

LYON NATURAL RADIOCARBON MEASUREMENTS VII

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INTRODUCTION

This list includes most of the measurements made in 1975 and 1976. Results lower than Ly-1000 are old measurements obtained with counters previously described, especially in R, 1973, v 15, p 134, when the laboratory was in the basement of the Nuclear Physics Institute. At the end of 1974 all the apparatus was transferred to a specially designed building with an isolated counting room overlain by 4m non-radioactive earth.

The new well-shielded spectrometer described in R, 1976, v 18, p 60 decreased the background by about 20%, now remaining at 3.1 ± 0.1 cpm (according to the counting vessels) for 3ml C_6H_6 , which does not change appreciably for 10ml C_6H_6 . A new spectrometer of the same type with a background of 4.0 ± 0.2 cpm has been set up without any shield but with better photomultipliers.

For technical reasons (obsolescence of the anticoincidence crown of Geiger counters), the two proportional detectors could not be used in routine counting. All the results in the new laboratory (after Ly-1000) were obtained by the two Packard liquid scintillation spectrometers.

Chemical treatments and calculation methods (half-life: 5570 ± 0 , one standard deviation, standard ^{13}C correction only for bones) remain the same.

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SAMPLE DESCRIPTIONS

I. GEOLOGIC SAMPLES

A. Samples from peat bogs of low altitudes

**Ly-1101. Sondage SM 6, Termoli,
Prov Campobasso, Italia 8800 \pm 350**

Peat from level of lagoonal clay from ca 14m below present sea level in Boring SM 6, in coastal plain 14km SE Termoli, Prov Campobasso, Italy ($41^{\circ} 55' N$, $15^{\circ} 8' E$). Coll and subm 1975 by G Magri, Lab Geol Ambientale, CNEN, Roma 1/3 sample diluted. *Comment (GM)*: date distinguishes between Tyrrhenian or Holocene age for peat. Peat is

Holocene and sea level was 14m lower than at present, 8800 yr ago, concurring with data on sea-level rise during Post-Würmian time.

Mollégès series, Bouches du Rhône

Peaty marl from 2 levels of boring in alluvial plain of La Durance R at Mollégès, Bouches du Rhône (43° 48' N, 4° 57' E). Coll 1973 with "Coûteau" drill by M Reille, and subm 1974 by H Triat, Lab Bot Hist et Palyn, Univ Marseille.

Ly-1019. Mollégès 85 7880 ± 200

From 85cm depth 2/3 sample diluted. *Comment* (HT): as compared with Ly-364: 5600 ± 150 (R, 1973, v 15, p 36) at Le Pont des Clapets in Rhône delta, a younger date was expected for Post-Würmian expansion of Mediterranean oak-grove shown by pollen diagram.

Ly-1020. Mollégès 200 10,670 ± 340

From 200cm depth, at base of boring. 2/3 sample diluted. *Comment* (HT): date agrees with pollen analysis which shows species with Late-Würmian affinity. Level should mark beginning of alluvial sedimentation in that part of La Durance plain after Alleröd period.

Paluds series, Courthézon, Vaucluse

Samples from boring with "Smith" drill in peat bog near Courthézon Vaucluse (44° 5' N, 4° 53' E). Coll and subm 1975 by H Triat.

Ly-1134. Les Paluds de Courthézon, 165-170cm 3470 ± 130

Peat from 165 to 170cm depth. Shows decrease of dense forest in plain and appearance of crop cultivation.

Ly-1135. Les Paluds de Courthézon, 345-350cm 7350 ± 170

Peat from 345 to 350cm depth. Levels correspond with more humid climate in pollen diagram. *Comment* (HT): slightly earlier date was expected, close to Ly-910: 6880 ± 180 (R, 1976, v 18, p 62) from Isle sur la Sorgue in same region. Result possibly indicates beginning of Atlantic.

Ly-1262. Les Paluds de Courthézon, 395-399cm 8480 ± 200

Peaty marl from 395 to 399cm depth. At this level, pollen analysis suggests Boreal with, eg, a short phase marked by *Corylus avellana* L. *Comment* (HT): date fits with a Boreal attribution in Provence, ca 8400.

Ly-1263. Les Paluds de Courthézon, 439-443cm 9740 ± 200

Peaty marl from 439 to 443cm depth. *Comment* (HT): date suggests a Pre-Boreal attribution to level concurring with pollen analysis showing preponderance of pine forest.

Ly-1136. Les Paluds de Courthézon, 470cm 11,530 ± 230

Peaty marl from 470cm depth at base of boring. Pollen analysis shows species with Late-Würmian affinities. *Comment* (HT): a date earlier than Ly-1020 above was expected because of the difficulty in distinguishing

Late Dryas. But warmer climate shown in pollen diagram may be attributed to Alleröd period.

General Comment (HT): more details on these results will be given in a general study of history of vegetation in low valley of Rhône R by H Triat (1978).

Molesme series, Cote d'Or

Samples from several levels of geol sec taken from steep side of small Le Laignes R, Molesmes, Côte d'Or (47° 57' N, 4° 21' E). Coll and subm 1972 by J J Puisségur, Lab Geol, Univ Dijon. All measurements made to date a malacologic diagram and to check the possibility of using micro-gasteropod shells for radiocarbon dating. Only shell pre-treatment was washing which eliminated clay and calcareous gangue but small size, < 1mm, of shells did not permit complete internal washing.

Ly-840. Molesme, Level 10 **5130 ± 120**
Peat from 1.25 to 1.35m depth.

Ly-835. Molesmes, Level 10 **5250 ± 140**
Shells of micro-gasteropoda, 1.25 to 1.35m depth.

Ly-839. Molesmes, Level 9 **5230 ± 130**
Peat from 1.35 to 1.55m depth.

Ly-834. Molesmes, Level 9 **6270 ± 170**
Shells of micro-gasteropoda, 1.35 to 1.55m depth.

Ly-833. Molesmes, Level 7 **9510 ± 210**
Shells of micro-gasteropoda, 1.9 to 2m depth.

Ly-838. Molesmes, Level 6 **8720 ± 150**
Peat from 2 to 2.05m depth.

Ly-837. Molesmes, Level 4 **9280 ± 170**
Peat from 2.2 to 2.4m depth.

Ly-836. Molesmes, Level 3 **9900 ± 290**
Peat from 2.4 to 2.6m depth, 2/3 sample diluted.

Ly-832. Molesmes, Level 3 **11,670 ± 340**
Shells from 2.4 to 2.6m depth, 1/3 sample diluted, very long counting time.

General Comment (JJP): taking into account only dates obtained from samples, all attributions to classic climatic phases for levels agree with ecologic data of fauna of micro-gasteropoda in region (Puisségur, 1976): Atlantic = Levels 10 and 9, Boreal = Level 6, Pre-Boreal = Level 4, and Late Dryas = Level 3. Using only dates obtained from shell samples, only Ly-835 agrees with that chronology. All other dates are obviously 1000 to 1500 yr too old. However most of these gasteropoda live out of water

and their old ages cannot be due to low ^{14}C content of carbon they used for making their shells. It seems more likely that some clayed and calcareous gangue remained in the apex of the small shells after the pre-treatment.

Clény series, Côte d'Or

Samples from base of boring in flood plain of little La Norges R at Clény, Côte d'Or (47° 24' N, 5° 7' E). Coll and subm 1972 by J J Puisségur.

Ly-841. Clény, Level 15	7900 ± 170
Peat from 5.2 to 5.4m depth.	
Ly-842. Clény, Level 16a	8010 ± 130
Peat from 5.4 to 5.5m depth.	
Ly-843. Clény, Level 16b	8540 ± 170
Peat from 5.5 to 5.6m depth.	
Ly-844. Clény, Level 17a	8410 ± 180
Peat from 5.6m depth.	
Ly-831. Clény, Level 17a	9440 ± 250

Shells of micro-gasteropoda from same level as Ly-844. 2/3 sample diluted.

General Comment (JJP): malacologic fauna indicate same climate as present for Levels 15 and 16, and, in agreement with dates, a Boreal attribution for these sediments. Level 17, as compared with Levels 1, 2 and 3 at Molesmes, are attributed to Late Dryas (Puisségur, 1976) despite Ly-844. Same discrepancy found between results from shells or peat of same level with same cause as at Molesmes, but here, none of the values fit ages expected by stratigraphy and especially by fauna.

B. Samples from peat bogs of high altitudes

All results reported here, except Ly-1030, were obtained as part of a general study of history of vegetation in S French Alps by J L de Beaulieu (1977).

Vallée des Merveilles series, Saint-Dalmas de Tende, Alpes Maritimes

Peaty soils of piedmont or perilacustrine peat of small lake of high alt in Les Merveilles Valley near St Dalmas de Tende, Alpes Maritimes. Coll and subm 1975 by H de Lumley, Lab Prehist, Univ Marseille. Many peculiar protohistoric engravings appear on rocks, mostly of Bronze age (Lumley *et al*, 1976). Measurements are from lakes: Long-inferieur, Mouton and Huile and were made to follow retreat of glaciers from lowest part of Les Merveilles Valley to highest lakes which, according to their orientation, still have some névés which are no longer permanent.

Ly-1250. Lac du Diable 1	1410 ± 140
Alt: 2408m (44° 3' N, 7° 26' E).	
Ly-1251. Lac du Diable 2	660 ± 140
Alt: 2408m (44° 3' N, 7° 26' E).	
Ly-1252. Lac du Trem 3	890 ± 140
Alt: 2242m (44° 3' N, 7° 27' E).	
Ly-1253. Roche de l'Autel 4	1090 ± 160
Alt: 2320m (44° 4' N, 7° 27' E).	
Ly-1254. Fond de la Vallée A	1430 ± 140
Alt: 2513m (44° 5' N, 7° 26' E).	
Ly-1255. Fond de la Vallée, Cote 2383	650 ± 140
Alt: 2383m (44° 5' N, 7° 26' E).	
Ly-1256. Pied des Merveilles 101	1430 ± 170
Alt: 2390m (44° 4' N, 7° 26' E).	
Ly-1257. Pied des Merveilles 102	1700 ± 130
Alt: 2410m (44° 4' 7° 26' E).	
Ly-1258. Pied des Merveilles 103	1420 ± 130
Alt: 2405m (44° 4' N, 7° 26' E).	
Ly-1259. Pied des Merveilles 104	Modern
Alt: 2380m (44° 4' N, 7° 26' E).	
	$\Delta^{14}\text{C} = +2.5\% \pm 1.5$
Ly-1260. Pied des Merveilles 105	2090 ± 150
Alt: 2375m (44° 4' N, 7° 26' E).	
Ly-1261. Pied des Merveilles 106	1100 ± 160
Alt: 2370m (44° 4' N, 7° 26' E).	

General Comment (H de L): all dates which evidently post-date engravings and occurred from end of antiquity to the early middle ages. During that period some peaty soils formed and persisted in these high alt. Soils probably rejuvenated either at times by advance of moraine névé, or continuously by persolation of organic matter (Beaulieu, 1976). Presence of *Olea* at Lac du Trem (Ly-1252) and Les Merveilles valley fits well with late Sub-Atlantic age of sediment. However, diagram corresponding to Ly-1260 shows late Sub-Atlantic pollen spectra much younger than 2090 BP, explained either by percolation of pollen or older wood embedded and decomposed in peaty sediments. Ly-1261 seems too young because of absence of *Olea* but presence of *Picea* and *Abies* suggest 2000 to 3000 BP.

Ly-1137. Baïssescure 572, 90-95, Murat sur Vèbre, Hérault 3700 ± 130

Peat from 90 to 95cm depth in Baïssescure peat bog near Murat sur Vèbre, Hérault (43° 33' N, 2° 48' E). Coll 1972 and subm 1973 by J L de Beaulieu, Lab Bot Hist, Univ Marseille. At that level pollen diagram shows maximum of *Fagus* curve. *Comment* (JL de B): agrees with expected age. Beginning of *Fagus* was previously dated at 100 to 105cm depth in same boring (R, 1975, v 17, p 9), Ly-777: 4720 ± 150.

Ly-1030. Praveilles, La Versanne, Loire 6720 ± 160

Peat from 1.20cm at base of peat bog at 1000m alt on gentle slope near crest line of Le Pilat massif near La Versanne, Loire (45° 21' N, 4° 30' E). Coll and subm 1975 by A M Domenach and N Gilet, Lab d'écol végétale, Univ Lyon. *Comment* (AMD & NG): indicates beginning of Atlantic period; agrees with date of pollen analysis which shows species characteristic of Boreal (*Quercus*, *Corylus*, *Pinus*, and *Betula*) assoc with species resembling Atlantic more closely (*Tilia*, *Abies*, and *Fagus*) (Domenach and Gilet, 1974). Previous dates from Central Massif, Le Pont de Clamouse: Gif-1162: 4100 ± 130 (R, 1972, v 14, p 307) and from Les Cevennes Massif, Baïssescure: Gif-1104: 6000 ± 150 (R, 1972, v 13, p 235).

