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GIF NATURAL RADIOCARBON MEASUREMENTS VI

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This list consists mainly of dates obtained from analysis during 1967 and 1968 of archaeologic and geologic samples. The last section deals essentially with climatic, palynologic, and sea level variation problems. All measurements of atmospheric CO_2 made periodically from 1962 until end of 1970 are also published here. In agreement with international convention, all dates have been calculated on the basis of the C^{14} half-life of 5568 years and 95% of NBS oxalic acid as the modern reference year.

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SAMPLE DESCRIPTIONS

I. ARCHAEOLOGIC SAMPLES

A. France

1. W. France

Gif-1117. Kervéo, Plomelin, Finistère — **2120 ± 110 / 170 B.C.**

Charcoal from Iron age souterrain, Kervéo, Plomelin (47° 55′ N Lat, 4° 10′ W Long), Finistère. Coll. and subm. 1967 by P. R. Giot, Fac. Sci., Rennes. *Comment*: assoc. ceramics belong to La Tène I period. Date is slightly too young (Giot, 1969; Giot and Ducouret, 1968).

Gif-812. Mesperleuch, Plouhinec, Finistère — **2250 ± 100 / 300 B.C.**

Charcoal from salt-pan brickworks of Iron age, in a clayey block, at Mesperleuch, Plouhinec (48° 00′ N Lat, 4° 30′ W Long), Finistère. Coll. and subm. 1967 by P. L. Gouletquer, Fac. Sci. Rennes. *Comment*: in good agreement (Gouletquer, 1967, 1970; Giot, 1968).

Gif-748. Le Hellen, Cleder, Finistère — **3250 ± 115 / 1300 B.C.**

Charcoal from middle Bronze age barrow at Le Hellen, Cleder (48° 40′ N Lat, 4° 05′ W Long), Finistère (Le Roux, 1966). Coll. and subm. by C. T. Roux, Fac. Sci., Rennes. *Comment*: agrees well with date of monument (Giot, 1968; Le Roux, 1966).

Gif-749. Lescongar, Plouhinec, Finistère — **3570 ± 115 / 1620 B.C.**

Wood from grave of Early Bronze age barrow at Lescongar, Plouhinec (48° 01′ N Lat, 4° 30′ W Long), Finistère (Briard, 1968; Giot, 1968). Coll. and subm. 1966 by J. Briard, Fac. Sci., Rennes. *Comment*: correct age for barrow of this series.

3800 ± 120
Gif-809. Kerleven, La Forêt-Fouesnant, Finistère 1850 B.C.

Charcoal from Chamber C of megalithic cairn, Kerleven, La Forêt-Fouesnant (47° 42′ N Lat, 3° 48′ W Long), Finistère. Coll. and subm. 1967 by C. T. Le Roux. *Comment*: this cairn, of a type especially found in S Finistère, was dated by Gsy-III: 4825 ± 125 (R., 1966, v. 8, p. 135). Traces Late Neolithic reutilization (Le Roux and l'Helgouach, 1967; Giot, 1968).

Kernonen, Plouvorn series, Finistère

Samples from an Early Bronze age barrow, at Kernonen, Plouvorn (48° 35′ N Lat, 4° 03′ W Long), Finistère. Coll. and subm. 1967 by J. Briard.

3910 ± 120
Gif-805. Kernonen A 1960 B.C.

Wood from chest containing flat axes.

3200 ± 120
Gif-806. Kernonen B 1250 B.C.

Charcoal in clayey material of barrow.

3150 ± 120
Gif-807. Kernonen C 1200 B.C.

Charcoal in soil under barrow.

General Comment: dates for Charcoals B and C are statistically consistent but too young, for an unexplained reason; wood from chest is older than expected; possibly, this one-piece chest is from a big tree trunk (Briard, 1970; Giot, 1968, 1969).

Plouzévédé series, Finistère

Charcoal from middle Bronze age barrow of Ar Reunic (48° 35′ N Lat, 4° 15′ W Long). Coll. and subm. 1967 by J. Briard.

3200 ± 120
Gif-1113. Plouzévédé A 1250 B.C.

1.40 m depth in barrow, N and E trenches.

3160 ± 120
Gif-1114. Plouzévédé B 1210 B.C.

1.20 m depth in barrow S trench.

General Comment: barrow without central tomb and without grave goods, only some potsherds of middle Bronze age. Age usually found for this type of monument (Giot, 1969).

Barnenez, Plouézoch series, Finistère

Charcoal from different passage graves of great cairn of Barnenez, Plouézoch (48° 40′ N Lat, 3° 51′ W Long). Coll. and subm. 1967-1969 by P. R. Giot.

5100 ± 140
Gif-1116. Barnenez, Dolmen F, passage 3150 B.C.

Gif-1309. Barnenez, Dolmen G, chamber **5750 ± 150**
3800 B.C.

Gif-1310. Barnenez, Dolmen A, chamber **5450 ± 150**
3500 B.C.

Gif-1311. Barnenez, Dolmen B, entrance **3200 ± 120**
1250 B.C.

Gif-1556. Barnenez, Chamber F, chamber **5550 ± 140**
3600 B.C.

General Comment: Gif-1311, as Gsy-30 and Gsy-147 (2200 ± 200 and 2690 ± 105, R., 1966, v. 8, p. 137) indicate that Megalithic site of Barnenez was re-used during Bronze and Iron ages. Gif-1116, -1309, -1310, and -1556 date 1st occupation and agree well with established chronology for construction of the different dolmens (Giot, 1969, 1970).

Gif-767. Prajou menhir, Trebeurden, Finistère **5330 ± 150**
3380 B.C.

Charcoal from additional hearth in megalithic monument, Prajou menhir, Trebeurden (48° 47′ 40″ N Lat, 3° 33′ 45″ W Long), Finistère (l'Helgouach, 1966). Coll. and subm. 1966 by J. l'Helgouach, Fac. Sci., Rennes. *Comment*: 2000 yr older than expected. As suggested by P. R. Giot, should be a utilization of fossil wood from nearby peat bog (Giot, 1968; l'Helgouach, 1966).

Gif-804. Le Calais, Saint-Michel-Chef-Chef, Loire Atlantique **800 ± 100**
A.D. 1150

Charcoal from site with "augets", pottery salt-pan, at Le Calais, Saint-Michel-Chef-Chef (47° 10′ N Lat, 2° 09′ W Long), Loire Atlantique (Gouletquer *et al.*, 1968). Coll. by M. Tessier and subm. 1967 by P. L. Gouletquer. *Comment*: expected date: 100 B.C. (Giot, 1968).

Gif-803. Kerlavos, Trégastel, Côtes du Nord **1500 ± 100**
A.D. 450

Charcoal from Hearth 3 in remains of brickworks, from salt industry site, at Kerlavos, Trégastel (48° 48′ N Lat, 3° 32′ W Long), Côtes du Nord (Giot, 1965). Coll. and subm. 1967 by P. R. Giot. *Comment*: much later than assoc. ceramics (Giot, 1968).

Gif-747. Miniou Bonen, Côtes du Nord **2200 ± 105**
250 B.C.

Charcoal from Iron age surface site at Miniou Bonen (40° 12′ N Lat, 3° 15′ W Long). Coll. and subm. 1966 by P. R. Giot (Le Provost and Giot, 1966; Giot, 1968). *Comment*: assoc. with decorated ceramics of La Tène I type. Agrees well with expected age.

Gif-808. Grohan, Quessoy, Côtes du Nord **2290 ± 100**
340 B.C.

Charcoal from Iron age souterrain, Grohan, Quessoy (48° 22′ N Lat, 2° 41′ W Long), Côtes du Nord (Guyader, 1969). Coll. by Y.

Guyader and subm. 1967 by P. R. Giot. *Comment*: correct for age of La Tène I (Giot, 1968).

Gif-814. Cre'h-Quillé, Saint-Quay-Perros, Côtes du Nord, E entrance **3760 ± 120 / 1810 B.C.**

Charcoal from blocking of E entrance Crec'h-Quillé grave, Saint-Quay-Perros (48° 47′ N Lat, 3° 23′ W Long), Côtes du Nord (l'Helgouach, 1967). Coll. and subm. 1967 by J. l'Helgouach. *Comment*: to confirm date of Gif-344: 3740 ± 200 (R., 1970, v. 12, p. 430; Giot, 1968).

Gif-813. Ile Geignog, Landela, Finistère **4500 ± 120 / 2550 B.C.**

Charcoal from Dolmen III-E, Ile Geignog, Landela (48° 35′ N Lat, 4° 35′ W Long). Coll. and subm. 1967 by J. l'Helgouach. *Comment*: this passage grave is later addition to Cairn III; date would indicate utilization during Late Neolithic. Cf. Gsy-164 B (Giot, 1968).

Cap d'Erquy series, Côtes du Nord

Cap d'Erquy (48° 39′ N Lat, 2° 27′ W Long), Côtes du Nord, covered by remains of double entrenched camp of Protohistoric age. Under Fossé Catuélan which blocks way to extreme part of Cap, Neolithic industry was found. Fossé de Plaine-Garenne is 450 m E of this 1st entrenchment (Giot and Briard, 1969). Charcoal coll. and subm. 1967, 1968 by P. R. Giot and J. Briard.

Gif-1118. Fossé Catuélan, Erquy **4560 ± 140 / 2610 B.C.**

Comment: dates Neolithic forest clearance.

Gif-1302. Fossé de Plaine-Garenne, Erquy **2270 ± 110 / 320 B.C.**

Comment: Gif-715 (R., 1970, v. 12, p. 432) dates Fossé Catuélan to late Hallstatt age; Fossé de Plaine Garenne has La Tène fortification, with interlaced timber-work.

Gif-1115. Moustérian, Séné, Morbihan **1620 ± 110 / A.D. 330**

Charcoal from Kiln c of salt-pan of sta. of Moustérian, Séné (47° 36′ N Lat, 2° 44′ W Long), Morbihan. Coll. and subm. 1967 by P. L. Gouletquer. *Comment*: confirms too early age: 1495 ± 150 B.P. for charcoal coll. in another kiln of same sta. (Gif-229, R., 1966, v. 8, p. 79). Presence of fragments of vases of "La Tène" period makes these dates inexplicable (Gouletquer *et al.*, 1968; Giot, 1969; Gouletquer, 1970).

Gif-863. Saint-Fiacre, Melrand, Morbihan **3900 ± 135 / 1950 B.C.**

Wood from box of Early Bronze age barrow, Saint-Fiacre, Melrand (47° 58′ N Lat, 3° 07′ W Long), Morbihan. Coll. 1897 by Aveneau de la Grancière and subm. 1967 by H. J. Case, Dept. of Antiquities, Ashmolean Mus., Oxford. *Comment*: in Ashmolean Mus. Colln. since 1925. Compares well with Gif-805 (Giot, 1969).

Gif-458. Le Breuil-sous-Argenton, Deux-Sèvres **1260 ± 100 A.D. 690**

Charcoal from moat at Le Breuil-sous-Argenton, Deux-Sèvres (46° 59′ N Lat, 0° 27′ W Long). Coll. and subm. 1965 by M. Berthod, Paris. *Comment*: too old for feudal moat; charcoal probably dates earlier construction, on same site.

Gif-1119. Jard-sur-Mer, Vendée **3300 ± 120 1350 B.C.**

Charcoal from Late Neolithic barrow of Plage de Légère, Jard-sur-Mer (46° 25′ N Lat, 1° 35′ W Long). Coll. and subm. 1967 by J. Joussaume, Inst. Paleontol. Humaine, Paris. *Comment*: because of assoc. Beaker pottery, somewhat earlier date was expected (Joussaume, 1968; Giot, 1969).

Gif-802. "Moulin du Fâ", Barzan, Charente Maritime **2670 ± 110 720 B.C.**

Charcoal from Layer 0 under Gallo-Roman sta. of "Moulin du Fâ", Barzan (45° 32′ N Lat, 0° 53′ W Long). Coll. and subm. 1967 by J. P. Mohen, Merignac, Dordogne. *Comment*: important ceramics from La Tène I and Hallstatt epochs assoc. Date corresponds with Hallstatt occupation.

Gif-724. Cave of Rancogne, Charente **3150 ± 110 1200 B.C.**

Charcoal A found in clay deposit on walls of a well in cave of Rancogne (45° 41′ N Lat, 0° 24′ E Long), Charente. Coll. 1964 and subm. 1966 by C. Burnez, Gensac-La-Pallue, Charente. *Comment*: dates important Urnfield site, Stage II-III.

Gif-725. La Croix des Sables, Mainxe, Charente **2370 ± 110 420 B.C.**

Charcoal in ditch around settlement site, 1.50 m depth, under refuse deposit with bones, ceramics, and abundant charcoal at La Croix des Sables (45° 38′ N Lat, 0° 11′ W Long), Charente. Coll. 1963 and subm. 1966 by C. Burnez. *Comment*: dates a La Tène site.

