Early Late Paleolithic) industry. (7/30 diluted sample)

General Comment (FL): both dates are much too young despite good sample. Large amount of recent organic matter deposited for short time on site before excavation may have contaminated small amount of collagen remaining on bones.

Ly-1793. Esquicho-Grapaou Sainte-Anastasie, Gard 27,700 ± 1100

Bone from Layer CC2, Rassan (43° 56′ N, 4° 19′ E). Coll and subm 1978 by F Bazile, Vauvert. Assoc with Mousterian industry which is last such level in site and may be attributed to Würm-II/III interstadial. (5/6 diluted sample). *Comment* (FB): age is younger than expected and conflicts with unpub date from Late Paleolithic level overlying SLC1b: MC-2161: 34,540 ± 2000 BP.

Grotte Tournal series, Bize-Minervois, Aude

Table 30 lists samples from several loci in Tournal grotto (43° 20′ N, 2° 31′ E). Coll and subm by A Tavoso, Univ Marseille. Site is grotto deposition on stalagmitic floors, constituted by very concreted sediments containing Mousterian, Late Aurignacian, and Magdalenian industries. Sediments have been disturbed by suction action of karstic system sometimes open under stalagmitic floors.

TABLE 30
Tournal Grotto

Lab no.	Sample no.	Layer and sq	Sample	Assoc industry	Subm date	Dilution ratio	Age BP
Ly-1231	Bize 2	K31 C	Charcoal	Magdalenian IV	1975	1	12,550 ± 210
-1894	Bize 6	K31 C	Bone	Magdalenian IV	1978	1	12,860 ± 320
-1897	Bize 8	030 I	Bone	Magdalenian	1979	1	13,790 ± 420
-1232	Bize 3	M34 ALM	Bone	Magdalenian	1975	1/2	14,530 ± 510
-1675	Bize 4	M34 AF	Charcoal	Magdalenian	1975	2/5	14,770 ± 970
-1896	Bize 7	N32 PC	Bone	Late Paleolithic	1978	1	25,870 ± 830
-1895	Bize 5	LM32 F	Charcoal	Early Aurignacian	1978	1/6	⩾29,000
-1031	Bize 1	L31 C	Carbonaceous earth	Early Aurignacian	1974	1/3	⩾34,200
-1676	Bize 5	K29 C	Charcoal	Mousterian	1978	1	33,600 ± 1300
-1898	Bize 9	P31 G	Charcoal	Mousterian	1978	1/4	⩾35,800

General Comment (AT): because of fractioning of deposits in isolated units, most measurements were made to control correlation assumed from one unit to another. Most dates were expected. Magdalenian occupation of site took place during Middle Magdalenian and beginning of Late Magdalenian epochs although assoc industry is not characteristic. Because of small amount of available Early Aurignacian material, this industry could not be dated (Ly-1895). Ly-1031 seems too old and -1676 too young, with regard to stratigraphy. U/Th measurements were made on teeth and bones but dates are different for both samples.

Brugas series, Layer 4, Vallabrix, Gard

Charcoal from base of rock shelter (44° 03′ N, 4° 29′ E). Coll and subm 1978 by L Meignen, Centre Recherches Archéol, Valbonne. (17/30 diluted sample)

Ly-2038. 1 **⩾32,000**

Ly-2351. 2 **29,000 ± 860**

General Comment (LM): Ly-2351 is too young for unknown reason. Ly-2038 confirms industry does not belong to very Late Mousterian.

IV. HYDROGEOLOGIC SAMPLES

Wassia series, Saudi Arabia

Table 32 lists samples of water from five superimposed aquifers of several underground areas of Arabia. Coll from 1974 to 1977 by Bur Recherches Geol Min (BRGM) for Water and Agric Agency Arabian Kingdom. Subm from 1975 to 1977. Aquifers lie in sedimentary basin mainly deposited from Cretaceous to Neogene eras. They are, from lowermost to uppermost: Behiad (from ante-Cenomanian strata), Wassia (from Cenomanian), Um er Radhuma (Paleocene), Alat Kobar, and Neogene. Study was pub in BRGM rept (1980).