Lac de Saint-Léger series, Montclar, Alpes de Haute Provence

Samples from levels in peat bog in Saint-Léger lake near Montclar Alpes de Haute Provence (44° 25' B, 6° 20' E). Coll 1973 from boring in middle of lake, except Ly-724, which comes from boring made in 1972 at side of lake and subm by J L de Beaulieu.

Ly-1285. Saint-Léger 973, 120-130 1760 ± 130

Clayey peat from 120 to 130cm depth. Coll with "Smith" drill and subm 1975. Pollen diagram shows destruction of the *Alnus* forest by man.

Ly-1332. Saint-Léger 973, 330-335 2800 ± 120

Peat from 330 to 335cm depth. Coll with "Smith" drill and subm 1976. Pollen show settlement of a *Alnus* forest on lake side.

Ly-1286. Saint-Léger 973, 335-345 2770 ± 220

Peat sample from 335 to 345cm depth. Coll with "Smith" drill and subm 1975. 2.5/3 sample diluted. Same pollen event as previous.

Ly-1287. Saint-Léger 973, 445-450 3310 ± 140

Peat from 445 to 450cm depth. Coll with "Smith" drill and subm 1975. Pollen diagram indicates a slight increase of *Fagus* (continuous curve) and presence of *Larix*, indicating climatic phase of human influence.

Ly-1288. Saint-Léger 973, 595-600 5580 ± 160

Peat from 595 to 600cm depth. Coll with "Smith" drill and subm 1975. *Abies* maximum.

Ly-724. Saint-Léger 972, IV, 170-180 5860 ± 180

Peat from 170 to 180cm depth. Coll with "Couteau" drill and subm 1972. Same pollen as the previous sample but from another profile.

Ly-1138. Saint-Léger 973, 660-675 8400 ± 220

Gyttja from 660 to 675cm depth. Coll with "Hiller" drill and subm 1973. Pollen diagram shows Boreal increase of forest of supramediterranean oak.

Ly-1139. Saint-Léger 973, 685-700 9330 ± 430

Gyttja from 685 to 700cm depth. Coll with "Hiller" drill and subm 1973. Pollen diagram shows extension of *Betula*, *Quercus* and *Corylus*.

Ly-963. Saint-Léger 973, 745-758 12,520 ± 360

Gyttja from 745 to 758cm depth. Coll by "Hiller" drill and subm 1973. Pollen diagram shows a 1st increase of *Pinus*. 1/2 sample diluted.

General Comment (JL de B): all dates agree with pollen diagrams. Thin layer of sediments prevents accuracy at Bölling and Alleröd levels and makes interpretation of Ly-963 fairly difficult.

Le Forest 972 series, Saint-Etienne en Dévoluy, Hautes Alpes

Peat from 3 levels in boring in Le Forest peat bog near Saint-Etienne en Dévoluy, Hautes-Alpes (44° 38' N, 5° 57' E). Coll 1972 and subm 1974 by J L Beaulieu.

Ly-1144. Le Forest 972, 65-70 5100 ± 150

From 65 to 70cm depth, decline of *Abies*.

Ly-1143. Le Forest 972, 120-125 7570 ± 190

From 120 to 125cm depth, above beginning of *Abies*.

Ly-1142. Le Forest 972, 140 8440 ± 320

From 140cm depth, under beginning of *Abies*.

General Comment (JL de B): confirms previous date from 130 to 140cm depth in same boring: Ly-782: 8310 ± 180 (R, 1975, v 17, p 10) for beginning of *Abies* at site. Seems to contradict 2 dates on same site (Wegmüller, 1975) giving ca 5000 for same pollen event.

La Selle di Carnino series, Ponte di Nava, Prov di Coni, Italy

Peat from several levels in 2 borings in a small peat bog at alt 2090m at La Selle di Carnino near Ponte di Nova, Prov Coni, Italy (44° 9' N, 7° 41' E). Coll 1973 and subm 1974 by J L de Beaulieu. Valley is close to Les Merveilles Valley. Layer of coarse colluvium caused by collapse of a nearby cliff occurs between 1.80 and 2.10m depth. Measurements were taken to date underlying tardiglacial sediment and Holocene overlying sediment.

Ly-1203. Le Selle di Carnino, 50-55 550 ± 140

From 50 to 55cm depth, coll with "Smith" drill. Pollen diagram shows *Abies* maximum at upper level.

Ly-1204. Le Selle di Carnino, 105-110 990 ± 250

From 105 to 110cm depth, coll with "Smith" drill. Preponderance of *Abies*. 1/3 sample diluted.

Ly-1140. La Selle di Carnino, 175-180 6960 ± 160

From 175 to 180cm depth, overlying colluvial layer, coll with "Couteau" drill.

Ly-962. La Selle di Carnino, 210-216 9610 ± 170

From 210 to 216cm depth, underlying colluvial layer, coll with "Couteau" drill.

Ly-1141. La Selle di Carnino, 218-226 10,330 ± 210

From 218 to 226cm depth, coll with "Couteau" drill.

General Comment (JL de B): both 1st dates indicate peat growth was faster since last millennium although it was fairly slow before. Collapse might be at end of Pre-Boreal period if no erosion of sediments younger than Ly-962 is assumed.

Sabion series, Tende, Alpes Maritimes

Gyttja from lower part of boring in Sabion peat bog at Tende, Alpes Maritimes (48° 8' N, 7° 28' E). Coll and subm 1974 by J L de Beaulieu. Two measurements made to locate cold phase which appears in sediments but not in pollen diagram.

Ly-1145. Sabion 240-248 10,380 ± 400

From 240 to 248cm depth, above cold sediments. 1/3 sample diluted.

Ly-1146. Sabion 250-255 9340 ± 450

From 250 to 255cm depth, under cold sediments. 1/3 sample diluted.

General Comment (JL de B): both dates are inverted according to stratigraphic order but in the 2σ range. Cold climate should then be located at beginning of Pre-Boreal (ca 10,000). Pollution of layers remains a possibility.

Ly-1284. Le Col Bas B 75, 455-460,**Le Lauzet, Alpes de Haute Provence 9750 ± 200**

Clayey peat from 455 to 460m depth in peaty part of small, high-alt lake, ca 2050m, at Le Col Bas near Le Lauzet, Alpes de Haute Provence (44° 23' N, 6° 48' E). Coll and subm 1976 by J L de Beaulieu. At this level, pollen diagram shows increase of *Pinus* after Late Dryas and before supposed decrease in Pre-Boreal phase. *Comment* (JL de B): agrees with expected date. Date confirms that decrease of arboreal pollen occurred in Pre-Boreal.

Col des Lauzes series, Freissinières, Hautes Alpes

Sample from several levels in Col des Lauzes peat bog near Freissinières, Hautes-Alpes (44° 46' N, 6° 15' E). Coll with "Smith" drill and subm 1975 by J L de Beaulieu.

- Ly-1234. Col des Lauzes 775, 45-50** **2980 ± 130**
Peat from 45 to 50cm depth. Increase of *Larix* due to deforestation.
- Ly-1279. Col des Lauzes 775, 190-195** **5680 ± 170**
Peat from 190 to 195cm depth. Great increase of *Abies*.
- Ly-1280. Col des Lauzes 775, 280-285** **7510 ± 150**
Peat from 280 to 285cm depth. Slight appearance of *Abies*.
- Ly-1281. Col des Lauzes 775, 372.5-377.5** **9860 ± 200**
Peaty clay from 372.5 to 377.5cm depth. Maximum and preponderance of *Betula*.
- Ly-1282. Col des Lauzes, 382-387** **10,870 ± 330**
Clayey gyttja from 382 to 387cm depth. 1/2 sample diluted. End of 2nd extension of *Juniperus* and of steppe species.
- Ly-1333. Col des Lauzes 775, 387-392** **11,160 ± 320**
Clayey gyttja from 387 to 392cm depth. 2 5/3 sample diluted. Middle of 2nd extension of *Juniperus* and of steppe species.
- Ly-1283. Col des Lauzes 775, 392.5-397.5** **11,800 ± 340**
Clayey gyttja from 392.5 to 397.5cm depth. 2/3 sample diluted. Beginning of 2nd extension of *Juniperus* and of steppe species.
- Ly-1334. Col des Lauzes 775, 403-410** **11,730 ± 200**
Clayey gyttja from 403 to 410cm depth. Middle part of level corresponding to *Pinus* maximum.
- Ly-1209. Col des Lauzes 775, 415-420** **13,060 ± 270**
Clay from 415 to 420cm depth. End of increasing curve of *Pinus*.
- Ly-1210. Col des Lauzes 775, 424-428** **13,750 ± 450**
Clay from 424 to 428cm depth. 1/2 sample diluted, 1st maximum of *Juniperus* extension.

General Comment (JL de B): dates from peaty layers agree with date from pollen analyses. In clay, dates could be ca 300 or 400 yr too old compared with other dates of region. Ly-1283, which has a large statistical margin, is much older for unknown reasons.

- Ly-1245. Lac de l'Huile I, Tende Alpes Maritimes** **7520 ± 210**
Clay with many vegetal remains from 20 to 40cm depth in basal sediments of small, high-alt lake, 2281m, Lac de l'Huile, near Saint Dalmas de Tende, in Les Merveilles valley, Alpes Maritimes (44° 3' N, 7° 26' E). Coll and subm 1975 by J L de Beaulieu. Slightly lower alt than Les Merveilles lakes, above. This lake seems permanent. Level underlies a light gray clayey layer which seems to mark end of periglacial influences in region. Expected age: Boreal. *Comment* (JL de B): pollen analysis suggests very slow deposition of sediment. Date may correspond

to average value of a long period. Organic sedimentation probably began at Pre-Boreal, as at Lac Mouton, below.

Lac Mouton 875 series, Tende, Alpes Maritimes

Samples from several levels of boring in basal sediments of high-alt lake, 2266m, Lac Mouton, near Tende, in Les Merveilles valley, Alpes Maritimes (44° 4' N, 7° 27' E). Coll and subm 1975 by J L de Beaulieu.

Ly-1247. Lac Mouton 875, 70 3000 ± 160

Fragment of wood from 70cm depth embedded in sediments. May date large deforestation phase.

Ly-1248. Lac Mouton 875, 115-120 8220 ± 200

Peaty clay from 115 to 120cm depth. *Abies* beginning.

Ly-1249. Lac Mouton 875, 125-130 7930 ± 170

Peaty clay from 125 to 130cm depth, just before beginning of *Abies*.

Ly-1246. Lac Mouton 875, base 9340 ± 240

Peaty clay from base of boring.

General Comment (JL de B): all dates agree with age forseen by palynologic data and as compared with Lac Long-Inferieur series, below. 8000-8100 BP is more likely for beginning of *Abies* than Ly-1240 and -1239. Sedimentation in lake probably began before Pre-Boreal phase (Ly-1246) because an older layer, according to pollen diagram (Late Dryas) was found at base of nearby boring in same lake.

Lac Long Inférieur 875 series, Tende, Alpes Maritimes

Sample from boring in sediments of high-alt lake, Lac Long Inferieur, near Tende, in Les Merveilles valley (44° 4.5' N, 7° 27.5' E). Coll and subm 1975 by J L de Beaulieu. All samples come from same boring (875-S4), except Ly-1238, from nearby boring (875-S5) to check Ly-1208.

Ly-1244. Lac Long Inférieur 875, 40-45 2660 ± 190

Peaty silt from 40 to 45cm depth, cereal pollen maximum. 2/3 sample diluted.

Ly-1243. Lac Long Inférieur 875, 60-65 3740 ± 160

Peaty silt from 60 to 65cm depth, beginning of *Plantago*.

Ly-1242. Lac Long Inférieur 875, 80 4770 ± 300

Peat from 80cm depth, beginning of *Fagus*; relatively large error due to counting uncertainty (evaporation of benzene sample).

Ly-1241. Lac Long Inférieur 875, 100-105 5670 ± 170

Peat from 100 to 105cm depth, beginning of large increase of *Abies*.

Ly-1240. Lac Long Inférieur 875, 130-135 8730 ± 220

Peaty silt from 130 to 135cm depth, beginning of *Abies*.