2. S. W. France

Roanne series, Villegouge, Gironde

Charcoal from Neolithic sta. of Roanne, Villegouge (44° 57′ N Lat, 0° 22′ W Long), Gironde. Coll. and subm. 1967 by A. Coffyn, Bordeaux.

Gif-782. Roanne F 3, 1961 **3850 ± 135 1900 B.C.**

From hearth found in a pit.

Gif-783. Roanne 1963 **3700 ± 135 1750 B.C.**

In 5 cm charcoal layer, under 1.70 m stratified levels.

4280 ± 140

Gif-784. Roanne 1966 **2330 B.C.**

From same level.

General Comment: according to assoc. ceramics, belongs to Peu-Richard culture defined in Charente, but lithic industry is slightly different. Some hundred yr younger than other dates from Charente (Gsy-32, -71: R., 1966, v. 8, p. 131-132; Gif-474, -475, -313, and -417: R., 1970, v. 12, p. 435).

Auterive series, Haute Garonne

Carbonized wood from Roman site, at Auterive (43° 20′ N Lat, 1° 28′ E Long) Haute Garonne. Coll. and subm. 1966 by L. Latour, Auterive.

1920 ± 110

Gif-757. Auterive II **A.D. 30**

Upper level.

2610 ± 110

Gif-756. Auterive I **660 B.C.**

Deepest level.

General Comment: agrees well with Gif-757; but Gif-756 is several hundred yr older than expected.

4970 ± 140

Gif-826. Grotte de Puech Ricard, Aveyron **3020 B.C.**

Carbonized grains in Late Neolithic grave from grotte de Puech Ricard, la Bastide-Pradines (44° 01′ N Lat, 3° 04′ E Long), Aveyron. Coll. and subm. 1967 by A. Soutou, Toulouse. *Comment*: cf. results obtained for grotte of Sargel, near Puech-Ricard (Gif-444, -445: 4500 and 4570 B.P., R., 1970, v. 12, p. 423).

2375 ± 110

Gif-827. Puech de Mus, Aveyron **425 B.C.**

Charcoal from carbonized cinders from Iron age rampart of wall of Puech de Mus, Sainte-Eulalie de Cernon (43° 59′ N Lat, 3° 08′ E Long), Aveyron. Coll. and subm. by A. Soutou, Toulouse. *Comment*: in good agreement with expected age.

780 ± 90

Gif-773. Saint-Pardoux-Le-Neuf, Haute Corrèze **A.D. 1170**

Charcoal from medieval hypogeum, Saint-Pardoux-Le-Neuf (45° 37′ N Lat, 2° 20′ E Long), Corrèze. Coll. and subm. 1966 by R. Joudoux, Tulle. *Comment*: in expected date range.

3. S. E., S., and Central France

1720 ± 110

Gif-759. Roc de Las Caichos, Roquefère, Aude **A.D. 230**

Charcoal from filling of cist in a dolmen, Sepulcher III, Roc de Las Caichos, Roquefère, Aude (43° 22′ N Lat, 2° 21′ E Long). Coll. and subm. 1966 by J. Guilaine, Carcassonne, Aude. *Comment*: dates re-utilization of this Megalithic monument.

Gif-760. Cave of Chataigniers, Casenove, Vingrau, Mediterranean Pyrénées **3120 ± 120 1170 B.C.**

Charcoal from sepulchral cave of Chataigniers, Casenove, Vingrau (42° 51′ N Lat, 2° 47′ E Long). Coll. by Abbé Abelanet and subm. 1966 by J. Guilaine. *Comment*: assoc. with Early Bronze age industry of W Mediterranean (Guilaine and Abelanet, 1965). Somewhat younger than expected.

Hypogeum of Roaix series, Vaucluse

Charcoal from collective tomb in hypogeum of Roaix (44° 14′ N Lat, 5° 01′ E Long), Vaucluse. Coll. and subm. 1967, 1970 by J. Courtin, C.N.R.S., Marseille.

Gif-857. Roaix, Level 2 **4040 ± 140 2090 B.C.**

Typical Chalcolithic furniture.

Gif-1620. Roaix, Level 5 **4100 ± 140 2150 B.C.**

Basal level.

General Comment: same age for these 2 samples is confirmed by presence of copper pearls in both levels.

Gramari series, Methamis, Vaucluse

Charcoal from Sauveterrian site of Gramari (44° 01′ N Lat, 5° 14′ W Long), Methamis, Vaucluse. Coll. and subm. 1966 by M. Paccard, Velleron, Vaucluse (Paccard, 1966).

Gif-752. Gramari, Level 3 A **7740 ± 190 5790 B.C.**

Industry assoc. with remains of wild horse.

Gif-753. Gramari, Levels 3 B I and 3 B 2 **8000 ± 190 6050 B.C.**

Underlying level 3 A.

Gif-754. Gramari, Level C 4 **9340 ± 220 7390 B.C.**

Upper level of Layer C.

Gif-755. Gramari, Level C 5 **10,070 ± 230 8120 B.C.**

The deepest level, the last one with charcoal.

General Comment (M.C.): do not agree with archaeology: Levels 3 A and 3 B are not within conventional limits of classical Sauveterrian, and Level C 4, which comes from a level above the others, is older. Many questions seem to remain about this site.

Gif-867. Grotte Murée, Gorges du Verdon, Basses Alpes **4740 ± 140 2790 B.C.**

Charcoal from Layer 10, Grotte Murée, Gorges du Verdon, Montpezat (43° 45′ N Lat, 6° 15′ E Long) (Courtin, 1963). Coll. and subm.

1967 by J. Courtin. *Comment*: dates this layer to Middle Neolithic, as expected from archaeology.

Stantare series, Sartène, Corsica

Charcoal from bottom of 5th monolith of Alignment I of Stantare (41° 31′ N Lat, 8° 53′ E Long), Plateau of Cauria, Sartène, Corsica. Coll. and subm. 1968 by R. Grosjean, C.N.R.S., Paris.

Gif-1397. Stantare, Corsica 5-1968 — **2120 ± 110** / **170 B.C.**
30 cm depth.

Gif-1396. Stantare, Corsica 4-1968 — **2950 ± 110** / **1000 B.C.**

General Comment: Gif-1396 agrees very well with archaeologic expectation, but Gif-1397 is too young.

Bonifacio series, Corsica

Charcoal from hearths in well-defined levels, from surface to 1.30 m depth, in upper part of filling of Araguina rock shelter, at Bonifacio (41° 22′ N Lat, 9° 10′ E Long). Coll. and subm. by R. Grosjean.

Gif-776. Bonifacio, Corsica 1, 1966 — **3040 ± 110** / **1090 B.C.**
Level VI a, Area A 6, A 7, B 7.

Gif-777. Bonifacio, Corsica 2, 1966 — **3300 ± 120** / **1350 B.C.**
Level VI d, Area A 6.

Gif-778. Bonifacio, Corsica 3, 1966 — **3550 ± 120** / **1600 B.C.**
Level VI f, Area A 7, B 7, B 8.

Gif-779. Bonifacio, Corsica 4, 1966 — **3980 ± 140** / **2030 B.C.**
Level VI, Hearth F 3.

General Comment: dates last occupation of site and end of importation of obsidian from Sardinia (Gif-778).

Castello d'Araggio series, Lévie, Sartène, Corsica

Charcoal from a Torre monument, Castello d'Araggio (41° 38′ N Lat, 9° 15′ E Long), San-Gavino di Carbini, Lévie, Sartène, Corsica. Coll. and subm. 1967 by R. Grosjean.

Gif-898. Castello d'Araggio, C-Ar-2 — **2500 ± 110** / **550 B.C.**
On Hearth A, N room.

Gif-899. Castello d'Araggio, C-Ar-3 — **2890 ± 110** / **940 B.C.**
Central Hearth, upper circular E room.

Gif-1000. Castello d'Araggio, C-Ar-4 — **5130 ± 130** / **3180 B.C.**

Central Hearth, S guard room. *Comment*: was supposed to be similar either to Gif-898 or -899.

Gif-1001. Castello d'Araggio, C-Ar-1 — **2930 ± 120** / **980 B.C.**

Under Hearth A, N room.

General Comment: except for Gif-1000, results agree well with ages already obtained for Torre cult monuments in Corsica.

Curacchiaghiu series, Lévie, Corsica

Charcoal from sepulchral cave, Curacchiaghiu (41° 42′ N Lat, 9° 8′ E Long), Levie, Corsica. Coll. and subm. 1966 by R. Grosjean.

Gif-796. Curacchiaghiu, Corsica 6 — **7300 ± 160** / **5350 B.C.**

Level 5, 80 cm depth.

Gif-795. Curacchiaghiu, Corsica 5 — **8560 ± 170** / **6610 B.C.**

Level 5, 117 cm depth.

General Comment: dates arrival, maybe from N Africa, of a Neolithic culture with obsidian lithic industry and stamped and dotted ceramics (de Lanfranchi, 1967). Gives early date for apparition of ceramic in W Mediterranean.

Chaume de Montforgeon series, Courcelles-Fremoy, Côte d'Or

Charcoal from cinders and remains from ancient forge, at Chaume de Montforgeon, Courcelles-Fremoy (47° 26′ N Lat, 4° 10′ E Long). Coll. by C. de la Roncière and subm. 1966 by A. Marelle, Fac. des Lettres et Sci. Humaines, Dakar.

Gif-734. Chaume de Montforgeon, No. 1 — **830 ± 90** / **A.D. 1120**

40 to 80 cm depth.

Gif-735. Chaume de Montforgeon, No. 2 — **670 ± 90** / **A.D. 1280**

80 cm to 1 m depth.

General Comment: the 2 samples probably date same level.

Chaume-les-Baigneux series, Côte d'Or

Charcoal, in a barrow, at Chaume-les-Baigneux (47° 38′ N Lat, 4° 34′ E Long), Côte d'Or. Coll. and subm. 1966 by R. Ratel, Fac. Sci., Dijon, Côte d'Or.

Gif-786. Chaume-les-Baigneux 1 — **2710 ± 110** / **760 B.C.**

From a hearth.

2500 ± 110

Gif-1109. Chaume-les-Baigneux 2 **550 B.C.**

Charcoal from incineration.

General Comment: no archaeologic clue to date barrow. Belongs to Late Bronze age—Iron age limit.

1670 ± 100

Gif-789. Minot, Côte d'Or **A.D. 280**

Carbonized wood from Gallo-Roman villa, Ferme de Busserolles, Minot (47° 39′ N Lat, 4° 54′ E Long), Côtes d'Or. Coll. by R. Ratel and subm. 1967 by A. Joly, Circonscription des Antiquités Préhistoriques de Dijon. *Comment*: sample very well dated by archaeology at ca. 200 A.D. and used for calibration.

Bressey series, Côte d'Or

Different samples coll. at Bressey (47° 18′ N Lat, 5° 11′ E Long), Côte d'Or and subm. 1966, 1967 by R. Ratel.

2080 ± 100

Gif-727. Sablière de Bressey, 1 **130 B.C.**

Charcoal from refuse pit in Sablière de Bressey. *Comment*: assoc. ceramics typically from Hallstatt age. Too young.

2000 ± 100

Gif-1090. Ferme de Clair Bois, Bressey **50 B.C.**

Charcoal from incineration in barrow from Late Hallstatt, Ferme de Clair Bois, Bressey. *Comment*: confirms Gif-727 which dates a refuse pit situated some hundred m from barrow.

10,200 ± 230

Gif-788. Sablière de Bressey, 2 **8250 B.C.**

Wood from trunk of *Pinus sylvestris*, 3.50 m in sand, at la Sablière de Bressey. *Comment*: tree from same stratigraphic position as Sablière of Couternon, very close by, dated 9440 B.P. (Gif-341, R., 1966, v. 8, p. 89).

5250 ± 100

Gif-785. Neuvy-en-Dunois 66, Eure et Loir **3300 B.C.**

Carbonized human bones of 4 skeletons from collective sepulcher found in pit, covered by stones, at Neuvy-en-Dunois (48° 12′ N Lat, 1° 33′ E Long) (Masset, 1968). Coll. and subm. 1966 by C. Masset, Paris. *Comment*: agrees with numerous dates already obtained in Brittany for collective sepulchers.

Chaussée Tirancourt series, Somme

Charcoal from rehandled part of large gallery grave containing remains of ca. 300 skeletons, La Chaussée Tirancourt (49° 58′ N Lat, 2° 10′ E Long), Somme. Coll. and subm. 1968 by C. Masset. Sepulcher archaeologically dated from Chalcolithic age. Later on, large blocks of sandstone covering sepulcher were quarried away.