TABLE 32
Wassia

Sample no.	Sample	Date	Dilution ratio	Activity (% of modern)
Torrent in Djedah region (21°29′N, 39°16′E)				
Ly-1066	Oued	1/3/77	1	78.8 ± 2.0
Springs around Hofuf palm-tree grove (25°25′N, 49°45′E)				
Ly-1087	Aīn Najim 44	6/5/75	1	3.5 ± 0.4
-1088	Aīn Khudud 1	7/5/75	1	16.6 ± 0.6
-1089	Aīn Buhairiyah 9	8/5/75	1	24.2 ± 0.7
-1090	Aīn Jauhariyah 5	9/5/75	2/3	3.9 ± 0.4
-1091	Aīn Sabaa 3	10/5/75	2/3	⩽1.5
-1092	Aīn Manah 12	11/5/75	1	5.5 ± 0.4
-1432	Aīn Um Sabba	2/75	1	3.8 ± 1.8
-1433	Aīn Khalif	2/77	1	13.7 ± 2.2
-1434	Aīn Al Marah 112	2/77	1	15.2 ± 2.1
-1435	Aīn Jauhariyah	2/77	1	⩽4.8
-1436	Aīn Najim	2/77	5/6	5.2 ± 2.7
-1437	Aīn Harrah	2/77	1/8	⩽4.0
-1473	Aīn Khilud	30/4/77	2/3	21.2 ± 1.3
-1474	Aīn Barabir	1/5/77	1	8.5 ± 0.6
-1475	Aīn Huweirrah	2/5/77	2/3	4.7 ± 0.6
-1476	Aīn Buhairiyah	10/5/77	2/3	7.8 ± 1.0

TABLE 32 (continued)