Ly-1239. Lac Long Inférieur 875, 140-145 9330 ± 220

Peat from 140 to 145cm depth, just before beginning of *Abies*.

Ly-1238. Lac Long Inférieur 875, 285-294 10,310 ± 230

Peaty silt from 285 to 294cm depth, in boring in central part of lake. Increase of *Betula*.

Ly-1208. Lac Long Inférieur 875, G 11,270 ± 230

Peat from 212 to 217cm depth, same level as Ly-1238, according to pollen diagrams.

Ly-1207. Lac Long Inférieur 875, F 10,430 ± 210

Peaty silt from 217 to 225cm depth, large decrease of NAP (non-arboreal pollen).

Ly-1206. Lac Long Inférieur 875, E 10,970 ± 210

Peaty silt from 225 to 235cm, beginning of decrease of NAP.

Ly-1205. Lac Long Inférieur 875, D 12,040 ± 370

Peaty silt from 235 to 245cm depth, end of *Pinus* maximum. 2/3 sample diluted.

Ly-1237. Lac Long Inférieur 875, C 12,170 ± 280

Peaty silt from 245 to 255cm depth, middle of *Pinus* maximum.

Ly-1236. Lac Long Inférieur 875, B 12,510 ± 370

Slightly peaty silt from 255 to 255cm depth. Beginning of *Pinus* maximum. 2/3 sample diluted.

Ly-1235. Lac Long Inférieur 875, A 13,460 ± 410

Slightly peaty silt from 266 to 278cm depth, increasing curve of *Pinus*. 2/3 sample diluted.

General Comment (JL de B): measurements taken to establish chronology of several pollen diagrams in sediments of this lake, important because it is at outlet of Les Merveilles valley. All results, except Ly-1208, are coherent and indicate fairly constant sedimentation rate, ca 20cm/millennium. However Ly-1240 and -1239 are 1000 yr too old, for unknown reason. A Louvain lab measurement on sample from another boring and correlated by pollen with these 2 last values, is more consistent: Ly-517: 7410 ± 120 (de Beaulieu, 1974). On the other hand, comparison between Ly-1238 and -1208 shows that the latter is obviously out of general trend of data, and remains questionable. Relatively great age, probably beginning of Bölling, of deepest layer indicates a glacier retreat very early in Tardiglacial (Würm IV) even at this high alt. Also, all earliest dates, from Ly-1207, are a little older than climatic phase suggested by pollen data; they only fit using a 2σ strastistical range but always in the same direction, which seems to correlate with low organic content of samples. It is simpler, but questionable, to assume presence of older carbonaceous material in sediments;; up to now, discrepancy

between dates and pollen results could be more satisfactorily explained but studies are being made on other profiles (de Beaulieu and Evin, 1977).

C. Samples from Holocene fluvial, periglacial, and glacial sediments

Modern

Ly-1106. Tourette-Levens, Alpes Maritimes $\Delta^{14}\text{C} = 4.6\% \pm 2.6$

Bone from thick Late Quaternary sediments, discovered during road building at Tourette-Levens, Alpes Maritimes (43° 47' N, 7° 17' E). Coll 1975 by F Irr and subm 1975 by C Guérin, Geol Dept, Univ Lyon. Fauna may be either Holocene or Late Würm. *Comment* (CG): despite its relative depth, bone is very recent.

Grand'Maison series, Vaujany, Isère

Wood from peat in upper alluvium of Eau d'Olle R, at alt 1560m, Grand'Maison dam, near Vaujany, Isère (45° 12' N, 5° 7' E). Coll and subm 1975 by Division Geol, Electricité de France, Paris.

Ly-1013. Grand'Maison no. 1 1390 ± 220

Ly-1014. Grand'Maison no. 2 2410 ± 130

General Comment (EDF): considering apparent age of wood when buried, both dates confirm each other and show that alluvial filling of Eau d'Olle R valley is relatively recent.

Ly-1010. Foce del Fiume Fortore, Serracapriola, Prov di Foggia, Italia 4450 ± 130

Shells (*Helix*) from dune on edge of coastal plain, 2.5km from sea, at mouth of Fortore R, near Serracapriola, Prov Foggia, Italy (41° 54' N, 15° 26' E). Coll 1974 by G Dai Pra and subm 1974 by G Magri. *Comment* (GM): despite uncertainty of original ^{14}C value, dates gives Holocene age to deposits which crop out on coastal plain (Kelletat, 1974).

Ly-1310. Ponte del Torrente Correntino, Carpino, Prov di Foggia, Italia 2120 ± 180

Charcoal from fluvial sediment 2m deep on S side of Varano lake, 200m W of bridge of Correntino torrent, near Carpino, in Gargano headland, Pov Foggia, Italy (41° 52' N, 15° 50' E). Coll 1975 by C Carrara and G Dai Pra and subm by C Magri. Sample coll in sandy silt and brown clay containing lithic industry and overlying Würmian alluvial deposits (Mancini & Palma di Cesnola, 1967). *Comment* (GM): date confirms expected Holocene age of top sediments.

Ly-1056. La Maison Blanche, Fontenay sur Loing, Loiret 1830 ± 300

Wood embedded in clay from 1m depth in alluvial valley of Loing R, at La Maison Blanche, near Fontenay sur Loing, Loiret (48° 20' N, 2° 46' E). Coll and subm 1974 by J Allain, Dir Antiquités Préhist Centre, Bourges. *Comment* (JA): much younger than position of clay indicates, overlying basal gravels in valley.

Ly-1176. Vaux, Saint-Victor de Cessieu, Isère 1170 ± 130

Charcoal embedded in clay of paleosol overlain by drift-stones which may represent moraine at Vaux near Saint Victor de Cessieu, Isère (45° 32' N, 5° 25' E). Coll and subm 1974 by G Monjuvent, Inst Dolomieu, Univ Grenoble. *Comment* (GM): confirms another date from another sample from same site: Gif-3286: 890 ± 70 (unpub). Interglacial or interstadial date was expected, and it is difficult to explain presence of recent charcoal under moraine-like material. Either a wide landslide or an artificial earthwork may be assumed but not proven on the grounds that stratigraphic contacts seem normal.

Ly-1054. Vanvay, Côte d'Or 4710 ± 300

Small fragments of charred pine resin found scattered between 1.25 to 1.50m depth in Holocene sediment at Vanvey, Côte d'Or (47° 50' N, 4° 43' E). Coll and subm by J J Puissegur. Sediment seems to be formed from underlying cryoclastic slope-sand. *Comment* (JJP): Atlantic age, concurring with ecol data of assoc malacologic fauna (Puisségur, 1976).

Ly-1311. Les Menuires, Saint-Martin de Belleville, Savoie 4010 ± 160

Wood from 1m depth in small peat-bog downstream from Thorens Glacier at Les Menuires, near Saint-Martin de Belleville, Savoie (45° 22' N, 6° 30' E) (Vivian, 1975). Coll and subm 1976 by R Vivian, Inst Géog Alpine, Univ Grenoble. *Comment* (RV): agrees with previous date, Ly-891: 4470 ± 150 (R, 1976, v 18, p 64) from same Les Belleville valley. Confirms presence of ancient arboreal vegetation in valley at high alt. Vegetation was probably fairly extensive, judging from, > 50cm dia of tree trunk.

Modern**Ly-1299. Le Terrieu, Valflaunès, Hérault $\Delta^{14}\text{C} = 1.6 \pm 1.6\%$**

Fragment of tree trunk (*Quercus*), found uprooted in alluvium from side of Le Terrieu R at foot l'Hortus Mt, near Valflaunès, Hérault (43° 47' N, 3° 51' E). Coll and subm 1975 by M Archambault, Inst Etudes Ligériennes, Univ Orléans. *Comment* (MA): proves recent age for fossilization of wood, which means terrace or assoc erosion glacis cannot be dated.

Ly-763. La Couronne, Alba la Romaine, Ardèche 290 ± 110

Wood from 0.40m depth in colluvium of erosion glacis at lowest part of Valvignière depression at La Couronne, near Alba La Romaine, Ardèche (44° 31' N, 4° 34' E). Coll and subm 1972 by M Archambault. *Comment* (MA): indicates wood was embedded in recent landslide and cannot be used for dating all erosional landforms.

Ly-1300. Cebette, La Roche Saint-Secret, Drôme 540 ± 350

Fragment of charred wood embedded in sandy, clayey gravel sediments from bedded "grèze", partly overlying low terrace of Le Lez R at Cebette near La Roche Saint-Secret, Drôme (44° 27' N, 6° 1' E). Coll

and subm 1976 by M Archambault. Very diluted: 0.7/3 sample. *Comment* (MA): date of end of Tardiglacial (Late Würm) was expected. Date proves that material older than grèze can be redeposited.

Modern

Ly-1183. Lavars, Isère $\Delta^{14}\text{C} = -2.1\% \pm 1.4$

Wood from detrital filling of a small thalweg cut in lacustrine sands of Würmian ancient lake of Le Trièves near Lavars, Isère (44° 51' N, 5° 40' E). Coll and subm 1975 by M Archambault. The wood may either date filling which might be recent or mark a Late Würm stadial during which erosion of lacustrine sediments began. *Comment* (MA): date only proves that thalweg filling is recent.

Ly-1032. Chabulière, Percy, Isère **2710 ± 230**

Charcoal from mudflow, 20m above and 200m beyond moraine, between Chabulière and Les Blancs, near Percy, Isère (44° 48' N, 5° 38' E). Coll and subm 1974 by M Archambault. *Comment* (MA): landslide is contemporaneous with beginning of Iron age.

Darne series, Chichilianne, Isère

Wood from 2 levels in fluvio-glacial cone of ancient glacier of Donnière, dug by Darne-Orbannes R near Chichilianne, Isère (44° 50' E). Coll and subm 1975 by M Archambault.

Ly-1202. Darne No. 2 **7700 ± 180**

Wood from a tufa overlapping cone.

Ly-1201. Darne No. 1 **7940 ± 190**

Wood from clayey level with calcareous gravels 2m below tufa, presumably in youngest part of cone. Expected age: Würm III or IV.

General Comment (MA): Ly-1201 proves that wood is not contemporaneous with cone and is in statistical range of Ly-1202 which, as expected, dates tufa as recent.

Ly-1298. Luc en Diois, Drôme **10,350 ± 240**

Wood rooted in clayey layer of left side of La Drôme R near Luc en Diois, Drôme (44° 37' N, 5° 27' E). Coll and subm 1975 by M Archambault. *Comment* (MA): dates low terrace of la Drôme R and assoc erosion glaciers, to beginning of Postglacial. Another measurement from similar site 20km downstream gave a similar age, Gif-2218: 11,150 ± 250 (R, 1974, v 16, p 67).

*D. Samples from Würmian glacial, periglacial, and lacustrine sediments***Les Cèdres series, Salignac, Alpes de Haute Provence**

Fragments of wood embedded in silty fluvial sands overlying Würmian terrace of La Durance R at Les Cèdres near Salignac, Alpes de Hautes Provence (44° 15' N, 5° 58' E). Coll and subm 1975 by J L de Beaulieu and J Tiercelin. Samples found in 2 neighboring secs.

Ly-1290. Les Cèdres de Salignac 2 **13,800 ± 250**

From 1.65 to 2m depth in clayey sandy level. Pollen analysis shows preponderance of *Hippophar thammoïdes*, indicating settlement of pioneer vegetation on Würmian terrace.

Ly-1289. Les Cèdres de Salignac 1 **14,230 ± 290**

Wood found rooted in gray clayey level, from 4.15 to 4.45m depth. Pollen analysis shows dominance of *Pinus sylvestris*, indicating settlement of forest.

General Comment (JL de B): both dates are in statistical range. Bölling interstadial suggested by pollen analyses is unlikely; it is more probably pre-Bölling. Dates confirm early inception of arboreal vegetation in region.

Le Villard series, La Baume, Hautes Alpes

Wood from 2 tree trunks rooted in clayey layers, interstratified in gravelled formations at Le Villard near La Balme, Hautes Alpes (44° 34' N, 5° 41' E). Coll 1967 and subm 1973 by M Archambault. Both samples were counted with 10ml benzene and 1ml scintillating toluene in specially shielded spectrometer.

Ly-873. Le Villard No. 9 **40,300 ± 1100****Ly-874. Le Villard No. 9bis** **42,900 ± 900**

General Comment (MA): values are in statistical range. They confirm two previous dates, Gif-1138: $\geq 35,000$, and I-5022: $37,000 \pm 2900$ Archambault, 1969) and a new one: GrN-7574: $46,400 \pm 2100$, -1600 (unpub). These formations might be Würm II, which means a recent age for intersecting glaciais.