3350 ± 120

Gif-1289. La Chaussée Tirancourt, No. 1 **1400 B.C.**

Gif-1372. La Chaussée Tirancourt, No. 3 **3700 ± 120**
1750 B.C.

Gif-1378. La Chaussée Tirancourt, No. 4 **3650 ± 120**
1700 B.C.

General Comment: this extraction of sandstone began very soon after the sepulcher.

B. Africa

Gif-840. Tisoukai, Tassili n'Ajjer, Sahara **3650 ± 130**
1700 B.C.

Charcoal from refuse layer, with Neolithic implements, potsherds and assoc. with paintings of "Bovidian" period, at Tisoukai (9° 30′ N Lat, 24° 55′ E Long), Tassili n'Ajjer, Sahara. Coll. and subm. 1967 by H. Lhote, Mus. de l'Homme, Paris. *Comment*: youngest date obtained for "Bovidian" period which lasted a few millennia.

Gif-848. Zegag Oued, S Oran **5320 ± 150**
3370 B.C.

Pearls from 9000 ostrich-egg pearls found with 55 Neolithic pots, most undamaged, at Zegag Oued, near Hammaguir, S Oran (30° 49′ N Lat, 2° 55′ W Long). Coll. and subm. 1967 by H. Lhote. *Comment*: correct age for a Neolithic site.

Hassi Messaoud series, E Sahara

Neolithic sites on oil field at Hassi-Messaoud (32° 00′ N Lat, 5° 51′ E Long) E Sahara. Lithic material was studied by H. Brezillon and N. Chavaillon, palynology by F. Beucher. Subm. 1966 by H. Alimen, C.N.R.S., Bellevue.

Gif-731. Hassi Messaoud, "La Touffe", x o **5930 ± 150**
3980 B.C.

Coarse black sand with ash, Level III, 50 cm thick, depth ca. 50 cm. Some gramineae and abundant chenopodiaceae. Presence of fish, batrachia, and fresh-water mollusk indicate proximity of a stretch of water. Neolithic industry and ceramics of Capsian type.

Gif-732. Hassi Messaoud, x 5 **6100 ± 160**
4150 B.C.

Black sand with charcoal and shell fragments, depth: some cm. Same industry as Gif-731.

Gif-733. Hassi Messaoud, o Mn 17 **5490 ± 150**
3540 B.C.

Sandy black ground, 50 cm thick under yellow sand, in a large depression with flat bottom, diam. ca. 1 km; probably an ancient marsh. Ceramic and lithic industry is slightly more recent than for Gif-731 and -732.

General Comment: may be evidence of evolution from Neolithic of Capsian tradition towards pure Saharian Neolithic.

Cave of Bitorri series, Brazzaville, Congo

Samples from Cave of Bitorri, near village of Meya (3° 50′ S Lat, 14° 30′ E Long), 150 km N W of Brazzaville, Congo (Emphoux, 1970). Coll. and subm. 1966 by J. P. Emphoux, O.R.S.T.O.M., Brazzaville.

Gif-459. Cave of Bitorri, 1 **4030 ± 200**
2080 B.C.

Charcoal from Level 17, under 85 cm humic-rich layer with 20 archaeologic levels.

Gif-460. Cave of Bitorri, 2 **3930 ± 200**
1980 B.C.

Shells of gasteropods (kitchen-middens) from Level 14, 70 cm depth. *Comment*: as for Gif-459, presence of chipped flint implements. *General Comment*: dates late "Tshitolian" in Central Africa.

Gif-851. Karkarichinkat, Tilemsi, Mali **3310 ± 110**
1360 B.C.

Human and animal bones from Neolithic site of Karkarichinkat, in Valley of Tilemsi (16° 52′ N Lat, 0° 12′ E Long), 80 km N Gao, Mali. Coll. 1962 by J. Gaussen and subm. 1967 by R. Mauny, Fac. des Lettres et Sci. Humaines, Paris. Karkarichinkat (Mauny, 1955), stretching on some hectares is a site with abundant Neolithic material: axes, heads of arrows, bone tools, ceramics, fauna, etc. (Gaussen and Gaussen, 1960); nearby are very big flint works. *Comment*: Neolithic age lasted till Iron age in W Africa; age is correct (Mauny *et al.*, 1968).

C. Peru

Chilca Canyon series, Peru

Samples from different villages, in upper Chilca Canyon, central coast of Peru. Coll. and subm. 1967 by Frederic Engel, Univ. Nac. Agraria, Lima, Peru (Engel, 1964).

Gif-864. Chilca Canyon, V. 2474 **9700 ± 200**
7750 B.C.

Willow-wood from pillar in a hut, Village 304 (12° 26′ S Lat, 76° 46′ W Long). *Comment*: dates one of most ancient villages of coast of Peru.

Gif-1070. Chilca Canyon, V. 2411 **3210 ± 110**
1260 B.C.

Burnt plant remains from Site 12 B-VII, Village 867 (12° 32′ S Lat, 76° 41′ W Long). *Comment* (F.E.): dates one of large pre-agricultural villages in the "lomas" where food was based on a flora growing from the only atmospheric moisture.

Gif-1071. Chilca Canyon, V. 2417 **1100 ± 100**
A.D. 850

Vegetal debris in Site 12 B-VII, Level I, Village 868 (12° 31′ S Lat, 76° 41′ W Long). *Comment*: important village of maize consumers in gorge presently entirely dried up.

Gif-1072. Chilca Canyon, V. 2444 **2050 ± 110**
100 B.C.

Shells from Site 12 B-VII, Level I, Village 933 (12° 31′ S Lat, 76° 38′ W Long), village of stony houses in the "lomas".

Gif-1296. Chilca Canyon, V. 2415 **6080 ± 150**
4130 B.C.

Carbonized vegetal remains from refuse, ash and shell deposit on Site 12 B-VII, Village 908, Chilca Canyon (12° 28′ S Lat, 76° 46′ W Long), central coast of Peru.

Gif-1297. Chilca Canyon, V. 2532 **1420 ± 100**
A.D. 530

Carbonized vegetal remains from Site 12 B-VII, Village 2050 (12° 29′ S Lat, 76° 40′ W Long), Chilca Canyon, central coast of Peru. Village with semi-subterranean stone houses and store-pits, in the "lomas." *Comment* (F.E.): sample would help date start of potato culture in the village.

Gif-1299. Chilca Canyon, V. 2665 **635 ± 110**
A.D. 1315

Wool cloth, Site 12 B-VII-12, village on left side of Chilca Canyon (12° 29′ S Lat, 76° 43′ W Long). *Comment*: will help date some villages of "Cuculi" phase.

Gif-1298. Bandurria, V. 2664 **470 ± 110**
A.D. 1480

Cotton cloth fragment from corpse buried at 1 m depth under refuse deposit, Site 12 B-VII-61, village of Bandurria (12° 30′ S Lat, 76° 46′ W Long). Coll. and subm. 1967 by F. Engel.

Chavin de Huantar series

Carbonized vegetal remains from Chavin de Huantar complex (9° 35′ S Lat, 77° 10′ W Long), alt 3200 m, Peru. In this monument, signs of a new culture that arrived ca. 1600 B.C. in Peru, were defined and called "Chavin" culture. Coll. and subm. 1967 by F. Engel.

Gif-1077. Chavin de Huantar, V. 2481 **2370 ± 100**
420 B.C.

Site 8 D-X-I, Level 3, in stairs leading to Great Temple. Coll. by L. G. Lumbreras.

Gif-1078. Chavin de Huantar, V. 2482 **2730 ± 110**
780 B.C.

Site 8 D-X-I, Level 3, in so-called "gallery of offerings"; assoc. with ceramics. Coll. by F. Caycho.

Gif-1079. Chavin de Huantar, V. 2483 **2100 ± 100**
150 B.C.

Site 8 D-X-I, Level 5, in atrium of temple, covered by alluvia. Coll. by L. G. Lumbreras. *Comment*: dates reoccupation of site, just after departure of its builders.

3845 ± 200
Gif-707. Bay of Paracas, V. 2335 **1895 B.C.**

Human excrement from refuse deposit in a pit, covered by eolian sand, Site 14 A-VI-96, near Bay of Paracas, 265 km S of Lima (13° 51′ S Lat, 76° 15′ W Long). Alt. +6 m. Coll. and subm. 1966 by F. Engel. *Comment*: corresponds to Late Preceramic period with cotton, in middle S coast of Peru.

4120 ± 200
Gif-708. S of Lima, V. 2336 **2170 B.C.**

Human excrement from Site 12 B-VII, Village 613, 58 km S of Lima (12° 25′ S Lat, 76° 45′ W Long), alt 200 m. Found on ground of a "kiwa", an oval stony construction, half underground with 2 steps. Coll. and subm. 1966 by F. Engel. *Comment*: corresponds to last occupation of site during Preceramic period.

4735 ± 140
Gif-770. Perro Perdido, Supe Valley, V. 1654 **2785 B.C.**

Charcoal from Site 10 A-VIII, II, Perro Perdido, Aspera peninsula, Supe valley (10° 49′ S Lat, 77° 45′ W Long), central coast of Peru. Coll. and subm. 1966 by F. Engel. *Comment*: preceramic site with cotton.

2370 ± 100
Gif-771. Bermejo, V. 1656 **420 B.C.**

Cloth from Site 10 A-I-20 (I) I-2, at Bermejo (10° 34′ S Lat, 77° 55′ W Long), Peru. Coll. and subm. 1966 by F. Engel. *Comment*: dates reutilization of a preceramic site during Chavin period.

5175 ± 200
Gif-772. Paracas, V. 2450 **3225 B.C.**

Feathers found on corpse, in a grave, Site 14 A-VI, Village 96, Paracas Peninsula (13° 51 S Lat, 76° 15′ W Long), S coast of Peru. Coll. and subm. 1966 by F. Engel.

400 ± 90
Gif-1073. Quallikani, Puno, V. 2458 **A.D. 1550**

Straw used to temper raw bricks, in a funeral tower, Site 171-XI-2, Level I, Quallikani, Puno (16° 13′ S Lat, 19° 54′ W Long), alt 4000 m. Coll. and subm. 1967 by F. Engel.

2890 ± 110
Gif-1074. Cave of Jankulloni, Puno, V. 2461 **940 B.C.**

Carbonized plants from cave of Jankulloni, Site 18 F-II-I, Level 3 (16° 29′ S Lat, 69° 22′ W Long), Pisacoma dist., Puno, alt 4000 m. Coll. and subm. 1967 by F. Engel. *Comment*: deepest level of site; assoc. with lithic industry.

2700 ± 110
Gif-1076. Kampa, Puno, V. 2466 **750 B.C.**

Burnt plants from Rock-shelter I of Kampa, Site 171-XI-I, Level 2, (16° 45′ S Lat, 69° 59′ W Long), Pisacoma dist., Puno, alt 4100 m.

Coll. and subm. 1967 by F. Engel. *Comment*: dates occupational period of shelter with walls decorated by paintings.

D. Miscellaneous Countries

Gif-1247. Arta, Majorca, Balearic Is., M.A.J. S.P. **2900 ± 110 / 950 B.C.**

Charcoal from burning level, 90 cm depth, from House 12, Arta (39° 41′ N Lat, 3° 21′ E Long). Coll. by G. Lilliu and subm. 1968 by R. Grosjean. *Comment*: interesting for chronologic comparison between similar civilizations: Talyotic in Balearic Is., Nuragic in Sardinia and Torre civilizations in Corsica.

Mallia series, Kriti

Charcoal from Mallia (37° 17′ N Lat, 25° 27′ E Long, Kriti.

Gif-447. Mallia 1 **3800 ± 200 / 1850 B.C.**

Charcoal 70 cm depth in well-sealed layer between stucco ground and close course of bricks. Coll. and subm. 1966 by J. C. Poursat, Ecole Française d'Athènes.

Gif-448. Mallia 2 **3905 ± 200 / 1955 B.C.**

Carbonized wood, 80 cm depth, in destruction layer. Coll. and subm. 1966 by J. C. Poursat.

Gif-449. Mallia 3 **3420 ± 200 / 1470 B.C.**

Charcoal, 80 cm depth, at surface of thick layer of potsherds. Coll. and subm. 1966 by J. C. Poursat. *Comment*: date is too young.

Gif-874. Mallia 4 **3350 ± 120 / 1400 B.C.**

Charcoal, 2.80 m depth. Coll. and subm. 1967 by J. C. Poursat.

Gif-875. Mallia 5 **3780 ± 130 / 1830 B.C.**

Carbonized wood from a cypress pillar, 90 cm depth, same house as Mallia 4. Coll. and subm. 1967 by J. C. Poursat.