Sample no.	Sample		Date	Dilution ratio	Activity (% of modern)
Borings in Al Hassa and Hofuf region (25°25′N, 49°45′E)					
Ly-1045	WM 541	Neogene	15/3/75	1	9.6 ± 1.5
-1048	WM 194	Neogene	18/3/75	1	1.9 ± 0.3
-1049	D 1072	Neogene	19/3/75	1	1.5 ± 0.3
-1356	A 1681	Neogene	76	2/3	⩽2.5
-1360	G 241	Neogene	76	2/3	⩽2.5
-1364	G 001	Neogene	76	1/2	⩽3.0
-1429	A 1699	Neogene	2/77	1	16.9 ± 0.6
-1445	A 609	Neogene	3/77	2/3	9.7 ± 1.0
-1446	A 818	Neogene	3/77	5/6	⩽1.8
-1449	HD 4N	Neogene	3/77	1	⩽1.9
-1450	HH 1 N	Neogene	3/77	1	2.1 ± 0.7
-1453	HH 2 N	Neogene	3/77	5/6	⩽2.8
-1455	HH 2 N	Neogene	3/77	1	⩽4.3
-1456	HC 6 N	Neogene	3/77	5/6	2.0 ± 0.6
-1479	HC 4 N	Neogene	25/4/77	2/3	6.7 ± 0.8
-1481	HE 2 N	Neogene	20/4/77	1	2.7 ± 0.5
-1483	HD 2 N	Neogene	8/4/77	2/3	⩽1.5
-1485	HC 3 N	Neogene	4/4/77	2/3	3.8 ± 0.7
-1486	HC 2 N	Neogene	1/5/77	2/3	6.1 ± 0.8
-1487	HD 1 N	Neogene	3/5/77	2/3	2.3 ± 0.6
-1492	HD 5 N	Neogene	20/5/77	2/3	3.3 ± 0.8
-1500	HE 1 N	Neogene	18/6/77	2/3	⩽2.1
-1068	UW 810	Alat Kobar	26/3/75	1	3.0 ± 0.5
-1047	WW 810	Alat Kobar	16/3/75	1	⩽1.0
-1352	B 84	Alat Kobar	76	1/2	⩽2.5
-1355	A 613	Alat Kobar	76	1/2	3.6 ± 1.6
-1358	B 85	Alat Kobar	76	2/3	⩽2.5
-1359	A 576	Alat Kobar	76	1	⩽2.0
-1362	A 612	Alat Kobar	76	1/2	3.7 ± 1.2
-1363	A 560	Alat Kobar	76	1	⩽3.5
-1365	G 240	Alat Kobar	76	2/3	⩽3.0
-1428	DH/WW 2	Alat Kobar	2/77	2/3	2.8 ± 0.7
-1439	A 570	Alat Kobar	3/77	2/3	⩽2.0
-1440	G 013	Alat Kobar	3/77	2/3	⩽2.5
-1441	A 604	Alat Kobar	3/77	2/3	4.1 ± 0.8
-1442	A 1679	Alat Kobar	3/77	1	⩽2.2
-1444	U 897	Alat Kobar	3/77	2/3	⩽1.9
-1452	HH 2 K	Alat Kobar	3/77	1/2	⩽4.0
-1454	HC 6 K	Alat Kobar	3/77	1	⩽2.1
-1478	HE 2 K	Alat Kobar	17/4/77	1	2.7 ± 0.4
-1480	HC 4 K	Alat Kobar	23/4/77	1	6.4 ± 0.9
-1490	HD 3 K	Alat Kobar	5/5/77	2/3	2.2 ± 0.3
-1498	HU 5 K	Alat Kobar	9/6/77	2/3	4.5 ± 0.7
-1503	HE 1 K	Alat Kobar	4/7/77	1	⩽1.6
-1046	UW 909	Um er Radhuma	16/3/75	1	10.0 ± 1.5
-1067	UW 819	Um er Radhuma	25/3/75	1/2	⩽2.0
-1069	UW 816	Um er Radhuma	27/3/75	1	1.4 ± 0.3
-1071	UW 999	Um er Radhuma	29/3/75	1/3	7.2 ± 1.4
-1118	WA 1597b	Um er Radhuma	4/6/75	5/6	60.7 ± 1.7
-1353	A 596	Um er Radhuma	76	1/3	⩽2.5
-1354	S 57	Um er Radhuma	76	1	3.1 ± 0.7
-1357	SH 808	Um er Radhuma	76	1	⩽2.5
-1366	A 828	Um er Radhuma	76	1	2.2 ± 0.7
-1423	U 817	Um er Radhuma	2/77	1	⩽2.5
-1424	U 818	Um er Radhuma	2/77	1	4.3 ± 1.8
-1425	AD 812	Um er Radhuma	2/77	1	2.4 ± 1.6
-1426	AD 809	Um er Radhuma	2/77	1	4.5 ± 2.1
-1427	SH 812	Um er Radhuma	2/77	1	⩽2.5
-1430	SH 805	Um er Radhuma	2/77	5/6	⩽2.4
-1431	HA 814	Um er Radhuma	2/77	1	6.0 ± 1.8
-1438	A 579	Um er Radhuma	3/77	3/5	65.0 ± 3.5
-1443	A 608	Um er Radhuma	3/77	2/3	⩽2.2

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TABLE 32 (continued)