Achenheim series, Bas Rhin

Charcoal from top of lehm layer, called "Le Grand Lehm noir", interstratified in Hurst loess quarry at Achenheim, Bas Rhin (48° 34' N, 7° 37' E). Coll and subm 1972 and 1973 by A Thevenin, Dir Antiquités Prehist, Alsace. No assoc industry. Level may correspond either to Riss-Würm interglacial (Wernert, 1957) or to Early interstadial (Bordes, 1960; Thevenin, 1973; 1976) which seems more likely.

Ly-761. Achenheim 1 **36,700****+2200****-1700**

Normal treatment and counting with 3ml benzene.

Ly-1276. Achenheim 2 **> 43,500**

Very careful treatment and counting with 3/4 sample and 1/4 dead benzene in 10ml benzene.

General Comment (AT): Ly-761 suggested Würm II/III interstadial which might be possible, but Ly-1276 shows more careful treatment eliminated contamination more effectively and samples may be as old as Würm I/II interstadial or even older.

E. Samples from marine and lagoonal sediments

Sant Agata di Militello series, Provincia di Messina, Italia

Charcoal from fluvial sands at 2 sites near Sant Agata di Militello, Prov Messina, Italy (38° 2' N, 14° 10' E). Coll 1974 by D Robillard and subm 1975 by G Duée, Univ Lille.

Ly-1051. Torrecandele DD70 **1400 ± 130**

Ly-1052. Santa Anna DD163 **380 ± 110**

General Comment (DR): much younger than expected. Date shows very recent stream channel brought charcoal and redeposited fluvial sands overlying terrace (Robillard, 1975).

Lac Retba series, Sénégal

Samples from 2 places on Retba lakeside, 28km NE of Dakar, Sénégal (14° 50' N, 17° 13' W). Subm by P Elouard, Dept Geol, Univ Lyon.

Modern

Ly-1278. Lac Retba WS 51 $\Delta^{14}\text{C} = +5.4\% + 3.0$

Vermetus adansoni Daudin from S side of lake encased in calcareous vesicular crust, forming nodular concretions, lying at base of lake, under 3m water, at alt -5m (bsl). Coll 1975 by L Hebrard and subm 1975. *Vermetus adansoni* live on marine littoral in intertidal zone before waves, in very aerated conditions. Their geol position thus indicates real marine episode for region but at a level lower than actual sea level. This occurred either at beginning of Nouakchottian, when sea level rose, ca 7000, or during a short fluctuation Post-Nouakchottian, ca 4000. High ^{14}C count of old shells may ensue from isotopic exchange between carbonates of surface of shells and bicarbonates of lake water, enriched by considerable evaporation. Because shells were too thin, usual pretreatment was impossible. *Comment (PE)*: influence of bomb radiocarbon is evident and obviously does not agree with paleoecol data of Lake Retba, which was a gulf when *Vermetus adansoni* were living, and is now highly saline lake. Date demonstrates difficulty of radiocarbon dating thin, unburied shells.

Modern

Ly-1274. Lac Retba WS 51 $\Delta^{14}\text{C} = -1.7\% + 1.6$

Sandy clay with montmorillonite and large amount of organic matter from NW side of lake. Coll and subm 1976. Level is overlain by sandy terrace with marine shells. *Comment (PE)*: As clay could not have been redeposited, overlying shells must be secondary deposit from offshore bars previously dated ca 1000: see 6 Ly dates (R, 1976, v 18, p 68). Such re-deposition is probably due to heavy storm of present lake, because layer consists solely of lightest shells of ancient offshore bar.

Ly-1275. Lac Tanma, WS 55, Sénégal **5410 ± 170**

Radiorotula orbiculus Blainv from W side of Tanma lake, 45km NW Dakar, Sénégal (14° 54' N, 17° 5' W). Coll and subm 1976 by P Elouard.

Samples coll in layer with sea urchins indicating fully marine conditions which may be attributed to Nouakchottien, ca 5500 in Sénégal and Mauritania. *Comment* (PE): agrees with attribution, confirms previous measurement: Ly-890: 2630 ± 110 (R, 1976, v 18, p 68) from overlying layer which contains *Arca senilis* L, marking coastal marine or lagoonal conditions of end of Nouakchottien. Level with *Echinides* indicates fully open gulf at maximum of transgression.

Sondage du delta du fleuve Sénégal series, Sénégal

Clayey peat from 2 borings in N delta of Sénégal R near Debi, Sénégal. Coll 1970 by M. Audibert and subm 1976 by J Monteillet, Inst Fondamental d'Afrique Noire, Dakar. Peat layers embedded in sandy clayey layers with shells presumably Tchadian, 11,000 to 7000 = Early Holocene. Overlying clay and clayey sand seem to be late Tchadian. Underlying sands with flakes of mica and red dune-sand may represent base of Tchadian and Ogolian, end of Würm in Europe, respectively.

Ly-1269. Sondage Eudoxie Fl 1 **8870 ± 240**

From 25m depth, -23m, in Eudoxie Fl 1 boring at Debi (16° 30' N, 16° 17' W).

Ly-1270. Sondage Lea Fl 2 **8450 ± 220**

From 22.5m depth, -20.5m, in Lea Fl 2 boring 4km NW Debi (16° 34' N, 17° 10' W).

General Comment (JM): dates confirm Early Holocene attribution (Monteillet & Evin, 1977), and agree with data of Ogolian sea level rise and with data on humidity of climate in Sahara (Elouard, 1973).

F. Samples from miscellaneous origins

Ly-1103. Tarfaya, Morocco **1100 ± 120**

Camel's jaw bone from Neolithic site at Tarfaya, Morocco (27° 56' N, 12° 58' W). Coll 1974 by N Petit-Maire and subm 1975 by J Bouchud, Inst Paleontol Humaine, Paris. Camel presumably disappeared from Africa from Paleolithic to Roman periods. *Comment* (JB): dates proves that bone cannot belong to Neolithic layer in which it was buried; paleontol problem about camel's possible existence during Neolithic is not solved.

Le Trou des Cervidés series, Gex, Ain

Bones found on heap of rocks at base of deep limestone have, "Le Trou des Cervidés", open on side of Le Mont Rond near Gex, Ain (46° 20' N, 6° 1' E) at alt 1500m. Coll 1952 by E Pellaton and subm 1974 by L Chaix, Dept Anthropol, Univ Geneva. Measurements part of contribution to general review of all fauna found in such a condition in W Switzerland.

Ly-1186. Le Trou des Cervidés Cerf **3700 ± 140**

Bones of deer.

Ly-1187. Le Trou des Cervidés Elan 4180 ± 140

Bones of elk.

General Comment (LC): both dates are almost in statistical range and indicate that fauna found inside grotto (Revillod, 1953) is fairly homogeneous: animals fell into cave at end of Late Neolithic period

Ly-1185. Gouffre de la Dent d'Oche, Novel, Haute Savoie 6800 ± 170

Bones from base of limestone cave open in SE side of La Dent d'Oche Mt, near Novel Haute-Savoie (46° 21' N, 4° 24' E). Coll 1973 by P Dardilly and subm 1974 by F Baud, Mus Hist Nat, Geneva. Six skeletons of *Ursus arctos* L were found in grotto. One, lying near entrance, is recent (Baud, 1975); the 5 others, lying further inside, are ancient and more recent date, was suggested because of preservation. *Comment (FB)*: dates prove age was underestimated and bears used grotto as hibernation shelter for a long time.

Zawiyah series, Lybie

Calcium carbonates from Quaternary fixed dunes at Zawiyah, Lybia (32° 40' N, 12° 44' E). Coll and subm 1974 by A Legall, SOGREAH soc, Grenoble.

Ly-923. Zawiyah encroutement 5540 ± 250

Calcic crust from some interdunal depressions. More probable age range, with ¹⁴C original value = 80% NBS: 3790 ± 290. 1/2 sample diluted.

Ly-924. Zawiyah nodule 4690 ± 110

Calcareous nodules from same depth, inside dunes. More probable age range, with ¹⁴C original value = 80% NBS: 2920 ± 130.

General Comment (AL): both dates seem to indicate that calcic crust and nodules are contemporaneous, or subjected to same isotopic exchange. This approx age suggests former presence of ground water near present soil.

II. ARCHAEOLOGIC SAMPLES

*A. Historic period***Ly-1291. Viremont, Jura 840 ± 140**

Wood from 2.5m depth in morainic sediments at Viremont, Jura (46° 26' N, 5° 38' E). Coll 1973 and subm 1975 by M Jacquemin, Moirans en Montagne, Jura. Wood is presumably from base of ancient well probably from Bronze age. *Comment (MJ)*: younger than expected but possible because hollowed-out trees remained in use as water collector at base of well from Metal ages or Roman periods, such as well of salt fountain of Saint-Père lès Vezelay, Yonne. Date assoc wood with Middle age habitation.

Ly-1301. Princay, Vienne 1170 ± 140

Human bone from peculiar sarcophagus found near church of Princay, Vienne (46° 18' N, 0° 17' E). Coll 1974 by M Delaroche, Loudun and subm 1975 by B Guillet, Centre Pédol, Vandoeuvre lès Nancy. At 3km from Princay is the presumed Merovingian necropolis of Dercé, but sarcophagus may also come from Carolingian or Capetian time. *Comment* (BG): skeleton may be either from beginning of Carolingian time, AD 780, or from end of Merovingian, as expected.

Ly-1157. La Grave, Hautes Alpes 1280 ± 150

Human bones from 4 isolated graves near La Grave village, Hautes Alpes (45° 3' N, 6° 18' E) in high valley of La Romanche R, at alt 1500m. Coll, subm, and treated in radiocarbon lab by J P Depardon, Dept Geol, Univ Lyon. No assoc industry nor documentation of graves, which may date from ca AD 400 to 1600. *Comment* (JP D): graves are of Early Middle age.

Ly-1224. Les Fous, Izieux, Ain 1310 ± 150

Human bones from isolated grave at 0.6m depth at Les Fous near Izieux, Ain (45° 39' N, 5° 38' E). Coll and subm 1975 by M Dunand and R Vilain, Dept Geol, Univ Lyon. Type of grave is called "Burgonde", probably Early Middle age, but graves might have been re-used later. *Comment* (MD): agrees with expected age for this type of grave. A possible 2nd use could only have occurred shortly after grave was dug.

Ly-1223. Géligneux, Murs et Géligneux, Ain 1350 ± 120

Human bones from isolated grave from 1.20m depth at Géligneux, Ain (45° 39' N, 5° 39' E). Coll 1975 by A Juillar and subm 1975 by R Vilain. This "Burgonde" grave (Morel & Demetz, 1961) presumably belonged to former Early Middle age cemetery. *Comment* (RV): date agrees with expected age and with neighboring site, Les Fous d'Izieux, above.

Ly-1133. Jonqueirolle, Bollène, Vaucluse 1610 ± 130

Charcoal from Layer 2 in Kiln 743 A in Jonqueirolle site near Bollène (44° 16' N, 5° 45' E). Layer is refuse portion of potter's workshop containing hardly known and poorly dated pottery, assumed by typology to date from Early Middle age. Site was occupied from Roman to end of Middle age. Archaeomagnetic date, made by Thellier's method, cannot be considered because kiln was turned around by bull-dozer. It indicated either middle of 1st Century AD or between AD 500 to 700. *Comment* (JT): considering a double standard deviation, ± 260, real date, ca 500, seems more possible and will be determined precisely by typology and thermoluminescence measurement.

Kanaris series, Oasis du Fayoum, Egypte

Charcoal or charred wood from boiler room and frigidarium of Greco-Roman bath at Karanis, Fayoum oasis, Egypt (29° 19' N, 30° 50'

E). Coll and subm 1975 by G Castel, Inst Français Archéol Orientale, Cairo. The 3 samples presumably represent building period, lintel from frigidarium and last occupation, charcoal from boiler room, of site (El Nassery *et al*, 1976).

Ly-1268. Karanis Linteau **1340 ± 230**

From lintel of frigidarium niche. 2/3 sample diluted.

Ly-1266. Karanis Charbon de Bois **2110 ± 210**

From hearth in boiler room, upper layer, 9/10 sample diluted.

Ly-1267. Karanis Charbon de Bois **2690 ± 140**

Same place as above.

General Comment (GC): Ly-1268, lintel, corresponds to late repair of building, when it had not been used as frigidarium for a long time. One sample from boiler room indicates last occupation of bath, the other proves that some very old wood might have been used as combustible material, as previously assumed in Les Kellia Qouçur Isa site (see 2 Ly results: R, 1971, v 13, p 55).