Gif-1277. Mallia 7 **3380 ± 110 / 1430 B.C.**

Charcoal from destruction layer of the "Petit Palais," 0.50 to 1 m depth, 1 m thick. Coll. and subm. 1968 by O. Pelon, Ecole Française d'Athènes.

Gif-1279. Mallia 6 **3410 ± 110 / 1460 B.C.**

Charcoal, 1 m depth, under a close course of bricks. Coll. and subm. 1968 by J. G. Poursat.

3100 ± 110
Gif-1521. Mallia 8 **1150 B.C.**

Charcoal, from destruction layer of the "Petit Palais." Coll. and subm. 1968 by O. Pelon.

Mari series, Moyen Euphrate

Samples from palaces of Mari, in Mesopotamia (34° 29′ N Lat, 40° 56′ E Long). Archaeologically well situated in 1st half of 3rd millennium B.C. Coll. 1965 and subm. 1966 by A. Parrot, Archaeol. Mission in Mari.

4100 ± 150
Gif-496. Mari 1 **2150 B.C.**

Fragment of wood from beams of presargonic palace in Mari.

4075 ± 150
Gif-497. Mari 2 **2125 B.C.**

Similar to Gif-496.

4040 ± 150
Gif-498. Mari 3 **2090 B.C.**

Similar to Gif-496.

4000 ± 150
Gif-721. Mari 6 **2050 B.C.**

Fragment of wood from beams from podium of presargonic palace in Mari.

3820 ± 120
Gif-722. Mari 4 **1870 B.C.**

Carbonized wood in central Jar I, Rm. 219, palace in Mari.

3720 ± 150
Gif-723. Mari 5 **1770 B.C.**

Carbonized wood and corns in central Jar 2, Rm. 219, palace in Mari.

General Comment: chronology places level dated by Gif-496, -498 and Gif-727 between 2700 and 2400 B.C. C^{14} dates are at least 400 yr too young. But Gif-722 and -723 come from a palace burnt very probably in 1760 B.C.; C^{14} dates are, thus, very coherent with archaeologic data.

II. GEOLOGIC AND PALYNOLOGIC SAMPLES

A. France

1. W. France

Gif-709. Plage de Corréjou, Plouguerneau, Finistère **935 ± 100** **A.D. 1015**

Peat under sand hill, on beach of Corréjou, Plouguerneau (48° 38′ N Lat, 4° 30′ W Long). Coll. and subm. 1966 by M. T. Morzadec, Lab. Geol. Fac. Sci., Rennes. *Comment*: disagreement with pollen analysis; contaminated by rootlets of present vegetation; base level of the peat bog, 1 m deeper, was found 4250 yr old (Gif-282, R., 1966, v. 8, p. 78; Morzadec, 1969).

Gif-712. Lampaul-Plouarzel, Finistère **3020 ± 110**
1070 B.C.

Salt marsh peat from base level of peat bog under sand hill, Plouarzel (48° 28′ N Lat, 4° 46′ W Long), Finistère, 3.50 m above mean sea level. Coll. and subm. 1966 by M. T. Morzadec. *Comment*: Pollen Zone: VII b—VIII transition. Presence of hystrichospheres, at base level only, indicates site was close to seashore, at that time.

Gif-713. Le Scluz, Brignogan, Finistère **1260 ± 100**
A.D. 690

Submerged peat bog on strand, Le Scluz, Brignogan (48° 41′ N Lat, 4° 20′ W Long) 2.50 m above mean sea level. Coll. and subm. by M. T. Morzadec. *Comment*: Pollen Zone VII b; certainly contaminated.

Gif-714. Trezien, Plouarzel, Finistère **3660 ± 115**
1710 B.C.

Fresh water peat, on shore, Trezien, Plouarzel (48° 26′ N Lat, 4° 47′ W Long), Finistère. Coll. and subm. 1966 by M. T. Morzadec; 1.50 m above mean sea level. Pollen Zone: VII b.

Gif-818. Santec, Finistère **2330 ± 105**
380 B.C.

Salty peat, ca. 2 m above m.s. l, on shore of Santec, N part (48° 43′ N Lat, 4° 02′ W Long), Finistère. Coll. and subm. 1967 by M. T. Morzadec. *Comment*: pollen analysis: Sub-Atlantic, Zone VIII.

Landunvez series, Finistère

Salty peat bog on shore, Gwen-Trez, Landunvez (48° 32′ N Lat, 4° 48′ W Long), N Argenton, Finistère. Coll. and subm. 1967 by M. T. Morzadec.

Gif-815. Landunvez 1 **3620 ± 125**
1670 B.C.

Ca. m.s.l. *Comment*: pollen analysis: Sub-Boreal—Sub-Atlantic transition, VII b—VIII, or just under.

Gif-816. Landunvez 2 **3970 ± 125**
2020 B.C.

0.50 m under m.s.l. Zone VII b.

Gif-817. Landunvez 3 **2180 ± 105**
230 B.C.

4 m above m.s.l. *Comment*: pollen zone: Sub-Atlantic. Zone VIII.

Ploulec'h series, Côtes du Nord

Peat dredged in estuary of Lannion R., Ploulec'h (48° 44′ N Lat, 3° 32′ W Long), Côtes du Nord. Coll. and subm. 1967 by P. R. Giot and M. T. Morzadec.

Gif-819. Ploulec'h 1 **3075 ± 110**
1125 B.C.

Comment: 2 swords were dredged at this place which corresponds to an ancient ford.

1600 ± 105

Gif-820. Ploulec'h 2 **A.D. 350**

Comment: many Roman antiquities are found in this ancient river bed.

General Comment: agree well with archaeologic frequentation of the site. Both Zone VIII, Sub-Atlantic.

Porsguen series, Plouescat, Finistère

Submerged peat bog on strand, Porsguen Beach, Plouescat (48° 41′ N Lat, 4° 13′ W Long), Finistère. Coll. and subm. 1966 by M. T. Morzadec. Pollen Zone: VIIa-VIIb.

3390 ± 120

Gif-710. Porsguen, Plouescat 1 **1440 B.C.**

Peaty silt, +2.50 m bovea m.s.l. *Comment*: many sherds of Bronze age pottery were found in this level. Transition Zone VIIb-VIII.

4120 ± 140

Gif-711. Porsguen, Plouescat 2 **2170 B.C.**

Wood and charred wood from peaty level, +2.00 m above m.s.l. *Comment*: presence of hystrichospheres. Zone VIIb.

1100 ±90

Gif-891. Pointe de la Torche, Plomeur, Finistère **A.D. 850**

Shells in sandy layer, with gravel, ca. +2 m above sea level, at Pointe de la Torche, Plomeur (44° 31′ N Lat, 4° 22′ W Long), Finistère. Coll. and subm. 1967 by P. R. Giot and A. Guilcher, Fac. des Lettres, Brest. *Comment*: a 1st sample from another level at another point was dated in 1963, 580 B.P. (Gif-238, R., 1966, v. 8, p. 77). Both corroborate existence of very recent sea levels at this place, as expected.

2670 ± 110

Gif-1100. La Torche, Plomeur, Finistère **720 B.C.**

Debris of shells from a lumachelle, 1 m thick, on strand, at low tide sea level, N La Torche, Baie d'Audierne (47° 32′ N Lat, 4° 22′ W Long). Coll. and subm. 1967 by A. Guilcher and P. R. Giot.

10,200 ± 230

Gif-850. Off S. Pointe de Penmarc'h **8250 B.C.**

Shells (*Cyprina Islandica*) dredged in place, between 110 and 120 cm depth, in muddy sediments called "La Grande Vasière", on continental shelf, 45 km off S. Pointe de Penmarc'h (47° 20′ N Lat, 4° 32′ W Long). Coll. and subm. by M. Glemarec, Fac. Sci., Brest. *Comment*: this shell species, at present, occurs only N of 52° N Lat; its presence confirms cold water, S of Bretagne 10,000 yr ago (Glemarec, 1969).

6350 ± 160

Gif-849. Off estuary of Loire **4400 B.C.**

Shells (*Glycymeris*) dredged at 40 m depth, in Atlantic Ocean, off estuary of Loire (47° 00′ N Lat, 2° 40′ W Long). Lying on surface sediment, probably not *in situ*. Coll. and subm. 1967 by M. Glemarec. *Com-*

ment: expected to prove fossil species; different varieties of *Glycymeris,* both fossil and living, were found later on this part of continental shelf.

Gif-876. Loire estuary **4300 ± 140 2350 B.C.**

Wood from a big trunk, 12 to 16 m depth, from bank of Loire, at Nantes (47° 14′ N Lat, 1° 35′ W Long). Subm. 1967 by F. Ottman, Fac. Sci., Nantes. *Comment*: rate of sedimentation in Loire estuary calculated 3 to 4 mm/yr, coherent with other estimates.

Gif-839. Saint-Lumine de Coutais, Loire Atlantique **3970 ± 140 2020 B.C.**

Peat, in a drowned peat bog, 125 to 137 cm depth, at Saint-Lumine de Coutais (47° 04′ N Lat, 3° 02′ W Long). Coll. 1966 and subm. 1967 by N. Planchais. *Comment*: subm. because of abundance of vine pollen at this level, but systematic pollen analysis in region also indicated important mixing of sediments, probably due to a tide-race which devastated country at end of 6th century.

Asnelles series, Calvados

Three borings were made in Quaternary formations, along the coast, at Asnelles, (49° 20′ N Lat, 0° 34′ W Long), Calvados. The 1st one, on the strand, the 2nd, at the top of the beach, 130 m from the 1st and, the 3rd in the marsh behind shoestring sands, ca. 70 m SE of the preceding one. At the bottom, is sandy gravel, becoming finer and then silty with organic remains; peat overlies silty sand. On the top, in Borings 2 and 3, are either brackish or marine sediments, which are probably eroded in Boring 1. Alt of borings relative to m.s.l. is +0.3 m for Boring 1, +2.65 m for Boring 2, and + 3.20 m for Boring 3. Peat or peaty silt were coll. and subm. 1967, 1968 by C. Larsonneur, Fac. Sci., Caen, Calvados. Palynologic study was done by H. Elhai. Depths are given from top of the core.

Gif-1009. Asnelles, Boring 1, As 9 **7000 ± 170 5050 B.C.**

78 cm depth. *Comment*: intercalated level between As 2: 5680 ± 250 and As 13: 8320 ± 200 (R., 1969, v. 11, p. 329).

Gif-1012. Asnelles, Boring 1, As 23 **11,450 ± 270 9500 B.C.**

210 cm depth, base level of peat bog. *Comment*: according to pollen analysis, would correspond to Alleröd.

Gif-1013. Asnelles, Boring 2, As 34 **3950 ± 140 2000 B.C.**

83 cm depth.

Gif-1014. Asnelles, Boring 2, As 36 **5650 ± 150 3700 B.C.**

105 cm depth.

Gif-1015. Asnelles, Boring 2, As 38 — **7450 ± 150** / **5500 B.C.**
126 cm depth.

Gif-1016. Asnelles, Boring 2, As 39 — **8700 ± 250** / **6750 B.C.**
160 cm depth.

Gif-1017. Asnelles, Boring 2, As 40 — **8600 ± 200** / **6650 B.C.**

Gif-1176. Asnelles, Boring 3, As 51 — **710 ± 95** / **A.D. 1240**
50 cm depth.

Gif-1177. Asnelles, Boring 3, As 53 — **600 ± 95** / **A.D. 1350**
70 cm depth.

Gif-1178. Asnelles, Boring 3, As 56 — **2710 ± 110** / **760 B.C.**
110 cm depth.

Gif-1179. Asnelles, Boring 3, As 58 — **3400 ± 130** / **1450 B.C.**
150 cm depth.

Gif-1180. Asnelles, Boring 3, As 64 — **8700 ± 200** / **6750 B.C.**
200 cm depth.

General Comment: good correlation with pollen analysis for the 3 cores. Peat bog was formed while sea was still very low, hence depths cannot be related to former sea level. It is only during the Sub-Boreal that influence of the sea is seen (presence of Chenopodiaceae); by that time sea level was very near the present.

Peat formation was particularly rapid during the Boreal period (10 cm/100 yr) and from the end of Atlantic to Sub-Boreal period (5700 to 2700 B.P.) (Delibrias *et al.*, 1969).

Cherbourg harbor series, Manche

Submerged peat from borings, off Cherbourg. Subm. 1968 by C. Larsonneur. Depths related to m.s.l.

Gif-1020. Cherbourg, 121 C — **4950 ± 140** / **3000 B.C.**
In Becquet bay (49° 40′ N Lat, 1° 32′ W Long). Depth: 34.60 m. *Comment*: very young for such depth.