Sample no.	Sample		Date	Dilution ratio	Activity (% of modern)
Ly-1447	A 562b	Um er Radhuma	3/77	1	2.8 ± 0.5
-1448	HD 4 U	Um er Radhuma	25/3/77	1	2.3 ± 0.5
-1451	HH 1 U	Um er Radhuma	3/77	2/3	2.5 ± 0.7
-1482	HH 5 U	Um er Radhuma	27/4/77	2/3	⩽2.9
-1484	HD 2 U	Um er Radhuma	7/4/77	2/3	⩽2.1
-1488	HD 1 U	Um er Radhuma	2/5/77	1	2.0 ± 0.5
-1489	U 904	Um er Radhuma	4/5/77	1/3	⩽2.6
-1491	HD 5 U	Um er Radhuma	20/5/77	1	2.9 ± 0.5
-1499	HC 5 U	Um er Radhuma	30/5/77	1	3.2 ± 0.5
-1501	HH 3 U	Um er Radhuma	4/7/77	2/3	⩽2.4
-1502	HE 1 U	Um er Radhuma	4/7/77	1	2.1 ± 0.6
-1070	UW 887	Wassia or Behjar	28/3/75	1/6	⩽2.0
-1077	HA 1 W	Wassia or Behjar	20/4/75	1/3	⩽2.0
-1086	HA 2 W	Wassia or Behjar	3/5/75	2/3	⩽1.6
-1477	HD 4 TW	Wassia or Behjar	7/4/77	1	3.5 ± 0.5
Borings in Wadi Myah region (19°N, 48°E)					
Ly-1081	WA 251	Neogene	27/4/75	2/3	53.2 ± 1.7
-1079	MI 3 A	Alat Kobar	25/4/75	2/3	⩽2.8
-1078	MI 1 U	Alat Kobar	25/4/75	1	⩽1.5
-1080	MI 2 K	Alat Kobar	26/4/75	2/3	⩽1.7
-1113	MI 2 WP	Wassia	25/5/75	1/3	⩽2.7
Borings in Al Quatif (26°35′N, 50°00′E)					
Ly-1094	WA 1682	Neogene	14/5/75	1/6	91.6 ± 4.0
-1095	WM 1238	?	15/5/75	2/3	3.7 ± 0.4
-1050	WA 793	Alat Kobar	22/4/75	2/3	⩽1.0
-1082	Q 3 A	Alat Kobar	28/4/75	2/3	⩽2.8
-1083	Q 2 K	Alat Kobar	29/4/75	2/3	⩽1.5
-1093	WA 1678	Alat Kobar	13/5/75	1/3	⩽3.2
-1074	S 394	Alat Kobar Um er Radhuma	11/4/75	1/2	⩽2.0
-1084	Q 1 U	Um er Radhuma	29/4/75	1	⩽1.8
-1072	Abqaiq 835	Wassia	2/4/75	1/6	⩽2.0
-1085	BU' AYJ 802	Wassia	2/5/75	1	1.6 ± 0.4
-1073	Berri 809	Wassia	9/4/75	1/2	⩽1.5
Borings in Harad (14°15′N, 49°00′E) and Khurais (24°55′N, 48°05′E) regions					
Ly-1075	Khurais	805	14/4/75	1/2	⩽1.5
-1096	HAP 5	Um er Radhuma	18/5/75	1/4	⩽1.5
-1097	HAP 43	Um er Radhuma	18/5/75	2/3	4.7 ± 1.1
-1160	HD 1 W	Wassia	5/12/75	1/2	2.8 ± 0.7
-1199	KH 1 W	Wassia	25/1/76	1/2	3.3 ± 0.8
Borings in Aïn Dar region (25°55′N, 45°10′E)					
Ly-1119	WA 603	Um er Radhuma	6/6/75	1/2	2.0 ± 0.3
-1361	AD 804	Um er Radhuma	76	1/2	⩽2.0
Borings in W Riyad region (24°N, 46°30′E)					
Ly-1076	WB 6	Wassia	15/4/75	1	⩽1.1
-1120	N 5	Wadi Nisah Wassia	9/6/75	2/3	33.9 ± 1.3
Borings in NW Riyad region (27°N, 45°30′E)					
Ly-1115	WA 1632	Um er Radhuma	31/5/75	2/3	110.0 ± 2.1
-1117	S 734	Um er Radhuma	3/6/75	1/6	⩽4.0
-1114	WA 1613	Wassia	30/5/75	1/2	50.7 ± 1.7
-1116	WA 1601	Wassia	1/6/75	2/3	84.7 ± 2.3

General Comment (BRGM): results prove that five superimposed aquifers are independent from isotopic point of view although there are local phenomena of drainage.