**Ly-1023. Pont de Tourenne C4,
Capdenac le Haut, Lot**

1780 ± 230

Wood from mass of various Gallo-Romain remains, buried in ancient terrace in le Pont de Tourenne quarter, Part C4 in Capdenac le Haut site, Lot (44° 35' N, 2° 4' E). Coll 1973 and subm by A Sors, Figeac Lot. 1/3 sample diluted. Capdenac le Haut was presumably important Gallic camp besieged by Caesar in 52 BC during Roman conquest, and remained important fortress till end of Middle ages (Sors, 1971). *Comment (AS):* considering large statistical range, real date may be in last century BC.

B. Iron and Bronze ages period

Ly-1024. Ibos No. 3

2500 ± 160

Charcoal from sepulture of base of Moulin de Géline tumulus near Ibos, Hautes Pyrenées (43° 14' N, 0° 11' W) on Ger plateau. Coll 1964 and subm 1974 by R Coquerel, Tarbes. Assoc with industry that resembles late Bronze age, ca 2850, compared with Salies de Bearn site, dated ca 3100 (Ly-246 and -247: R, 1966, v 8, p 253, and Gif-394: R, 1970, v 12, p 241). Dated also to solve sampling problem that appeared after 2 previous measurements: Ly-660 and -661 (R, 1975, v 17, p 17) 1/3 sample diluted. *Comment (RC):* date is younger than expected and shows that Hallstatt civilization may have been delayed on Ger plateau. Date is close to Ly-660: 2460 ± 180, from sepulture in NE flank of tumulus, and proves that Ly-661: 2200 ± 260, origin of which was doubtful, came from another sepulture at top of tumulus assoc with La Tène II industry that also has some delayed character.

La Pièce au Loup series, Saint-Marcel, Saône et Loire

Charcoal from 2 places in La Saône riverside site, La Pièce au Loup, near Saint-Marcel, Saône et Loire (46° 46' N, 4° 52' E). Coll and subm

1975 by L. Bonnamour, Mus Denon, Châlon sur Saône (Bonnamour, 1974).

Ly-1028. La Pièce au Loup III **2320 ± 190**

From Sq F9 and F10 at base of Hallstatt level, Layer III. 1/3 sample diluted. *Comment* (LB): much more recent than expected, ca 2550, generally assumed age for Hallstatt civilization. Date older than 2550 is possible because of contamination by outer, overlying Late Bronze age layer, while Gallo-Roman one, more consistent with date, lies 2m above.

Ly-1029. La Pièce au Loup I **2790 ± 120**

From Sq M13 at top of Hallstatt level, Layer I. *Comment* (LB): date indicates Late Bronze age and therefore possibility of redeposit from underlying sediments as suggested by mixing of archaeol material.

**Ly-1229. Le Tumcher de Salival,
Haraucourt sur Seille, Moselle** **3240 ± 380**

Charcoal from filling of Tumulus 4 in Protohistoric necropolis Moyenvic at Le Tumcher de Salival, near Haraucourt sur Seille, Moselle (48° 49' N, 6° 35' E). Coll and subm 1974 by J M Prignon, Villers lès Nancy. Assoc with pottery industry attributed to Hallstatt period. *Comment* (JMP): date does not agree with expected age and involves redeposit of Bronze age material when tumulus was constructed.

Ly-1180. Bliesbrück, Moselle **2580 ± 210**

Charcoal from 1m depth in Layer 3, Pit A, Sand site at Bliesbrück, Moselle (49° 8' N, 7° 11' E). Coll 1973 and subm 1975 by C Guillaume, Dir antiquités préhist, Lorraine, Nancy. Assoc with Late Hallstatt industry. *Comment* (CG): almost agrees with expected age, indicates rather Middle Hallstatt. No other dates exists for this civilization in region.

Ly-1179. Dieue, Meuse **2340 ± 160**

Charcoal from 0.55m depth in Pit 3 of open-air site, Le Boular, at Dieue, Meuse (49° 4' N, 5° 26' E). Coll and subm 1975 by C Guillaume. Assoc with a Middle Hallstatt industry. *Comment* (CG): younger than it should be according to assoc industry.

Ly-1018. Rosheim, Bas-Rhin **2700 ± 120**

Charcoal from shallow hearth dug in loess, found in Helmbacher quarry at Rosheim, Bas-Rhin (48° 25' N, 7° 26' E). Coll 1973 by J Sainty and subm 1974 by A Thévenin, Dir Antiquités Préhist, Alsace. Assoc with graphitic ceramics of Early Hallstatt (Sainty *et al*, 1974). *Comment* (AT): agrees with generally accepted age of industry.

Ly-1017. Mundolsheim 1-73, Bas-Rhin **2500 ± 150**

Charcoal from shallow hearth discovered in the foundation of Montbert house at Mundolsheim, Bas-Rhin (48° 38' N, 7° 42' E). Coll 1973 by C Jeunesse and subm 1974 by A Thevenin. Assoc with graphitic ceramics of Early Hallstatt (Sainty *et al*, 1974). 1/3 sample diluted. *Comment*

(AT): date, ca 2700, similar to Ly-1018, was expected and can only be deduced by assuming a double standard deviation.

Les Rives de Thorey series, Saint-Germain du Plain, Saône et Loire

Charcoal from Sq B 91 in La Saône riverside site, Les Rives, at Le Thorey near Saint-Germain du Plain, Saône et Loire (46° 42' N, 4° 57' E). Coll and subm 1974 by L Bonnamour. Layer lies at top of filling of kiln assoc with Late Bronze IIIb industry (Bonnamour, 1973).

Ly-1026. Les Rives de Thorey, No. 1 **2780 ± 230**
2/3 sample diluted.

Ly-1027. Les Rives de Thorey, No. 2 **2770 ± 260**
1/2 sample diluted.

General Comment (LB): average of both values: Ly-1026/27: 2780 ± 170. Agrees with generally admitted age of industry.

Ly-1230. Puy Saint-André, Busséol, Puy de Dôme **2780 ± 130**

Bones from bottom of ancient hut at Le Puy Saint André, near Busséol, Puy de Dôme (45° 42' N, 3° 6' E). Coll 1975 and subm 1976 by L Tixier, Fourzel, Puy de Dôme. Assoc with ceramic industry of transition Late Bronze. Early Hallstatt period (Daugas & Tixier, 1975). *Comment* (LT): agrees with expected age from other region. There is no date from that period in Auvergne.

Ly-1098. Cheval d'Auvernier, Auvernier, Canton de Neuchatel, Suisse **3190 ± 200**

Horse bone found under 0.3m lacustrine chalk in Auvernier bay, in Neuchatel lake, Switzerland. Coll during underwater excavations 1972 and subm 1974 by B Arnold, Service Cantonal d'Archéol, Neuchatel. Bone belonged to almost complete skeleton lying across late palisade of coastal sta N Auvernier, of Late Bronze age, Habitat 2, according to Gerbach (Egloff, 1972). No stratigraphic connection with archaeol level could be made because of erosion of sediments. *Comment* (BA): dendrochronol correction tables pub in Ralph *et al* (1976) give: LYON-1098: 1290-1760 bc+, which involves 400 yr between horse and habitat. Such a topographic position can only be explained by chance (Arnold, 1977).

Ly-1053. Abri de la Gourgue d'Asque, Asque, Hautes Pyrénées **3800 ± 200**

Bones from single layer of La Gourgue d'Asque shelter near Asque, Hautes Pyrénées (43° 1' N, 0° 15' E). Coll and subm 1974 by A Clot, Bordère sur Echez, Hautes Pyrénées. Archeol level is a triple sepulture assoc with type of decorated pottery also found on Ger plateau and in Landes region, and is generally attributed to Hallstatt period, ca 2700. However, same pottery is found in Asque region in Tumulus Lescar No. VI and Tumulus Sauvagnon No. II, dated Gif-2515: 3840 ± 80 and Gif-2516: 3720 ± 80 respectively (unpub).

C. Neolithic period

Ly-1188. Dolmen du Riffat I, Thédillac, Lot 4090 ± 130

Human bone from earth of clandestine excavations in open-air dolmen, Le Riffat No. 1 near Thédillac, Lot (44° 35' N, 1° 19' E). Coll and subm 1974 by J M Grafeille, D Cavallier, and V Vanel, Lab ERS Catus, Lot. Assoc with a Chalcolithic industry and close to an urn grave. *Comment* (JMG): corresponds closely to ages generally obtained for industry in region; see, eg, La Bertrandoune dolmen: Ly-1220, below, or les Grèzes dolmen at Souillac: Ly-895: 3910 ± 100 (R, 1976, v 18, p 73) (Clottes, 1976) or Les Grèzes dolmen at Souillac: Ly-895: 3910 ± 100 (R, 1976, v 18, p 73).

Ly-1220. Dolmen de La Bertrandoune, Prayssac, Lot 4170 ± 120

Human bones from lowest part of archaeol level in funerary room of La Bertrandoune dolmen at Prayssac, Lot (44° 31' N, 1° 12' E). Coll 1975 by F Rouzard and subm 1975 by J. Clottes, Dir Antiquités préhist Midi-Pyrénées, Foix. Assoc with a Chalcolithic industry. *Comment* (JC): agrees with expected age and other results from dolmens containing same industry in region: Le Riffat dolmen: Ly-1188, above, and Les Grèzes de Souillac: Ly-895: 3910 ± 100 (R, 1976, v 18, p 73) (Clottes, 1976). All dates confirm a large chronologic difference between dolmens of Quercy and these from Atlantic coast.

Ly-1105. Tumulus BI, Chenon, Charente 5540 ± 140

Human bones from funerary room T in Tumulus BI at Chenon, Charente (45° 57' N, 0° 13' E). Coll 1972 and subm 1974 by D Gauron, Angoulême. Room contains homogeneous material of Late Chalcolithic, Artenac civilization: expected age: 3900 to 4200. *Comment* (DG): much older than all other values for Artenac civilization. Date may, however, correspond with age of building of tumulus, Middle Neolithic. Whole sample possibly came from ancient bone material that remained in middle of Chalcolithic material of 2nd usage.

Ly-1195. Chambre 2 Tumulus E, Bougon, Deux Sèvres 4700 ± 140

Human bones from 2nd funerary rm of Tumulus E in Megalithic necropolis "Les Tumulus", near Bougon, Deux Sèvres (46° 21' N, 0° 11' E). Coll 1973 and subm 1975 by J P Mohen, Mus Antiquités, Saint-Germain en Laye. The 1st funerary rm of Tumulus E was previously dated, Ly-966: 5800 ± 230 (R, 1976, v 18, p 74), which gives a Late Neolithic age (Mohen, 1973). Dated to check this value, which is oldest for that type of monument. *Comment* (JPM): date is much younger than expected and similar to those from nearby Tumulus F, Ly-967 and -968: ca 4550. It corresponds to Late Neolithic. It is known that Funerary Rm 2 of Tumulus E had been visited at this time but it was thought that during this 2nd visit, bones from former construction time remained *in situ*. On the contrary, date proves that a new burial was made.

Stations cotières du Lac de Clairvaux series

Samples from several coastal stas in N part of Clairvaux lake at Clairvaux, Jura (46° 40' N, 5° 46' E). Coll and subm by P Pétrequin, Dir antiquités Préhist, Besançon (Pétrequin, 1974).

Ly-1154. Clairvaux, Sta La Motte aux Magnins, Level V, CT 97 **4950 ± 140**

Wood, coll 1973 and subm 1974. Expected age: ca 5000.

Ly-1153. Clairvaux, Sta II bis, Delta 8, cordon **4430 ± 150**

Charcoal, coll and subm 1974. Expected age: 4500 to 5000.

Ly-1152. Clairvaux, Sta II bis, Pile No. 1474 **4650 ± 130**

Fragment of pile dwelling. Coll and subm 1974. Expected age: 4500 to 5000.

Ly-1151. Clairvaux, Sta II bis, Pile No. 456 **5520 ± 150**

Fragment of pile foundation. Coll and subm 1974. Expected age: 4500 to 5000.

Ly-1058. Clairvaux, Sta III, Delta 2, Level IIIb **4620 ± 130**

Charcoal, coll and subm 1974. Expected age: 3700 to 4000.

Ly-1059. Clairvaux, Sta III, Delta 2, Level IIe **4780 ± 130**

Charcoal, coll and subm 1974. Expected age: ca 4300.

Ly-1155. Clairvaux, Sta VII, sondage **4340 ± 140**

Fragment of pole and board from peaty layer. Coll and subm 1975. Expected age: ca 4800.