Gif-1021. Cherbourg, 128 C — **9470 ± 130** / **7520 B.C.**
In Becquet bay (49° 41′ N Lat, 1° 33′ W Long). Depth: 34.40 m.

Gif-1022. Cherbourg, 215 C — **8200 ± 190** / **6250 B.C.**
In outer roadstead (49° 40′ N Lat, 1° 37′ W Long). Depth: 29.10 m.

Gif-1023. Cherbourg, 235 C **9880 ± 230 / 7930 B.C.**

In outer roadstead (49° 40′ N Lat, 1° 37′ W Long). Depth: 22.90 m. *General Comment*: interesting for studying variations of sea level (Delibrias and Guillier, in press).

Le Havre series, Channel

Peat from sediment cores taken off Le Havre preparatory to construction of a relay-port for super-tankers. Subm. 1966, 1967 by J. P. Michel, Fac. Sci., Paris; P. Larsonneur and M. Guyader, Dir. Autonomous Harbour, Le Havre. Depths related to m.s.l.

Gif-744. Core 289 **9900 ± 300 / 7950 B.C.**

26.75 m (49° 30′ N Lat, 0° 06′ E Long).

Gif-745. Core 287 bis **9730 ± 300 / 7780 B.C.**

27.40 m (49° 30′ N Lat, 0° 06′ E Long).

Gif-746. Core 284 **9340 ± 300 / 7390 B.C.**

27.70 m (49° 30′ N Lat, 0° 06′ E Long).

Gif-1019. Core 9 H **8130 ± 190 / 6180 B.C.**

19.50 m (49° 28′ N Lat, 0° 17′ W Long).

Gif-1238. Core X **8850 ± 200 / 6900 B.C.**

29 m (49° 28′ N Lat, 0° 17′ W Long).

Gif-1401. Core 804 **8250 ± 220 / 6300 B.C.**

21.5 m to 22.7 m (49° 28′ N Lat, 0° 17′ W Long).

General Comment: agrees well with pollen analysis (Michel, 1968). Interesting for studying variation of sea level.

Gif-1067. Saint Sauveur de Pierrepont, Manche **9650 ± 210 / 7700 B.C.**

Mollusk shells, underlying greensand and pebbles, 16.40 m thick, in boring at Saint Sauveur de Pierrepont (48° 37′ N Lat, 1° 36′ W Long), Manche. Ca. —6.40 m related to m.s.l. Coll. and subm. 1967 by C. Pareyn, Fac. Sci., Caen. *Comment*: impossible to interpret shell bed as old beach.

Gif-1110. Mammoth tooth, Channel **19,300 ± 700 / 17,350 B.C.**

Collagen from mammoth tooth from Channel, ca. 60 m depth (50° 27′ N Lat, 0° 25′ W Long), from site of numerous mammoth remains. Subm. 1967 by C. Larsonneur. *Comment*: from same site as Sa-342 (8720 ± 300, R., 1966, v. 8, p. 90), of which total carbon (not only collagen) was extracted for dating.

2. N. and Central France

Marquenterre series, Picardie

Peaty samples from Sec. M 21, in peat bog, at Marquenterre (50° 16′ N Lat, 1° 42′ E Long), in maritime plain of Picardie. Alt +4 m. Coll. and subm. 1967 by P. Lefevre, Stat. d'Agronomie, Amiens. Pollen analysis by N. Planchais.

Gif-841. Marquenterre, 100 cm — **980 ± 100** / **A.D. 970**

Sandy brown peat.

Gif-842. Marquenterre, 440 to 460 cm — **3060 ± 110** / **1110 B.C.**

Brown peat with vegetal remains. Pollen zone: late appearance of *Fagus*; Sub-Atlantic.

Gif-843. Marquenterre, 580 to 600 cm — **5080 ± 140** / **3130 B.C.**

Brown peat, with lighter zones. Pollen zone: Atlantic-Sub-Boreal transition.

Gif-844. Marquenterre, 640 to 660 cm — **5520 ± 150** / **3570 B.C.**

Brown peat with shells of small gastropods.

Gif-845. Marquenterre, 660 to 670 cm — **6450 ± 160** / **4500 B.C.**

Brown peat with sandy appearance. Pollen zone: Atlantic period with *Quercus, Titiolum, Ulmus,* and *Alnus* dominant.
General Comment: dates stages of formation of coastal plain of Picardie.

Gif-836. Mur de Sologne, Loiret — **7800 ± 190** / **5850 B.C.**

Silty peat, level 2.62 to 2.75 m, in peat bog near Mur de Sologne (47° 25′ N Lat, 0° 36′ E Long). Coll. 1966 and subm. 1967 by N. Planchais, Fac. Sci., Montpellier. *Comment*: pollen diagram shows frequencies of *Pinus* and *Betula,* rise of *Corylus,* and beginning of *Ulmus.* Corrects age, which was too young, for Sa-235 (R., 1965, v. 7, p. 241) from same level but probably contaminated. Beginning of Boreal.

Rians series, Cher

Peat from bog, Rians (47° 09′ N Lat, 0° 15′ E Long), Cher. Coll. 1966 and subm. 1967 by N. Planchais.

Gif-837. Rians, 0.70 m depth — **3970 ± 140** / **2020 B.C.**

Pollen zone: *Quercus, Tilia,* just before beginning of *Fagus.* Beginning of Sub-Atlantic.

Gif-838. Rians, 1.10 to 1.40 m — **6630 ± 170** / **4680 B.C.**

Pollen zone: *Quercus* and *Ulmus* abundant, *Tilia* at low frequency and *Fraxinus* at beginning. Indicates Boreal-Atlantic boundary.

Mont de l'Espinouse series, Cévennes

Sphagnum peat bogs, lying on gneiss bedrock, from S limit of Massif Central, in Mont de l'Espinouse, Cévennes. Coll. and subm. 1967 by A. Pons, Fac. Sci., Marseille.

Gif-1101. La Salverguette **850 ± 100** **A.D. 1100**

75 cm depth, (43° 38′ N Lat, 2° 54′ E Long), alt: 1070 m.

Gif-1102. La Salverguette **1140 ± 100** **A.D. 810**

100 cm depth, base level.

Gif-1103. Font-Salesse **350 ± 95** **A.D. 1600**

65 cm depth, base level (43° 36′ N Lat, 2° 58′ E Long), alt: 1060 m.

Gif-1104. Baissescure **6000 ± 150** **4050 B.C.**

140 cm depth, base level with silt, (43° 32′ N Lat, 2° 48′ E Long), alt: 1000 m.

General Comment: except for Gif-1104, which is dated from Boreal, ages found are surprising and tend to cast doubt on accepted inferences from pollen analysis in this region. This is probably due to geography of region, subject both to Mediterranean and Atlantic influences. Pollen study by de Beaulieu (1969).

3. S. E. and S. W. France

Gif-1129. La Flachère, Isère **⩾35,000**

Black lignite with fragments of wood in clay under fluvial facies of alluvia and glacial sand, at La Flachère (45° 24′ N Lat, 5° 58′ E Long), Isère valley. Coll. and subm. 1968 by G. Montjuvent, Fac. Sci., Grenoble. *Comment*: as expected.

Gif-1130. Bruant, Isère **⩾35,000**

Debris of branches in local moraine of Vercors, Bruant (45° 01′ N Lat, 5° 37′ E Long), Isère. Coll. and subm. 1968 by G. Montjuvent. *Comment*: question was whether this moraine was built recently by local glaciers.

Gif-824. Plateau de la Matheysine, Savoie **9830 ± 230** **7880 B.C.**

Submerged peat, from bank of Lac Mort, on Plateau de la Matheysine (45° 02′ N Lat, 5° 47′ E Long), S E Grenoble. Coll. and subm. 1967 by G. Montjuvent. Plateau is a glacial valley, alt: 900 m. During the Würm it was occupied by 2 glacier tongues; the Romanche tongue, at the N, built a series of frontal moraines which now delimit 4 dammed lakes; one is Lac Mort. Age of peat implies that glacier evacuated the valley ca. 10,000 B.P.

3550 ± 130

Gif-825. Trièves, Savoie **1600 B.C.**

Fossil wood in calcareous and marly material transported in a landslide over Würm moraine (44° 47′ N Lat, 5° 44′ E Long). Coll. and subm. 1967 by G. Montjuvent. *Comment*: corrects geologic map on which these sediments were shown as post-Würm alluvium.

Lac de Balcère series, Pyrénées Orientales

Peat from submerged peat bog of Lac de Balcère (42° 35′ N Lat, 2° 03′ E Long), Pyrénées Orientales; alt: 1764 m. Coll. and subm. 1967 by C. Jalut, Lab. de Botanique, Fac. Sci., Toulouse.

3780 ± 135

Gif-1060. Lac de Balcère, Palyn 6 **1730 B.C.**

0.50 m to 0.60 m depth. Pollen analysis: Zone VII b of Sub-Boreal period. *Comment*: too young; superficial levels probably slightly contaminated.

9250 ± 210

Gif-791. Lac de Balcère, Palyn 1 **7300 B.C.**

1.50 m to 1.60 m depth. Pollen analysis: appearance of *Abies*; end of Pre-Boreal period. *Comment*: date in good agreement.

11,240 ± 280

Gif-792. Lac de Balcère, Palyn 2 **9290 B.C.**

2.60 m to 2.70 m depth. Pollen analysis: Zone II of Alleröd. *Comment*: in good agreement.

General Comment: aids study of evolution of flora from Early Dryas to Sub-Atlantic. Alleröd oscillation is shown for 1st time in Pyrénées Orientales (Van Campo and Jalut, 1969).

Mas de la Borde series, Pyrénées Orientales

Peat bog, in Valley of Têt, Mas de la Borde (42° 32′ N Lat, 2° 05′ E Long), alt: 1680 m, Pyrénées Orientales. Coll. and subm. 1967 by G. Jalut.

5380 ± 150

Gif-868. Mas de la Borde, Palyn 3 **3430 B.C.**

0.70 m to 0.80 m depth; from surface to 0.60 m depth, ploughed soil overlies peat bog with sharp contact. Pollen analysis indicates beginning of cultivation.

7500 ± 170

Gif-869. Mas de la Borde, Palyn 4 **5550 B.C.**

2.30 m to 2.40 m depth. Pollen analysis: extension of *Abies*. *Comment*: in good agreement.

8300 ± 190

Gif-870. Mas de la Borde, Palyn 5 **6350 B.C.**

3.50 m to 3.60 m depth.

General Comment: *Abies* is dated here at 7500 B.P. whereas it is dated

at 9250 B.P. at Lac de Balcère; these 2 peat bogs, some km apart, have very different exposures, which can explain age difference.

Gurp series, Médoc

Fossil soils in cliff of Gurp (45° 26′ N Lat, 1° 08′ W Lat), Médoc. Coll. and subm. 1967 by P. Dutil, Sta. Agron., Châlons-sur-Marne.

Gif-1032. Gurp, G. U. Paleosol **3300 ± 120 1350 B.C.**

Black organic horizon, A_0 A_1, of a Podzol under a dune, 150 to 170 cm below top of cliff. *Comment*: iron hardpan was without carbon; age similar to other Podzols in region.

Gif-1105. Gurp, G. U., wood **⩾35,000**

Wood from lignite, from foot of cliff, 340 cm depth, just above blue gray silt. *Comment*: too old to be dated by C^{14}, as expected.

4. Mediterranean

Gif-738. Shoal of Méjean **⩾35,000**

Polyparies, 3.90 m below surface; in sediment core C.A.P.P. 58, at 430 m depth, 12 km S of Lérins Is. (43° 23′ N Lat, 7° 1′ E Long) (Pautot, 1967). Coll. and subm. 1966 by G. Pautot, Sta. de Géodynamique sous-marine, Villefranche-sur-Mer, Alpes Maritimes. *Comment*: agrees with known sedimentation rates in W Mediterranean Sea (Labeyrie *et al.*, 1968).

Gif-829. Little Submarine Canyon of Planier **⩾30,000**

Chlamys septemradiatus, 24 km off Cap Couronne, 170 m depth in the little Canyon of Planier (43° 34′ N Lat, 5° 05′ E Long), Mediterranean. Dredged during Mission Calypso 1966 and subm. 1967 by L. Dangeard, Fac. Sci., Caen. *Comment*: *Chlamys septemradiatus* is characteristic of cold water.

Gif-828. Living Chlamys, Marseille **$\delta C^{14} = +8.4‰$**

Coll. near Marseille, 1967 (43° 05′ N Lat, 5° 06′ E Long).