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La Grotte de la Cocalière series, Courry, Gard

Table 33 lists samples of water from three loci in karstic system of La Cocalière grotto (44° 19′ N, 3° 10′ E). 501 samples coll and quickly prepared by strong acidification in lab by G Marien, C Pachiaudi, and P Renault, Geol Dept, Univ Lyon. Measurements were made as part of study of origin and turnover of calcium bicarbonates in karstic systems and on hydrogeol of fissured limestones (Burger, 1980). Samples were taken either from bottom of two underground rivers right tributary (AD) or left tributary (AG) or outflow of system (R). Only undiluted samples were measured in proportional counters; others in liquid scintillation devices.

TABLE 33
La Cocalière Grotto

Sample no.	Loc	Date	Dilution ratio	$\delta^{13}C$ (‰ PDB ± 0.1)	Activity (% of modern)
Ly-1110	AD	7/5/75	1/3	−14.5	97.1 ± 3.2
-1111	R	27/6/75	1/4	−12.6	106.6 ± 2.6
-1112	AD	27/6/75	1/6	−15.3	96.5 ± 4.6
-1129	R	2/6/75	1/4	−11.5	110.3 ± 5.8
-1130	AD	2/10/75	1/3	—	123.2 ± 4.5
-1131	R	27/11/75	4/15	− 7.3	124.7 ± 4.4
-1132	R	2/12/75	1/3	− 7.4	119.8 ± 3.8
-1174	AD	28/1/76	1/5	−13.2	120.2 ± 4.9
-1277	AG	11/3/76	1	−17.1	113.7 ± 2.5
-1278	R	11/3/76	1	−15	117.1 ± 2.5
-1227	AG	26/5/76	4/15	−11.0	121.4 ± 4.4
-1228	AD	27/5/76	1/6		119.9 ± 6.8
-1336	AD	22/7/76	1/6	−14.2	102.3 ± 5.0
-1337	AD	21/9/76	4/15		116.4 ± 4.3
-1338	R	21/9/76	1/5	−18.3	91.1 ± 4.3
-1339	AG	2/12/76	1/5	−14.5	112.2 ± 4.6
-1340	AD	2/12/76	1/6	−13.2	112.3 ± 5.3
-1539	AG	10/12/77	1/4		123.7 ± 4.2
-1540	R	10/12/77	2/3	−15.3	116.2 ± 3.1
-1541	AD	22/4/77	1	−13.8	107.9 ± 1.6
-1542	AG	22/4/77	2/3	−14.3	96.3 ± 3.2
-1543	AG	30/5/77	1	−13.0	121.5 ± 1.9
-1544	R	30/5/77	1	−11.6	120.7 ± 2.0
-1545	AG	9/6/77	1/3	− 9.0	122.0 ± 5.2
-1546	R	9/6/77	1		119.5 ± 3.1
-1547	R	17/6/77	1	−13.1	122.5 ± 3.1
-1548	AG	17/6/77	1/3	−15.1	118.8 ± 4.6

General Comment: results are very homogeneous and confirm reliability of sampling, transport, and preparation procedures. Compared to other climatologic data (mainly precipitation and evapotranspiration), highest activities (ca 120% modern) correspond to periods with normal precipitation when karstic system mainly let flow 1-yr-old waters. During low-water periods lowest activities (up to 91% modern) indicate temporarily larger contribution of waters > 1 yr old, probably stocked in fissures of limestone. On larger scale, same phenomena was previously studied by numerous ^{14}C measurements in Fontaine de Vaucluse system (see Le Chene series, R, 1971, v 13, p 65).

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