General Comment: some dates, approx same as ages expected in 1974-1975, are now too recent or too old after new archaeol correlations. However some measurements made to check previous dates (see another Clairvaux series: R, 1975, v 17, p 19-20) confirm them. Discrepancy with new expected values is too great and cannot be explained by usual causes in coastal stas such as: re-use, apparent age of wood redeposits (Boisau-bert *et al*, 1974).

Ly-1296. Mundolsheim, RU 74, Bas Rhin **5200 ± 300**

Some thin pieces of charcoal from a hole, 1.8m deep, in loess, Junkergaten site at Mundolsheim (48° 38' N, 7° 42' E). Coll 1974 by J Rapp and subm by A Thévenin. Assoc with Late Rubané pottery. Very diluted: 0.7/3 sample. *Comment* (AT): despite relatively large statistical margin, date agrees perfectly with expected age: ca 5000. Some older dates were obtained for 1st phase of Rubané, see Dachstein: Ly-1295, and Evendorf: Ly-1181, below.

Ly-1295. Dachstein, 74 E4 RU, Bas Rhin **6280 ± 320**

Charcoal from pit dug in loess, 1.5m deep, in Vonesch quarry, at Dachstein, Bas Rhin (48° 34' N, 7° 32' E). Coll 1974 by J Sainty and

subm 1975 by A Thévenin; 1/2 sample diluted. *Comment* (AT): correct value for Early Rubané; see Reichtett, Ly-865: 5940 ± 140 (R, 1976, v 18, p 76).

**Ly-1171. Pincevent, Sta 64, Sepulture 184,
La Grande Paroisse, Seine et Marne 3580 \pm 140**

Human bones from a triple sepulture, 70cm deep, Layer II, Magdalenian site, Pincevent, near La Grande Paroisse, Seine et Marne ($48^{\circ} 23' N$, $2^{\circ} 53' E$). Coll 1974 and subm 1975 by C Girard, Lab Technol, Mus Homme, Paris. No material assoc with 3 skeletons that, according to their positions, seem to belong to Seine-Oise-Marne (S O M) civilization (Girard & Leclerc, 1977). Neolithic *sensu lato*: between Neolithic and Bronze age. *Comment* (CG): younger than usual range of S O M dates, between 4400 and 3650. However this value is almost same as date of collective S O M sepulture of Guiry en Vexin, Gif-3329: 3640 ± 100 (unpub in Radiocarbon) and those of La Chaussée Tirancourt, 3 dates: Gif-3350-3700 (R, 1971, v 13, p 222).

Ly-1057. Le Suc, Arlempdes, Haute Loire 5980 \pm 150

Very black carbonaceous earth from hearth, 2m deep, in underbasalt rock shelter at Le Suc, near Arlempdes, Haute Loire ($44^{\circ} 51' N$, $3^{\circ} 55' E$). Coll and subm 1974 by A Cremillieux, Le Monastier sur Gazeille, Haute Loire. Site is wide slope at base of a cliff. Hearth only contains fauna but no archaeol remains; it lies under Late and Middle Neolithic layers. *Comment* (AC): date probably marks oldest Neolithic known in high valley of La Loire R. All other measurements in region, eg, Ly-164: 3670 ± 130 (R, 1971, v 13, p 59) from La Baume Loire, or Ly-49: 4750 ± 300 (R, 1969, v 11, p 115) from Le Rond du Lévrier, are more recent (Cremillieux, 1975).

Ly-1181. Evendorf, Kirchnaumen, Moselle 6050 \pm 200

Charcoal from 0.8m depth in hearth at base of pit in Dolem site at Evendorf, near Kirchnaumen, Moselle ($45^{\circ} 25' N$, $6^{\circ} 34' E$). Coll by M Michels and subm 1975 by C Guillaume; assoc with Rubané industry. Site seems to be 1st Neolithic habitat in Lorraine. *Comment* (CG): agrees with other results on Rubané industry; see Dachstein: Ly-1295, above, and Reichstett, Ly-865: 5940 ± 140 (R, 1976, v 18, p 76).

Lino series, Peru

Samples from 3 villages of a Preceramic people, near Lino, Peru ($11^{\circ} 54' S$, $77^{\circ} 6' W$). Coll and subm 1975 by F Engel, Centre d'Investigation Zones Arides, Univ Agraire Peru, Lima. Villages consisted of huts with only some wood foundations and refuse remaining. Expected age from typologie criteria was 6000 to 10,500.

Ly-1034. Lino 11b XI-81, Unité K, Layer 2 6010 \pm 260

Marine shells from ashy layer.

Ly-1035. Lino 11b XI-81, Unité B, Layer 2 **7750 ± 160**
Charcoal from refuse filling a hut.

Ly-1036. Lino 11b XI-81, Unité F, Layer 2 **8560 ± 170**
Charcoal from refuse filling a hut.

General Comment (FE): 3 samples from same site gave ages in 1500 range. Thus site was occupied several times between long periods of disuse.

D. Mesolithic and Epipaleolithic periods

Ly-1222. L'Adreyt de La Baume d'Arlempdes, Arlempdes, Haute-Loire **2500 ± 130**

Very thin pieces of charcoal from layer with geometric industry without ceramics in basaltic rock shelter, La Baume, at Greycenet near Arlempdes, Haute Loire (44° 52' N, 3° 55' E). Coll and subm 1975 by A Crémillieux. Level lies below Bronze and Neolithic layer from which it is separated by gravel layer (Crémillieux, 1974). Assoc industry could be Tardenoisian which may be Early, and expected age is a little greater than Ly-1057 from Le Suc d'Arlempdes, above. *Comment (AC):* too recent date proves that charcoal from Bronze age layer or younger fell down through upper layers, as frequently occurred in this type of site, see, eg, Ly-452: 3950 ± 120 for Paleolithic layer of La Baume Loire II site (R, 1973, v. 15, p 147).

Ly-1198. Botiqueria del Moros, Mazaleon, Provincia de Teruel, Spain **7550 ± 200**

Charcoal from lowest level of Botiqueria del Moros site near Mazaleon, Prov Teruel Spain (41° 3' N, 0° 5' E). Coll 1974 and subm 1975 by I Barandiaran, Dept Arqueol, Univ La Laguna, Spain. Level corresponds to 1st occupation of site and contains Epipaleolithic industry with geometrics attributed to Tardenoisian, Sauveterrian, or Castelnovian civilization. It may be correlated with "Cocina I" horizon in Spanish Levant. In upper level of site is industry with evolved geometric and the 1st appearance of Cardial ceramics. *Comment (IB):* date as expected. It is close to Castelnovian value obtained from Chateauneuf lès Martigues, see eg, Ly-448: 7270 ± 220 (R, 1973, v 15, p 527) and close to values of Sauveterrian at Montclus site, Ly-308: 7760 ± 260 (R, 1971, v 13, p 42) (Barandarian, 1976).

Ly-1189. La Passagère, Méaudre, Isère **8790 ± 190**

Bones from Layer 2 of La Passagère grotto, Epipaleolithic site at Méaudre, Isère (45° 9' N, 5° 33' E). Coll and subm 1974 by P Bintz, Inst Dolomieu, Univ Grenoble. Assoc with Magdalenian-type industry with burins and Azilian points and with a fauna containing reindeer. Expected age: 9500. *Comment (BP):* younger than expected, date may be compared with previous result from nearby grotto, Grotte Colomb, industry of which is similar and contemporaneous, Ly-430: 8960 ± 420 (R, 1973,

v 15, p 147). Last result was doubtful according to Magdalenian character of industry. It now appears, not only from similarity of both dates but also from palynologic, sedimentologic, and faunal date, that chronology of Late Paleolithic civilization in region must be revised and may involve survival of Magdalenian groups up to beginning of postglacial period.

Saint-Thibaud de Couz series, Savoie

Bones from 2 upper levels of La Grotte Jean Pierre I site at Saint-Thibaud de Couz, Savoie (45° 40' N, 5° 50' E). Coll and subm by P Bintz. Many dates and description were pub in previous date list (R, 1975, v 17, p 24).

Ly-1309. Saint-Thibaud de Couz JP I, Layer 1 3790 ± 260

Some bones from Layer 1; no assoc industry. Subm 1976. Pollen diagram indicates large decrease of tree and fern pollen due to intentional deforestation. Sedimentology shows deterioration of climatic conditions, colder and dryer, following climatic optimum attributed to Atlantic period. 1/3 sample diluted. *Comment* (PB): date indicates Sub-Boreal, agrees with sedimentologic and palynologic data.

Ly-1190. Saint-Thibaud de Couz JP I, Layer 5 10,620 ± 210

Bones from Layer 5 where pollen diagram shows short cold phase in Pre-Boreal which can be assimilated to Piottino phase. Subm 1974. *Comment* (PB): for unknown reason date agrees neither with palynologic attribution, Piottino: 950 to 10,000, nor with 2 previous dates from nearest overlying and underlying levels, Ly-428: 9050 ± 260 for Layer 5A, and Ly-596: 10,750 ± 300 for Layer 6.

Abri du Mannlefelsen I series, Oberlarg, Haut-Rhin

Charcoal from 2 levels in Mannlefelsen I rock shelter at Oberlarg, Haut-Rhin (47° 27' N, 7° 14' E). Coll by J Sainty and subm by A Thévenin. Site now shows up to 8m sediment and contains Epipaleolithic and Mesolithic industry, probably with a continuous stratigraphy from end of Würm IV to Atlantic period. Lowest and highest layers were previously dated by 2 labs, Layer S: Ny: 10,220 ± 330 (unpub) and Layer G: Gif-2634: 5140 ± 140 (Thévenin, 1976). The following dates concern layers excavated during a deep bore-hole.

Ly-1016. Oberlarg JK Y20 7860 ± 280

From 3.42m depth in Sq Y 20 at top of Layer K. Coll 1973 and subm 1974. Assoc with Middle Mesolithic microlithic industry. Pollen diagram suggests end of Boreal. Charcoal sample was very small, diluted 2/3.

Ly-1015. Oberlarg KL W3 7810 ± 170

From 3.42m depth in Sq W3 at base of Layer K. Coll 1973 and subm 1974. Same industry and pollen as Ly-1016.

Ly-1297. Oberlarg P X3 8230 ± 300

From 4.6m depth in Sq X3 of Layer P and base of Layer Q, Early Mesolithic. Coll and subm 1975. Pollen diagrams indicate Pre-Boreal–Boreal transition in Layer Q. Another date in Layer Q, Gif-2387: 9030 ± 160 (unpub). Because charcoal was in very fragile pieces, one complete treatment with pyrophosphate could not be made; some humic pollution might remain in sample. Very diluted: 0.8/3 sample.

General Comment (AT): Ly-1015 and -1016 attribute a precise date to Layer K. Average is 7830 ± 130, agreeing with industry, pollen and other values. Ly-1297 is too young compared with Gif-2387, but falls well within range of expected date, considering large statistical deviation.

Rochedane series, Villars sous Danjoux, Doubs

Bones from 3 levels in rock shelter Rochedane at Villars sous Danjoux, Doubs (47° 21' N, 6° 46' E). Coll by J Sainty and subm by A Thévenin. This large rock shelter contains 3.5m sediment divided into 10 main levels, including industries probably belonging to Azilian or Mesolithic periods. Analyses indicate End of Würm IV — postglacial transition: Alleröd, Late Dryas, and Pre-Boreal, but precise attribution for different levels remains difficult. One of upper levels, A4, was previously dated, Gif-2530: 9210 ± 120 (Thévenin & Sainty, 1976).

Ly-1194. Rochedane 75 B G3 10,730 ± 190

From 1.60m depth in Layer B, Sq G3. Coll and subm 1975. Assoc with rich industry probably belonging to Azilian with engraved pebbles. The climatic phase seems to be Late Dryas or Pre-Boreal.

Ly-1192. Rochedane 74 C'I A3 11,090 ± 200

From 2.07m depth in Layer C'I, Sq A3. Coll 1974 and subm 1975. Assoc with industry similar to that of Layer B. Climatic phase seems to be Late Dryas. Both Layers B and C'I are almost inserted into one another.

Ly-1193. Rochedane 74 DI A3 11,060 ± 470

From 2.22m depth in Layer DI, Sq A3. Coll 1974 and subm 1975. Assoc with poor industry which may be Azilian or Late Magdalenian. Climatic phase is Alleröd and fauna marks last appearance of reindeer. Absence of arctic species of micromammals excludes attribution to Early or Middle Dryas. 1/3 sample diluted.

General Comment (AT): Ly-1193 agrees with expected age and indicates Alleröd despite large statistical range.