B. Africa

Tchad series

In low regions of Tchad, between 13th and 17th parallel, 2 litho-stratigraphic units may be distinguished: (1) Soulias series forms sandy bars with layers of clay and marl with Ostracods in interdune depression. (2) Labdé series is lacustrine, clayey and diatomaceous, or calcareous, 10 to 15 m thick, in which 2 lacustrine extensions can be distinguished: l_1 and l_2 (Servant *et al.*, 1969). Samples coll. and subm. 1966-1968 by M. Servant. Office de la Recherche Sci. des Territoires d'Outre Mer (O.R.S.T.O.M.), Fort-Lamy, Tchad.

Gif-799. Amakha, Tchad, S-805 **Modern**

Mollusk shells, 1 km S of well of Amakha (13° 51′ N Lat, 15° 28′ E Long), Tchad, in sandy silt with calcareous concretions, 5 m above

Bahr-el-Ghazal. *Comment*: top of recent alluvium of base of Bahr-el-Ghazal.

140 ± 90

Gif-1096. Nedeley, Tchad, S-1106 A.D. 1810

Pila shells in sandstone at top alluvium of floor of Bahr-el-Ghazal, 1 km E of Nedeley well (15° 36′ N Lat, 18° 09′ E Long), Tchad. *Comment*: base at Bahr-el-Ghazal was marshy at very recent period; assoc. with elephant and hippopotamus.

1750 ± 100

Gif-1099. Kosomanga, Tchad, S-1426 A.D. 200

Bulinus shells in interdune depression at Kosomanga (14° 02′ N Lat, 16° 03′ E Long), Tchad. *Comment*: confirms existence of moist pulsation in Tchad ca. 1800 B.P. Sequence l_2 of Labdé.

1760 ± 105

Gif-798. Well of Salal, Tchad, S-731 A.D. 190

Peaty silt in a well of Salal (14° 50′ N Lat, 17° 13′ E Long), 11.60 m depth at base of lacustrine silt. *Comment*: base of alluvium of Bahr-el-Ghazal.

2450 ± 110

Gif-797. Ebeta, Tchad, S-485 500 B.C.

Tufa with Phragmites from upper part of lacustrine sediment, 1 m thick, in 1 unterdune depression, Ebeta (13° 48′ N Lat, 15° 42′ E Long). *Comment*: dates end of a wet period, 2nd sequence of lacustrine Labdé series, l_2.

2500 ± 110

Gif-1230. Largeau, S Sahara, Tchad, K-339 550 B.C.

Valvata shells at base of thin calcareous diatomic layer, on landing field at Largeau (17° 56′ N Lat, 18° 07′ E Long).

3380 ± 130

Gif-1234. Kichi-Kichi, Tchad, K-289 1430 B.C.

Valvata shells at base of calcareous silt with diatoms, 48 km S E of well of Kichi-Kichi (17° 19′ N Lat, 17° 47′ E Long). *Comment*: agrees well with stratigraphy.

3500 ± 150

Gif-1229. Well of Kelba, Tchad, S-1639 1550 B.C.

Organic remains in sand, 4.75 m depth, in well of Kelba (13° 45′ N Lat, 16° 31′ E Long). Comment: inserted in lacustrine series of Labdé (Sequence l_2); to be related to a regressive phase.

6050 ± 150

Gif-1264. Angamma, Tchad, K-32 4100 B.C.

Nodule of calcareous sandstone, atop a deltaic body at Angamma, 32 km E of Kichi-Kichi, Tibesti (17° 34′ N Lat, 17° 38′ E Long). *Comment*: 2 dates for base of this body: 9260 ± 140 (T-731) and 10,160 ± 160 (T-732) (Servant *et al.*, 1969) show that deltaic series is entirely Holocene, when rivers were flowing and this area was in a pluvial zone.

Gif-1231. Largeau, Tchad, K-354 **7000 ± 170**
5050 B.C.

Diatomaceous limestone, at base of minor diatomaceous sequence, in outcrop 5 km ENE landing field at Largeau (17° 57′ N Lat, 19° 11′ E Long).

Gif-1227. Well of Tjéri, Tchad, S-1608 **8750 ± 200**
6800 B.C.

Organic remains in clayey layer with diatoms, depth 7 m, in well of Tjéri (13° 44′ N Lat, 16° 30′ E Long). *Comment*: belongs to 2nd lacustrine cycle of Labdé series.

Gif-1226. Well of Tjéri, Tchad, S-1604 **9000 ± 200**
7050 B.C.

Organic remains in clayey layer with diatoms, depth 7.75 m, in well of Tjéri. *Comment*: same layer as Gif-1227, slightly deeper.

Gif-1095. Koro-Toro, Tchad, S-1165 **9470 ± 220**
7520 B.C.

Melania shell in outcrop of marly layer above sand, at top of cliff, NNE Koro-Toro (16° 05′ N Lat, 18° 29′ E Long), Bahr-el-Ghazal, Tchad. *Comment*: base of diatomaceous Sequence l_2.

Gif-801. Kamala, Tchad, S-826 **10,100 ± 230**
8150 B.C.

Melania shells, in marly layer, 0.10 m thick in basal lacustrine unit, 10.50 m thick, in wall of a well, Kamala (13° 02′ N Lat, 16° 15′ E Long). *Comment*: dates transgression of ancient lake and belongs to lower part of Sequence l_2.

Gif-1094. Nedeley, Tchad, S-1116 **10,100 ± 230**
8150 B.C.

Vegetal debris in silt under remains of Holocene diatomites in outcrop, 2 km S of well at Nedeley (15° 35′ N Lat, 18° 10′ E Long), Bahr-el-Ghazal, Tchad. *Comment*: base of diatomaceous Sequence l_2.

Gif-1097. Nedeley, Tchad, S-1121 **10,900 ± 300**
8950 B.C.

Clayey limestone with diatoms and impressions of reeds on E flank of Bahr-el-Ghazal valley, Nedeley (15° 35′ N Lat, 18° 08′ E Long), Tchad. Coll. and subm. 1967 by M. Servant. *Comment*: end of the 1st Sequence l_2 of lacustrine Labdé series.

Gif-1233. Kichi-kichi, Tchad, K-294 **11,950 ± 280**
10,000 B.C.

Lacustrine shells in sand intercalated between lacustrine sediment with gravel, 48 km SE of Kichi-Kichi well (17° 19′ N Lat, 17° 47′ E Long). *Comment*: belongs in Sequence l_2.

Gif-847. Djazena, Tchad, S-1055 **12,060 ± 380**
10,110 B.C.

Biomphalaria and *Bulinus* shells in marly layer at base of lacustrine

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sequence, 8.85 m depth in well at Djazena (13° 48′ N Lat, 17° 36′ E Long), Tchad. *Comment*: dates end of Sequence l_2.

21,900 ± 700

Gif-1228. Well of Kelba, Tchad, S-1633 **19,950 B.C.**

Sandy, silty limestone with ostracods between 2 eolian-sand deposits, depth 12.30 m in Kelba well. *Comment*: dates lacustrine unit in Soulias series.

Gif-800. Well of Kamala, Tchad, S-819 **⩾35,000**

Fine limestone from thin calcareous layer in lacustrine sequence between 2 periods of sand reworking; 15.35 m in well of Kamala. *Comment*: upper part of lacustrine unit of Soulias series.
General Comment: 2 lacustrine transgressions were dated in Labdé series; the last one, which corresponds to Sequence l_2, is the longest, characterized by 2 regressive episodes ca. 8500 to 7000 B.P. and 4000 to 3500 B.P. During the 2 last millennia, the lowest regions of Tchad, N of the 16th parallel, connected with Lake Tchad, until 150 B.P.

8220 ± 190

Gif-1028. Chari River, S Lake Tchad, Ref. 23 **6270 B.C.**

Varved silt with vegetal debris, 3 m depth, from left bank of Chari, 65 km SSE Fort-Lamy, S Lake Tchad (11° 34′ N Lat, 15° 17′ E Long). Coll. 1965 and subm. 1967 by B. Dupont, O.R.S.T.O.M., Fort Lamy, Tchad. *Comment*: dates a lacustrine period.

460 ± 95

Gif-1029. Lake Tchad, Ref. 663 **A.D. 1490**

Hardened silt with organic remains, 40 to 50 cm depth in sediments, between lacustrine layers, 2.90 m below surface of Lake Tchad (13° 27′ N Lat, 14° 30′ E Long). Coll. and subm. 1967 by B. Dupont. *Comment*: marks regression of lake; helps to calculate sedimentation rate of 1m/yr (Dupont and Delibrias, 1970).

Sebkha de N'Dramcha series, Mauritania

Shells from coastal Sebkha de N'Dramcha, N of Nouakchott, Mauritania. Stratigraphy of upper Quaternary in region shows 2 marine transgressions separated by a dry period with dune accumulation; last marine episode was followed by evaporation, indicated by a silty-gypsiferous layer. Coll. and subm. 1967 by C. Fontes, Fac. Sci., Paris.

6000 ± 160

Gif-852. Sebkha de N'Dramcha, N. K-171 **4050 B.C.**

Cardium edule, ca. 2 m depth in silty-gypsiferous layer (18° 36′ N Lat, 15° 46′ W Long). *Comment*: dates beginning of evaporation series, following closing of gulf.

6370 ± 160

Gif-853. Sebkha de N'Dramcha, N. K-172 **4420 B.C.**

Shells (*Venus sp.*) of various forms, 90 cm below N.K-171, in quartzose sediment, partly terrigenous (18° 36′ N Lat, 15° 46′ W Long). *Comment*: dates maximum of Nouakchottian transgression.

Gif-856. Sebkha de N'Dramcha, N. K-193 **5900 ± 150 / 3950 B.C.**

Cardium edule, 25 cm below a sandy crust (18° 50′ N Lat, 15° 29′ W Long). *Comment*: occupies a central position related to supposed outlines of Nouakchottian gulf; expected to be much older.

Gif-854. Sebka de N'Dramcha, N. K-191 **⩾35,000**

Arca senilis from lumachelle cropping out from recent formation, NW of Sebkha (18° 55′ N Lat, 15° 23′ W Long). *Comment*: belongs to shell-rich shore of Upper Inchirian.

Gif-855. Sebkha de N'Dramcha, N. K-192 **⩾35,000**

Arca senilis, 30 cm below surface (18° 52′ N Lat, 15° 28′ W Long). *General Comment*: dates determine shorelines corresponding to Nouakchottian and Inchirian extensions of gulf.

Delta of Ogooué series, Gabon

Algae and mollusk shells from calcareous submarine layer, off delta of Ogooué, on continental shelf of Gabon. Coll. by dredging and subm. 1965 by P. Giresse, Fac. Sci., Caen.

Gif-456. Delta of Ogooué, G-600-50 **590 ± 95 / A.D. 1360**

50 to 60 cm depth (0° 23′ S Lat, 8° 55′ E Long).

Gif-457. Delta of Ogooué, G-300-15 **1540 ± 100 / A.D. 410**

10 to 20 m depth (0° 31′ S Lat, 8° 56′ E Long).

General Comment: expected to date an ancient shoreline; but obviously dredged material was not *in situ*.

Gif-871. Terrace of Benoué, N Cameroun **10,160 ± 230 / 8250 B.C.**

Fossil soil from middle terrace of Benoué R., 10 m above floodplain, near confluence of Benoué and Mayr Kebi Rivers (9° 15′ N Lat, 13° 22′ E Long). Coll. and subm. 1967 by G. Sifferman, Lab. de Géol. et Paléontol., Strasbourg. *Comment*: corresponds to moist period already dated in Tchad.

C. South America

Brazil coast series

Series of shells, along Brazilian littoral, from fossil lines of Vermetidae and uplifted reefs, near Recife and Ila Grande, 2000 km apart. Part of study of variations of sea level in the Holocene. Coll. and subm. 1967 by J. Laborel, Fac. Sci., Abidjan.

Gif-1059. Sitio Forte, Ila Grande, J.L. Br-67-1 **3420 ± 110 / 1470 B.C.**

Vermets limestone (23° S Lat, 45° W Long), +2.60 m.

Gif-1060. Sitio Forte, Ila Grande, J.L. Br-67-2 **1670 ± 100 / A.D. 280**

Vermets and Balanes limestone (23° S Lat, 45° W Long), +1.70 m.

Gif-1061. Sitio Forte, Ila Grande, J.L. Br-67-3 **380 ± 90 A.D. 1570**

Vermets limestone (23° S Lat, 45° W Long), ca. +0.50 m.

Gif-1062. Reef of Rio Doce, Olinda, Pernambuco, J.L. Br-67-4 **3100 ± 120 1150 B.C.**

Madreporaire (*Montastrea cavernosa*) (8° S Lat, 37° 10′ W Long), +3 m.

Gif-1066. Reef of Rio Doce, Olinda, Pernambuco, J.L. Br-67-8 **1830 ± 110 A.D. 120**

Madreporaire (*Siderastrea stellata*), (8° S Lat, 37° 10′ W Long), ca. present sea level.