Ly-1175. Abri de la Tête du Chien, La Madeleine, Penne, Tarn 10,110 ± 440

Bones from 1m depth in single level of small shelter, La tête du Chien, at La Madeleine, near Penne, Tarn (44° 5' N, 1° 43' E). Coll and subm 1974 by H Bessac, La Fau near Montauban. 1/3 sample diluted. Assoc with Azilian industry. *Comment* (HB): agrees with expected age

for this industry in region, between Magdalenian VI, eg, La grotte de Venus, Ly-1108, below, and Sauveterrian, eg, La grotte des Fieux at Miers, Lot, Gif-1807: 9450 ± 190 (R, 1974, v 16, p 26).

E. End of Late Paleolithic period

**Ly-1099. Rislisberghöhle, Oensingen,
Kanton Solothurn, Switzerland 11,860 ± 230**

Bones from Level II, Grid 33 in Rislisberghöhle site near Oensingen, Solothurn Canton, Switzerland (47° 19' N, 7° 42' E). Coll and subm 1973 by J H Barr and H R Stampfli, Kantonsarchäologie, Solothur. Assoc with Late Magdalenian industry. Accompanying fauna is that of cold climate. *Comment* (JHB): date agrees very closely with date of B-2316: $12,060 \pm 130$ (unpub in Radiocarbon) for Swiss Magdalenian open sta of Moosbühl, where occupation lasted from shortly before end of Bölling until beginning of Dryas II (Barr, 1975).

**Ly-1108. Sanuv kout, Hostim,
Beroun, Czechoslovakia 12,420 ± 470**

Horse bones from 105 to 160cm depth in Sq 143 E81 of camping site at Sanuv Kout in Berounka R valley, near Hostim, Prov Beroun, Czechoslovakia (49° 57' N, 14° 7' E). Coll 1968 and subm 1974 by S Venc, Inst d'Archéol Praha. Previous date of charcoal from upper level was obviously polluted or redeposited, Bln-495: 2005 ± 80 (R, 1970, v 12, p 405). *Comment* (SV): date agrees with expected age of industry, Late Magdalenian, contemporaneous with Stages IV or V of French Magdalenian.

Gönnersdorf series, Neuwied, Rheinland West Germany

Small fragments of bones, mainly horse ribs, from open air habitat at Gönnersdorf near Neuwied, West Germany (50° 27' N, 7° 19' E). Coll 1972 by G Bosinski, Univ Köhln and subm 1975 by F Polin, Mus hist nat, Paris. Measurements made to check Ly-768: $12,380 \pm 230$ (R, 1975, v 17, p 25) and to determine contemporaneity of soil of habitat and of underlying pits (Bosinski and Fischer, 1974) (Poplin, 1976).

Ly-1172. Gönnersdorf No. 2 12,660 ± 370
Sample from all the habitat soil, diluted 2/3.

Ly-1173. Gönnersdorf No. 3 11,100 ± 650
Sample from pits at base of habitat soil. Very diluted, 0.9/3.

General Comment (GB & FP): Ly-1172 and -768 are compatible. Ly-1173 is clearly more recent but obtained from small amount of bone which entails a large statistical margin; date cannot be used to determine length of site occupation.

**Ly-1109. Grotte de Venus,
La Madeleine, Penne, Tarn 11,180 ± 300**

Bones from 1.5m depth under cryoclastic fall of rock at entrance of shelter Grotte de Venus, at La Madeleine, near Penne, Tarn (44° 5' N,

1° 43' E). Coll and subm 1974 by H Bessac. Sample diluted 1/2. Assoc with Late Magdalenian (VI.) industry (Sonneville-Bordes, 1960). *Comment* (HB): agrees with expected age for this industry in region. May be compared with Le Trou des Forges at Bruniquel, Tarn et Garonne, BM-302: $11,750 \pm 300$ and BM-303: $11,110 \pm 160$ (R, 1969, v 11, p 283).

Ly-1200. Pech-Merle, Cabrerets, Lot 11,460 ± 390

Charcoal in dust form adhering to pieces of clay from small depressions at surface of Upper Paleolithic ground, 15cm deep and at top of Layer II in Pech-Merle cave near Cabrerets, Lot (44° 30' N, 0° 34' E). Coll and subm 1974 by M Lorblanchet, Thémines, Lot. Very crumbly sample which has not permitted basic pretreatment to eliminate any possible humus. Sample diluted 1/2. A few reindeer bones were found with charcoal but flint implements are not typical. Cave contains rock paintings of 2 main periods, probably Upper Perigordian to Solutrean and Magdalenian. However, dated layer may correspond to occupation different from time of execution of paintings. Blocking of primitive entrance by cone of debris is also unknown (Lorblanchet, 1976). *Comment* (ML): date must be considered minimum but could be correct, non-polluted sample, and in this case, it seems to reveal relatively late occupation and blocking of cave, *ie*, a long time after execution of paintings. It may be comparable to Gif-1697: $10,830 \pm 200$ (R, 1974, v 16, p 26), from nearby Upper Magdalenian cave Sainte-Eulalie.

Grottes de Caubeta series, Bagnères de Bigorre, Hautes-Pyrénées

Bones from 2 ancient grottoes destroyed by quarry at Caubeta, near Bagnères de Bigorre, Hautes-Pyrénées (43° 4' N, 0° 10' E). Bones were preserved in Mus Bagnères de Bigorre since end of ancient excavation. Subm 1974 by A Clot, Bordères, Hautes-Pyrénées. Assoc with industry presumably Late Magdalenian, V or VI.

Ly-1107. Grotte d'Aurensan inférieure 13,910 ± 230

From middle layer, coll 1869 by E and C. L. Frossard (Frossard & Frossard, 1870).

Iy-1055. Grotte Diogène 14,280 ± 300

From unknown layer, coll 1930 by M Quérueil (Rousseau, 1932).

General Comment (AC): both dates are in statistical range. They are older than expected, industry attributed to Late Magdalenian (Breuil, 1950). They may correspond more closely to Middle Magdalenian, III or IV, compared with sites of region, eg, 3 Ly dates between 14,180 and 13,510 in Duruthy site (R, 1976, v 18, p 79) or Ly-846: $13,810 \pm 740$ (R, 1975, v 17, p 23) in Le Fontanet grotto, or lastly Gif-2943: $12,760 \pm 170$ (unpub) in Saint-Jean de Vergès.

Ly-1182. Le Flageolet II, no. 4, Bézenac, Dordogne 14,250 ± 400

Bones from Layer IX in Le Flageolet rock shelter at Bézenac, Dordogne (44° 49' N, 1° 6' E). Coll and subm 1976 by J P Rigaud, Dir

Antiquités Préhist Aquitaine, Bordeaux. Two previous dates for same layer were, for top, Ly-917: $14,110 \pm 690$, and for the base, Ly-918: $15,250 \pm 320$ (R, 1976, v 18, p 80). Both dates seemed too old for assoc industry, attributed to Late Magdalenian, with regard to typologic characteristics. *Comment* (JPR): date confirms both previous values and suggests Middle Magdalenian attribution, which is not in disagreement with paleontologic or sedimentologic date (Rigaud, 1976).

Ly-1191. Rigney, Doubs 14,940 \pm 500

Bone, cervical vertebra, (*Coelodonta antiquitatis*) from base of Rigney grotto at Rigney, Doubs (47° 21' N, 6° 8" E). Coll 1952 by A Glory and subm 1975 by C Guérin, Geol Dept, Univ Lyon. Sample diluted 1/3. Fauna is represented only by 1 skull of woolly rhinoceros and some reindeer bones (Théobald & Szymanek, 1963). Assoc industry is badly defined Magdalenian, but certainly not Late Magdalenian. Engravings in grotto compare with those from Arlay or La Garenne sites (Glory, 1961). *Comment* (CG): agrees with attribution of industry to Early or Middle Magdalenian and with dates from Arlay; see 2 Ly dates ca 15,500 (R, 1973, v 15, p 518) and La Garenne series, below. Apart from paleontologic site Esclauzure, Corrèze, Ly-361: $14,540 \pm 300$ (R, 1973, v 15, p 150), Rigney site is most recent where *Coelodonta antiquitatis* has been found in W Europe and skull from this fauna is most recent known (Guérin, 1976).

F. Beginning of Late Paleolithic and Middle Paleolithic periods

La Garenne series Saint-Marcel, Indre

Bones from 3 layers in 2 superimposed but stratigraphically connected sites of La Garenne near Saint-Marcel, Indre (46° 36' N, 1° 30' E). Coll 1955 to 1974 and subm 1974 by J Allain, Dir Antiquités Préhist, Centre, Bourges. Numerous measurements were taken from site for 20 yr by 4 labs, using charcoal of charred bones. Results are between ca 8000 and 16,000. Assoc industry: "à navettes Magdalenian" is special type of which contemporaneity with classic Magdalenian industries is not well defined. It may be of 2nd part of Magdalenian period. No site with a similar industry has been well dated.

Ly-1125. La Garenne Grand Abri K I A 2 15,330 \pm 950

From deep layer in Le Grand Abri site corresponding to Upper level of "à Navettes Magdalenian". Bad conservation of organic matter. 1/6 samples diluted.

Ly-1126. La Garenne Grand Abri B 2 15,560 \pm 580

From lower level in Grand Abri corresponding to Middle level of "à Navettes Magdalenian". Sample diluted 2/3.

Ly-1127. La Garenne Abri Blanchard B 5 14,080 \pm 350

From single layer in Abri Blanchard, corresponding to Lower level of "à Navettes Magdalenian". Sample diluted 2/3.

General Comment (JA): as with other series from site, these 3 dates are unsatisfactory and in wrong stratigraphic order. Previous dates form 3 groups: 1) ca 9000 L-399 D (R, 1959, v 1, p 23) is obviously wrong because Ly present dates prove that bones in site are neither polluted nor redeposited; 2) 3 dates from 3 labs, ca 11,000 from burnt bones; 3) 2 isolated dates ca 13,000 and 15,900 (Chicago dates, unpub in Radiocarbon). Three present dates are closer than 3rd group but only Ly-1127 from Layer B5 in Abri Blanchard seems to agree with typologic and palynologic date.

L'Abri Fritsch series, Les Roches, Pouligny Saint-Pierre, Indre

Burnt bones, Ly-1001, and unburnt bones from several levels in Abri Fritsch at Les Roches, near Pouligny Saint-Pierre, Indre (46° 40' N, 1° 0' E). Coll 1973 and subm 1974 by J Allain (Allain & Fritsch, 1967).

Ly-1121. Abri Fritsch, 3a **17,130 ± 550**

Bones from Layer 3a assoc with Magdalenian 1 industry with raclettes, Upper Badegoulian. 2/3 sample diluted.

Ly-1122. Abri Fritsch, 4 **16,530 ± 550**

Bones from Layer 4 assoc with Magdalenian 1 industry with raclettes, Upper Badegoulian. Sample diluted 2/3.

Ly-1001. Abri Fritsch 5b IN₂ **14,960 ± 380**

Burnt bones treated as carbonaceous earth from Layer 5b, SqIN₂ Assoc with Late Badegoulian industry without raclettes. Presence of rootlets. *Comment* (JA): date is obviously at least 2000 yr too recent: pollution by recent carbon is certain.

Ly-1123. Abri Fritsch 5b **17,280 ± 350**

Bones from same level as Ly-1001, assoc with same industry.

Ly-1124. Abri Fritsch 6 **17,980 ± 350**

Bones from Layer 6, assoc with Magdalenian O industry, Lower Badegoulian. Attributed to Lascaux interstadial.

General Comment (JA): Ly-1001 must be discarded as polluted. Ly-1121 and -1122 should be in reverse order, but are within statistical margin. Apart from this, all dates agree, are in range of expected ages, correspond to typologic data and fit with previous date from lower Layer 8, GrN-5499: 19,280 ± 230 (R, 1972, v 14, p 57). It thus appears that Early Magdalenian in region is contemporaneous with some Solutrean industries, eg, at Parpallo in Spain, Birm-521: 17,900 ± 340 (R, 1975, v 17, p 273), or maybe at La Grotte Chabot in SE France, Ly-699: 17,770 ± 400 (R, 1975, v 17, p 27).

F. Beginning of Late Paleolithic and Middle Paleolithic periods

Ly-1150. Peyrehaute, Mejanne le Clap, Gard **21,700 ± 1500**

Bones from upper layer of filling of gallery in Peyrehaute Grotto, near Mejanne le Clap, Gard (44° 16' N, 4° 23' E). Coll and subm 1974

by X Gutherz, Dir Antiquités Préhist, Languedoc-Roussillon, Montpellier, and A Bonnet, Nimes. Assoc with reindeer and horse fauna and not well-defined industry (Mazauric, 1904). *Comment* (AB): date suggests attribution of industry to Late Aurignacian and cold phase indicated by fauna seems to belong to end of Würm III. Date may be compared with results from La Salpêtrière site, eg, Ly-942: $20,630 \pm 770$ and Ly-943: $21,760 \pm 490$, for Levels 30A and 30E, presumably Late Aurignacian (R, 1976, v 18, p 81).

Ly-991. La Lâouza, Sanilhac et Sagriès, Gard $10,000 \pm 480$

Bones from Layer 2 in La Laouza rock shelter near Sanilhac, Gard ($43^{\circ} 56' N$, $4^{\circ} 34' E$). Coll and subm 1973 by F Bazile, Vauvert, Gard. Sample diluted 1/2. Assoc industry: Early Aurignacian. *Comment* (FB): bones from layer 2 in La Lâouza rock shelter near Sanilhac, Gard ($43^{\circ} 56' N$, $4^{\circ} 34' E$). Coll and subm 1973 by F Bazile, Vauvert, Gard, Sample diluted 1/2. Assoc industry: Early Aurignacian. *Comment* (FB): contamination by recent bones seems impossible because all bones seem to have same fossilized aspect, but date is obviously much too young.

Ly-1102. Bacho-Kiro, Dryanovski Monastyr, Dryanovo, Gabrove, Bulgaria $29,150 \pm 950$

Bone from Layer 7/6a from Bacho-Kiro grotto at Dryanovski monastary, near Dryanonvo, Prov Gabrovo, Bulgaria ($42^{\circ} 40' N$, $25^{\circ} 27' E$) (Garrod, 1939). Coll 1972 and subm 1974 by J K Kozłowski, Inst archéol, Univ Krakow, Poland. Recent excavation revealed 6 Aurignacian levels and dated level is 5th from base. Aurignacian series lies between Mousterian-Levallois series and Late Paleolithic, Tardigravetian, level (Kozłowski, 1975). *Comment* (JKK): date agrees with expected age and indicates that more recent typical Balkan Aurignacian took place in Krinides Interstadial II with regard to series obtained at Tanaghi Philippon, Thessalia (Wijmstra, 1969).

**Ly-1104. Camiac et Saint-Denis, Gironde $35,100 \pm 2000$
 -1500**

Bones from basal layer of open-air site. Camiac, at Camiac et Saint-Denis, Gironde ($44^{\circ} 47' N$, $0^{\circ} 16' W$). Coll and subm 1974, by M Lenoir and F Prat, Inst Quaternaire, Univ Bordeaux. *Comment* (ML): although poor, assoc industry may be attributed to Middle Paleolithic or to very early Upper Paleolithic. Layer might have been formed in Würm II/III interstadial. Date agrees with data of fauna, industry, and sedimentology of site (Lenoir, 1976).

Grotte de la Baume series, Echenoz la Meline, Haute Saône

Bones from 2 levels in La Baume Grotto near Echenoz la Méline, Haute Saône ($47^{\circ} 36' N$, $6^{\circ} 7' E$). Coll and subm 1972 by M Campy Lab Géol, Univ Besançon. Assoc with probably Early Würm fauna and Mousterian industry (Campy, 1973).

Ly-550. Echenoz No. 1 +840
24,180
-630

From Level II. Coll 1971, 5/6 sample diluted.

Ly-772. Echenoz No. 2 ≥32,000

From Level III, coll 1972.

General Comment (MC): although upper level seems to have finite age, it seems more likely that this date is too young. Sample could be polluted for unknown reason. According to type of industry, archaic character of fauna, and sedimentology of all layers in site, an unlimited age as Ly-772, is more suitable.

III. HYDROGEOLOGIC SAMPLES

Fes series, Morocco

Water samples from springs and wells in several aquifers in Saïs plain near Fes, Morocco (34° 10' N, 5° 0' W). Coll 1972 by Dir Hydraulique, Royaume Maroc, Rabat, and subm 1972 by A Marcé, Bur recherches Géol Min, Orléans. This basin is mainly constituted by 2 aquifers separated by slightly permeable formation. Lower aquifer, Lias dolomitic limestones, contains artesian confined ground water coll by borings; upper aquifer, Plio-Quaternary lacustrine limestones, contains unconfined ground water.

Sample	Localization	Dilution: $\delta^{13}\text{C}$		
		% of sample	% PDB ± 0.1	^{14}C % modern
Ly-709.	Fes 532,830 cold spring: 42/15	100.0	-15.1	85.6 \pm 1.5
Ly-710.	Fes 534,950 cold spring: 48/15	100.0	-16.0	83.2 \pm 2.1
Ly-711.	Fes 520,100 hot spring: 105/15	83.3	—	8.7 \pm 0.9
Ly-712.	Fes 537,850 boring: 152/15	100.0	-14.0	51.1 \pm 1.1
Ly-713.	Fes 538,964 boring: 290/15	100.0	-17.5	79.1 \pm 1.4
Ly-714.	Fes 536,700 boring: 515/15	100.0	-15.3	81.1 \pm 1.3
Ly-715.	Fes 541,800 boring: 1225/15	66.7	-15.5	5.2 \pm 0.9
Ly-716.	Fes 547,653 hot spring: 1845/15	100.0	-17.2	50.3 \pm 1.2
Ly-717.	Fes 541,200 boring: 2060/15	100.0	-16.3	72.3 \pm 1.5
Ly-718.	Fes 540,250 boring: 2168/15	100.0	-14.0	57.5 \pm 1.3

General Comment (AM): ^{14}C contents from borings indicating recent waters show important renewal of Lias ground water, except low ^{14}C content of Ly-715, which, agrees with other data and confirms presence of a confined ground water in special region of basin. ^{14}C values from cold springs prove that water probably also comes from Lias aquifer. ^{14}C values from hot springs may be due to long transfer time of waters of same origin as Ly-715. ^{13}C values show no isotopic exchange occurred between limestones and bicarbonates of waters (Marcé, 1975).

Tangiers series, Morocco

Water from several wells in Charf el Akab aquifer, near Tangiers, Morocco (35° 5' N, 5° 50' W). Coll 1972 by Dir Hydraulique, Royaume Maroc, Rabat, and subm 1972 by A Marcé, Bur recherches Géol Min, Orléans. Mio-Pliocene closed basin of Charf el Akab has aquifer layers mainly constituted by calcarenites and sandstones. No dilution of samples.

Sample	Alt (asl)	$\delta^{13}\text{C} \text{‰ PDB}$ ± 0.05	$^{14}\text{C} \text{‰}$ Modern
Ly-728. Oued Mharhar	—	−13.26	122.9 \pm 1.6
Ly-730. 22/1	16.0m	—	19.1 \pm 0.6
Ly-732. 23/1	16.0	−16.74	54.3 \pm 0.9
Ly-734. 24/1	16.5	−17.13	46.1 \pm 0.9
Ly-736. 31/1	25.75	−11.36	17.2 \pm 0.6
Ly-738. 324/1	31.0	−11.21	10.2 \pm 0.5
Ly-739. 325/1	19.5	−18.55	60.3 \pm 1.0
Ly-740. 511/1	24.0	−21.23	83.7 \pm 1.2
Ly-741. 512/1	27.5	−15.8	65.8 \pm 1.0

General Comment (AM): highest ^{14}C values indicate recent waters supply aquifer, total volume of which is ca 500 10⁶ M3 (Marcé, 1975).

Beni Mellal series, Morocco

Water from springs and wells in several aquifers of Oumer Rbia R basin near Beni Mellal, Morocco (32° 36' N, 6° 25' W). Coll 1972 by Dir Hydraulique, Royaume Maroc, Rabat, and subm 1972, by A Marcé. Waters from springs of Oum er Rbia R are its main supply when it comes into Tadla basin where it is used for irrigation. In Tadla basin, there are phreatic ground waters in surficial formations and confined ground water in Turonian limestones. Only diluted sample, Ly-742: 1/2 sample.

Sample	Localization	$\delta^{13}\text{C}$ ‰ PDB ± 0.05	$^{14}\text{C} \text{‰}$ Modern
Ly-742. Beni Mellal 147/30	Spring of Oum er Rbia R	−15.94	65.2 \pm 1.9
Ly-743. Beni Mellal 516/30	Spring of Oum er Rbia R	−22.04	71.2 \pm 1.1
Ly-744. Beni Mellal 2324/36	Boring in phreatic GW	−14.94	76.1 \pm 1.7
Ly-745. Beni Mellal 332/36	Boring in phreatic GW	−18.19	61.8 \pm 1.0
Ly-746. Beni Mellal 2400/36	Boring in phreatic GW	−18.01	54.7 \pm 1.0
Ly-747. Beni Mellal 642/36	Boring in Turonian GW	−15.61	45.5 \pm 0.9
Ly-748. Beni Mellal 705/36	Boring in Turonian GW	−14.98	70.9 \pm 1.1

General Comment (AM): agrees with other analyses, comparison between values from springs and those from borings facilitates their distinction in Tadla basin. No drainage occurred from Turonian ground water to phreatic system (Marcé, 1975).

ADDENDUM

Dilution of previously published samples. The following numbers indicate % dilution of sample with respect to total amount of gas or benzene counted in detectors. All other samples were not diluted.

Ly- 16:94.7	Ly-255:21.4	Ly-391:83.9	Ly-516:43.3	Ly-624:67.6	Ly-753:50.0
20:87.9	263:66.7	392:28.2	517:39.8	632:29.2	756:66.7
21:87.6	264:34.1	395:32.8	518:28.2	634:83.3	770:58.1
23:60.0	265:33.4	396:20.9	526:88.9	640:83.3	780:66.7
51:87.5	269:91.6	397:37.8	531:43.5	646:63.6	788:46.9
53:90.7	270:53.6	400:35.3	534:56.2	648:39.4	798:77.2
63:14.5	279:81.6	403:47.3	549:60.4	649:87.3	793:66.7
66:94.0	280:75.6	409:35.0	550:83.3	651:47.4	801:43.3
71:87.3	283:52.7	410:64.2	556:83.3	454:56.2	812:66.7
91:77.3	284:64.3	411:51.3	558:58.3	655:11.0	846:28.6
92:38.6	285:63.0	414:31.9	560:69.6	656: 2.7	847:66.5
124:64.8	287:73.0	417:85.3	562:83.1	656:38.8	848:50.8
125:21.9	289:37.7	418:37.3	564:66.7	658:90.7	858:66.7
126:42.2	291:87.0	419:79.7	574:58.3	660:57.7	889:66.7
153:81.1	298:93.9	420:75.0	586:66.0	661:37.8	904:33.3
155:42.5	300:95.3	428:76.0	589:38.4	662:77.5	915:86.9
178:29.5	301:64.4	429:76.0	590:19.9	663:83.3	916:85.3
184:92.0	306:66.4	430:87.5	591:26.6	671:23.7	917:65.9
193:56.4	307:38.4	439:16.3	592:19.9	672:52.9	927:36.1
194:76.8	308:49.8	454:50.0	594:68.7	676:62.7	953:31.9
196:88.0	310:41.3	456:50.0	596:83.3	677:58.4	954:76.6
197:16.6	315:44.1	458:78.6	597:49.0	679:32.7	955:70.5
198:43.0	318:87.6	475:84.2	598:19.9	680:83.3	956:66.7
199:39.3	319:89.3	490:68.9	600:29.6	685:66.7	957:66.7
211:93.2	321:30.7	492:75.1	602:85.6	692:73.2	958:17.0
213:67.9	327:58.5	500:39.2	604:39.8	695:71.9	961:40.3
215:36.6	336:38.2	501:24.8	607:27.5	697:57.7	964:45.2
216:75.7	347:33.5	502:33.3	608:66.7	700:23.6	965:50.0
234:49.3	348:87.5	505:76.6	609:65.5	702:39.6	966:66.7
236:42.5	362:31.5	507:40.0	610:83.3	703:83.2	967:66.7
238:88.9	371:52.2	508:37.1	611:66.7	704:29.1	968:66.7
240:90.9	376:87.8	509:29.9	612:91.7	705:70.9	970:33.3
243:93.6	379:62.7	510:54.9	620:30.0	707:42.2	974:50.0
244:83.3	384:62.5	512:25.9	621:39.4	722:72.8	977:92.9
248:56.2	388:83.9	514:45.3	622:59.8	727:83.3	979:50.0
249:57.3	389:57.8	515:46.1	623:18.7	752:66.7	

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