Gif-1063. Reef of Rio Doce, Olinda, Pernambuco, J.L. Br-67-5 **390 ± 90 A.D. 1560**

Melobesiees limestone (8° S Lat, 37° 10′ W Long), ca. +50 cm.

Gif-1064. Lagoa de Itahype, Ilheus, Bahia, J.L. Br-67-6 **4070 ± 140 2120 B.C.**

Madreporaire (*Mussismilia braziliensis*), (14° 30′ S Lat, 39° W Long), ca. present sea level. *Comment*: species not now living in region.

Gif-1065. Ilha de Caieira, Vitoria Bay, Espiritu Santo, J.L. Br-67-7 **5520 ± 150 3570 B.C.**

Mussismilia harttii (20° 10′ S Lat, 40° 15′ W Long). *Comment*: species not now living in this lat.

General Comment: good correlation between dates and levels for these coastal regions of Brazil, 2000 km apart. Confirms existence in Brazil of recent variations of sea level as indicated by Van Andel and Laborel (1964) and studied by Bigarella (1965). Gif-1064 and -1065 date a climatic optimum because of disappearance of species from region.

Sambaqui da Pedra Oca series, Brazil

Shells from Sambaqui da Pedra Oca, Bahia de Todos (12° 51′ S Lat, 38° 31′ W Long), Santos, Brazil (Calderon, 1964). Coll. and subm. 1969 by J. Labeyrie.

Gif-877. Sambaqui da Pedra Oca 1 **2180 ± 110 230 B.C.**

Taken from beach rock under sambaqui, ca. +1 m of present sea level.

Gif-878. Sambaqui da Pedra Oca 2 **2630 ± 110 680 B.C.**

Shell from basal horizon of sambaqui, above beach rock.

General Comment: dates construction of Sambaqui, just after a slight marine transgression.

Rio de la Plata series, Argentina

Marine shells in Rio de la Plata, Argentina, a few km off present littoral, giving ancient position of littoral (Ottman and Urien, 1966). Subm. 1966 by F. Ottman.

3250 ± 110

Gif-736. Rio de la Plata 1 **1300 B.C.**

Shells dredged from black silt under sediment, S Arquimedes bank, (35° 12′ N Lat, 56° 17′ W Long) in lagoon formation, attributed to a slightly regressive episode.

3770 ± 110

Gif-737. Rio de la Plata 2 **1820 B.C.**

Shells from beach ridge farthest inland, a few m above present sea level, Rio de la Plata.

General Comment: no precise indication of alt of samples but in this very flat country, slight variation of sea level can explain penetration of sea a few km inland; Gif-737 may date maximum of a transgression.

D. Miscellaneous Countries

13,500 ± 300

Gif-835. Neutraubling, Bavaria **11,550 B.C.**

Bone, 1.60 m depth in layer of Danube alluvium, 10 m thick, Neutraubling, SE of Regensburg (48° 59′ N Lat, 12° 11′ E Long), Bavaria. Coll. 1962 and subm. 1967 by M. Léger, Inst. de Géog., Paris. *Comment*: date shows upper part of layer belongs to older Dryas and not to end of Würm, as supposed (Léger, 1965). Collagen not extracted for measurement.

2810 ± 150

Gif-780. Aalter, Belgium **860 B.C.**

B_2h horizon of Podzol beneath eolian sand 75 cm thick, Aalter, 20 km NW Gand (50° 50′ N Lat, 3° 29′ E Long), Belgium. Coll. and subm. 1966 by C. Sys, Ruks Univ., Ghent. *Comment*: Roman ceramics overlie the Podzol.

2410 ± 150

Gif-781. Anzegem, Belgium **460 B.C.**

B_2h horizon beneath eolian sands 70 cm thick, Anzegem, 30 km SW Ghent (51° 07′ N Lat, 3° 28′ E Long), Belgium. Coll. and subm. 1966 by C. Sys. *Comment*: like Gif-780, dates overlying sand of sandy region of Flanders.

2150 ± 110

Gif-897. Xivares, Asturias, Spain **200 B.C.**

Shells (*Purpura hoemastoma*), from Xivares beach (43° 34′ N Lat, 2° 02′ W Long), Cabo Penas, Asturias, Spain. Alt +3 m. Coll. and subm. 1967 by G. Mary, Fac. Sci., Univ. Caen. *Comment*: in this region recent crustal movement is not excluded.

14,900 ± 450

Gif-730. S W Madeira Island 12,950 B.C.

Mollusk shells and calcareous algae from shell rocks, 1900 m depth, 15 km off Funchal, SW Madeira (32° 33′ N Lat, 16° 56′ W Long). Coll. 1966 with bucket of Bathyscaphe by C. Pareyn; subm. 1967 by C. Pareyn and L. Dangeard. *Comment*: considered to be of littoral origin. Possibility of rapid subsidence in this volcanic region is not excluded.

Ile Maré series, New Caledonia

Ile Maré, one of Iles Loyauté, is coral atoll (21° 30′ S Lat, 168° E Long). Coral samples coll. at surface, and subm. 1967 by J. P. Chevalier, Inst. de Paléontol., Paris.

Gif-1024. Maré, M.A.-64 ⩾30,000

From reef knoll in lagoon. *Comment*: date is infinite, as expected.

Gif-1025. Maré, M.A.-83 ⩾30,000

From side of La Rocheknoll, on the ring. *Comment*: age expected: Pleistocene.

Gif-1026. Maré, M.A.-133 ⩾30,000

From Terrace 13, alt +4 m related to highest sea level. *Comment*: Holocene expected.

Gif-1027. Maré, M.A.-172 ⩾30,000

From Terrace 14, alt +2 m related to highest sea level. *Comment*: Holocene expected.

General Comment: Maré atoll seems to be recently uplifted ancient atoll, because most dated Pacific atolls have surface ages of 3000 to 5000 yr.

Gif-892. Motu Manu, Atoll de Mapelia, French Polynesia, No. 505 3450 ± 130 1500 B.C.

Calcareous coral, at Motu Manu, Atoll de Mapelia (16° 47′ S Lat, 153° 59′ W Long), alt +1 m. Coll. and subm. 1967 by A. Guilcher. *Comment*: confirms existence of higher recent sea level, in Pacific, as shown at Mururoa atoll by the authors (R., 1969, v. 11, p. 337-338) and by Thurber *et al.* (1965).

Gif-893. Motu Mote, Bora-Bora, French Polynesia, No. 581 2250 ± 130 300 B.C.

Calcareous coral from E passage Motu Mote, Barrier of Bora-Bora, French Polynesia (16° 27′ S Lat, 151° 45′ W Long). Coll. and subm. 1967 by A. Guilcher. *Comment*: same as for Gif-892.

Gif-823. Tapao, Phum Chhuk, Wompong Cham, Cambodia ⩾35,000

Peaty sample from core at 80 m depth, in alluvium of Mekong, at Tapao, Phum Chhuk (12° 09′ N Lat, 105° 44′ E Long), Kompong Cham, Cambodia. Coll. and subm. by J. P. Carbonnel, C.N.R.S., Paris. *Com-*

ment: corresponds to ancient phase filling of Mekong valley; too old to be precisely placed in history of aggradation.

Mannavanur series, Madras, Madurai dist., India

Peaty sediments from marsh in a swale at Mannavanur (10° 13′ N Lat, 77° 20′ W Long), alt 2100 m, Madras State, Madurai dist., India. Coll. and subm. 1967 by F. Blasco, Inst. Fr., Pondichery, India.

Gif-1136. Mannavanur, I.F.P.$_1$ **780 ± 90** **A.D. 1170**

40 to 50 cm depth, black silty mud with 30% organic matter.

Gif-1137. Mannavanur, I.F.P.$_3$ **900 ± 100** **A.D. 1050**

110 cm depth, sand with 2.8% organic matter.

General Comment: recent increase of sedimentation in this depression due to erosion related to destruction of vegetation by man. Rapid sedimentation rate explains why there is no change in pollen composition throughout the profile.

Gif-775. Christmas Harbour, Kerguelen 0-58 **780 ± 100** **A.D. 1770**

Organic remains, 1.20 m depth, in "peatbog", on a hillside, Bay of Christmas (48° 40′ S Lat, 69° 10′ E Long), Kerguelen. Bog, 1.50 m thick, lies on gravel bed. Coll. 1965 and subm. 1966 by N. Bellair, Fac. Sci., Paris. "Peatbog" on this island designates thick spongy soil containing abundant organic remains. *Comment*: pollen analysis indicates 2 cold periods: one at base of peat bog, and a 2nd one from 40 to 80 cm depth (Bellair and Delibrias, 1967).

III. GROUND WATER SAMPLES

No systematic program for dating ground waters of aquifers exists at the laboratory. Nevertheless, we undertook a short study of aquifers of Saudi Arabia and some preliminary measurements for aquifers of the Paris Basin, now being studied by other laboratories. In Saudi Arabia, water was sampled from aquifers of Wasi-Biyadh and of Minjur and from their respective outcrops; subm. 1967-1968 by Soc. Grenobloise d'Etudes et d'Applications Hydrauliques (SOGREAH) to determine if these aquifers are currently being supplied. Some dates were already obtained by Thatcher *et al.* (1961).

For aquifers of the Paris Basin, samples were subm. by Vuillaume, B.R.G.M., Orléans. Measurements are reported as % of modern, without correction for limestone dilution.

Wasia-Biyadh Aquifer, Saudi Arabia

Gif-905. Wadi Nisah, S-9 δC^{14} (% of modern) **36.2 ± 0.8**

150 m below water table, middle Wadi Nisah (24° 10′ N Lat, 46° 42′ E Long).

Gif-906. Bijidiyan-Khardj, S-426 **28.7 ± 0.8**
(24° 14′ N Lat, 47° 33′ E Long).

Gif-908. Khurais, K.S.W.W.J. **11.3 ± 0.6**
50 m depth from top of the aquifer, at Khurais (25° 03′ N Lat, 47° 56′ E Long).

Gif-907. Layla, S-892 **9.2 ± 0.6**
(22° 21′ N Lat, 46° 49′ E Long).

Minjur Aquifer, Saudi Arabia

Gif-910. M_1, Minjur outcrop, S-1524 **16.5 ± 0.7**
Middle part of lower Minjur formation (24° 30′ N Lat, 45° 48′ E Long).

Gif-909. Shaqra, S-1090 **7.2 ± 0.6**
Upper part of the lower Minjur formation (25° 15′ N Lat, 45° 15′ E Long).

Gif-901. Hayr, S-7 **4.7 ± 0.6**
46 m below water table, upper part of upper Minjur formation (24° 26′ N Lat, 46° 47′ E Long).

Gif-912. Majma'ah, S-999 **4.0 ± 0.6**
168 m below water table, middle part of upper Minjur formation (25° 53′ N Lat, 45° 21′ E Long).

Gif-913. W. Bu'ayja, S-8 **1.75 ± 0.4**
(24° 19′ N Lat, 46° 50′ E Long).

Gif-902. Jiza, S-105 **$\leqslant$1.2**
117 m below water table, middle part of upper Minjur formation (24° 34′ N Lat, 46° 45′ E Long).

Gif-900. Riyadh Shumeyssi, S-46 **$\leqslant$1.2**
197 m below water table, lower part of the upper Minjur formation (24° 39′ N Lat, 46° 43′ E Long).

Gif-904. Dirab, S-431 **$\leqslant$1.2**
103 m below water table, middle part of upper Minjur formation (24° 25′ N Lat, 46° 30′ E Long).

Gif-914. Drumah, S-429 **$\leqslant$0.5**
(24° 38′ N Lat, 46° 09′ E Long).

General Comment: measurements, accompanied by a classic hydrodynamic study, lead to conclusion that recharge for both aquifers is now

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very inferior to discharge; hence, these formations are being depleted naturally, without exploitation.

Albian Aquifer of Paris Basin, France

Gif-600. Radio House, Paris **$\leqslant$1.2**
Well (48° 52′ N Lat, 2° 20′ E Long).

Gif-604. Issy-les-Moulineaux, Seine **$\leqslant$1.2**
Well (48° 49′ N Lat, 2° 17′ E Long).

Gif-605. Fleury-la-Vallée, Yonne, FvH **23 ± 0.8**
Outcrop (47° 53′ N Lat, 3° 26′ E Long).

Gif-606. Chichery-la-Ville, Yonne, ch.v.J **58 ± 0.8**
Outcrop (47° 55′ N Lat, 3° 31′ E Long).

Gif-607. Viry-Châtillon, Essonne, V.c.A **$\leqslant$1.2**
Artesian well (48° 40′ N Lat, 2° 23′ E Long).

Gif-601. Dige, Yonne, K_1-K **100 ± 1.05**
Outcrop (47° 43′ N Lat, 3° 22′ E Long).

Gif-602. Dracy, Yonne, (A_1-A_4) **49.5 ± 0.8**
Outcrop (47° 46′ N Lat, 3° 16′ E Long).

Gif-603. Mantes, Yvelines **6.2 ± 0.6**
Well (48° 59′ N Lat, 1° 43′ E Long).

IV. ATMOSPHERIC SAMPLES

All atmospheric CO_2 samples coll. to determine increase of C^{14}/C^{12} ratio due to explosion of nuclear devices, and measured between publication of our first results (R., 1964, v. 6, p. 248-249) and end of 1970, reported here.

Technique for CO_2 collection is the same as used previously, *i.e.*, by bubbling air through solutions of NaOH. Flow-rate is chosen to obtain a quasi-total collection of CO_2.

Recently, δC^{13} measurements have become available for filling gases; corrections are now applied to δC^{14}, taking these values in consideration. For all other measurements, value of $-11‰$ corresponding to average of measured δC^{13}, was assumed.

Val Joyeux series, France

Scientific sta., Val Joyeux, Univ. of Paris, 10 km from Versailles, in the countryside, until now situated away from large roads (48° 49′ N Lat, 2° 01′ E Long). Mostly level atmosphere comes from W and, therefore, is not contaminated with CO_2 coming from industrial area of Paris which extends 20 km to 70 km E of Val Joyeux. All coll. samples are reported here. In Fig. 1, ΔC^{14} for samples coll. before 1963 (R., 1964, v. 6, p. 248-249) have been recalculated with δC^{13} value equal to $-11‰$.

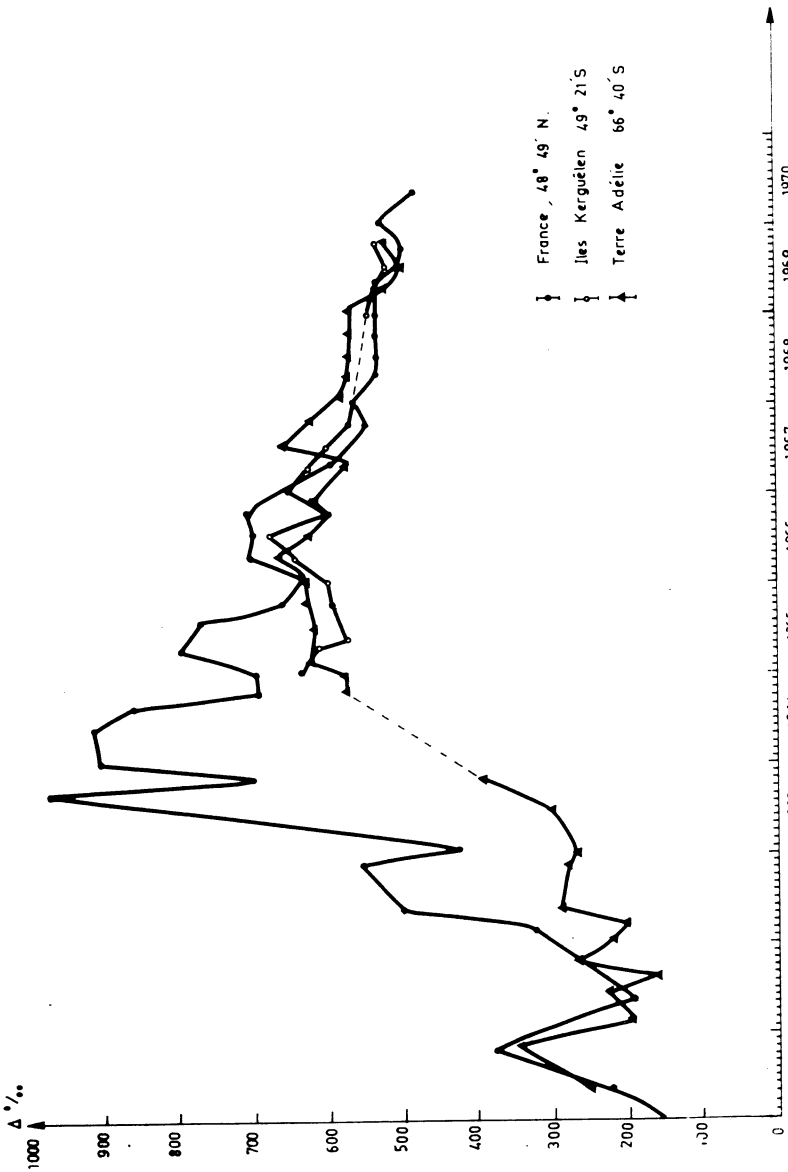

Fig. 1. Per mil C^{14} excess over natural concentration at Val Joyeux in France, at Iles Kerguelen (S Indian Ocean) and in Terre Adélie (Antarctica). Statistical errors are given in the legend. Parts of curves with dotted lines correspond to some periods when samplings were not done. All other values have been included.

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Date no.	Sample no.	Month	Day	Year	δC^{14}‰	δC^{13}‰	Δ‰
Gif-2000	63-I-A	Jan.	14-31	1963	465	(−11)*	424 ± 14
Gif-2001	63-III-A	Aug.	1-9	1963	1030	(−11)	973 ± 15
Gif-2002	63-IV-A	Oct.	17-24	1963	750	(−11)	701 ± 14
Gif-2003	64-I-A	Jan.	24-31	1964	960	(−11)	905 ± 14
		Apr.	28 to				
Gif-2004	64-II-A	May	6	1964	970	(−11)	915 ± 14
Gif-2005	64-III-A	Aug.	13-25	1964	910	(−11)	857 ± 15
Gif-2006	64-IV-A	Oct.	28 to				
		Nov.	7	1964	740	(−11)	691 ± 13
Gif-2007	65-I-A	Jan.	12-31	1965	750	(−11)	701 ± 13
Gif-2008	65-II-A	Apr.	14-22	1965	850	(−11)	798 ± 14
Gif-2009	65-III-A	July	1-7	1965	820	(−11)	769 ± 14
Gif-2010	65-IV-A	Nov.	10-20	1965	710	(−11)	662 ± 13
Gif-2011	66-I-A	Feb.	1-21	1966	680	(−11)	633 ± 13
Gif-2012	66-II-A	Apr.	18-25	1966	760	(−11)	711 ± 13
Gif-2013	66-III-A	July	1-8	1966	750	(−11)	701 ± 13
Gif-2014	66-IV-A	Oct.	11-17	1966	760	(−11)	711 ± 13
Gif-2015	67-I-A	Jan.	10-18	1967	705	(−11)	658 ± 13
Gif-2016	67-II-A	Apr.	10-14	1967	660	(−11)	614 ± 13
Gif-2017	67-III-A	July	27 to				
		Aug.	7	1967	640	(−11)	594 ± 13
Gif-2018	67-IV-A	Oct.	19-25	1967	590	(−11)	546 ± 12
Gif-2019	68-I-A	Jan.	12-17	1968	609	(−11)	564 ± 12
Gif-2020	68-II-A	Apr.	4-10	1968	577	(−11)	533 ± 13
Gif-2021	68-III-A	July	3-9	1968	580	(−11)	536 ± 13
Gif-2022	68-IV-A	Oct.	15-21	1968	580	(−11)	536 ± 13
Gif-2023	69-I-A	Jan.	24-31	1969	580	(−11)	536 ± 13
Gif-2024	69-II-A	Apr.	25-30	1969	580	(−11)	536 ± 13
Gif-2025	69-III-A	July	10-16	1969	561	− 9.6	513 ± 13
Gif-2026	69-IV-A	Oct.	22-28	1969	540	(−11)	497 ± 13
Gif-2027	70-I-A	Jan.	15-26	1970	577	−10.2	530 ± 13
Gif-2028	70-II-A	Apr.	3-8	1970	515	−13.2	479 ± 13
Gif-2029	70-III-A	July	1-6	1970	556	−10.24	515 ± 13

* δC^{13} assumed

General Comment: variations are similar to those already pub. by many laboratories: rapid increase of Δ C^{14} in 1963, followed by a progressive decrease pulsed by a yearly injection ("Spring injection") which grows less important and disappears completely after 1966.

Iles Kerguelen series

Atmospheric CO_2 coll. at scientific sta. Port aux Français, Iles Kerguelen (49° 21′ N Lat, 70° 13′ E Long) begun in 1965 by technicians of Terres Australes and Antarctiques Françaises. Small building shelter-

ing sampling apparatus, away from main sta., was accidentally destroyed in 1968, leaving no samples for April, July, and October 1968. Every year, in January, bottles with NaOH solution are brought back from Kerguelen to Gif with equipment of expedition.

Date no.	Sample no.	Month	Day	Year	δC^{14}‰	δC^{13}‰	Δ‰
Gif-2065	K-I-65	Jan.	8-13	1965	680	(−11)*	633 ± 13
Gif-2066	K-II-65	Apr.	3-7	1965	660	(−11)	614 ± 13
Gif-2067	K-III-65	July	5-9	1965	620	(−11)	575 ± 13
Gif-2068	K-IV-65	Oct.	4-9	1965	640	(−11)	594 ± 13
Gif-2069	K-I-66	Jan.	8-12	1966	647	(−11)	601 ± 13
Gif-2070	K-II-66	Apr.	2-7	1966	697	(−11)	647 ± 13
Gif-2071	K-III-66	July	4-8	1966	730	(−11)	682 ± 14
Gif-2072	K-IV-66	Oct.	5-10	1966	640	(−11)	594 ± 13
Gif-2073	K-I-67	Jan.	9-13	1967	700	−11.6	655 ± 14
Gif-2074	K-II-67	Apr.	8-11	1967	674	−10.3	625 ± 13
Gif-2075	K-III-67	July	1-7	1967	643	−12.0	600 ± 13
Gif-2076	K-IV-67	Oct.	2-7	1967	608	−12.5	568 ± 13
Gif-2077	K-I-68	Jan.	4-8	1968	608	−11.5	565 ± 13
Gif-2078	K-I-69	Jan.	26-30	1969	577	− 9.2	543 ± 13
Gif-2079	K-II-69	Apr.	20-25	1969	582	−10.6	537 ± 13
Gif-2080	K-III-69	July	20-24	1969	557	−12.4	518 ± 13
Gif-2081	K-IV-69	Oct.	20-24	1969	563	−15.2	532 ± 13

* δC^{13} assumed

Terre Adélie, Antarctica series

Atmospheric CO_2 coll. at sta. Dumont Durville in Terre Adélie (66° 40′ S Lat, 140° E Long). Coll. made by Expeditions Polaires Françaises, Paris. Sampling began in 1960 and continued till now, except for 1964, when equipment was lost in Papeete Harbour. As in Kerguelen, samples are brought back every year.

Date no.	Sample no.	Month	Day	Year	δC^{14}‰	δC^{13}‰	Δ‰
Gif-2030	TA-I-60	May	16-18	1960	290	(−11)*	254 ± 11
Gif-2031	TA-II-60	Nov.	10-15	1960	390	(−11)	351 ± 11
Gif-2032	TA-I-61	Feb.	15-17	1961	230	(−11)	194 ± 13
Gif-2033	TA-II-61	June	1-5	1961	260	(−11)	225 ± 11
Gif-2034	TA-III-61	Aug.	9-14	1961	190	(−11)	157 ± 11
Gif-2035	TA-IV-61	Oct.	11-15	1961	305	(−11)	269 ± 11
Gif-2036	TA-I-62	Jan.	7-9	1962	257	(−11)	222 ± 11
Gif-2037	TA-II-62	Feb.	24 to Mar. 10	1962	240	(−11)	205 ± 11

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Date no.	Sample no.	Month	Day	Year	δC^{14}‰	δC^{13}‰	Δ‰
Gif-2038	TA-III-62	May	12-25	1962	325	(−11)	288 ± 11
Gif-2039	TA-IV-62	Nov.	9-24	1962	320	(−11)	283 ± 11
Gif-2040	TA-V-62	Dec.	1-5	1962	300	(−11)	264 ± 11
Gif-2041	TA-I-63	June	12-26	1963	340	(−11)	302 ± 11
Gif-2042	TA-II-63	Sept.	24 to Oct. 4	1963	430	(−11)	390 ± 12
Gif-2043	TA-III-63	Dec.	19-26	1963	460	(−11)	419 ± 12
Gif-2044	TA-I-64	Oct.	25-30	1964	620	(−11)	575 ± 12
Gif-2045	TA-II-64	Dec.	2-5	1964	620	(−11)	575 ± 12
Gif-2046	TA-I-65	Feb.	26 to Mar. 2	1965	670	(−11)	623 ± 12
Gif-2047	TA-II-65	July	1-6	1965	660	(−11)	615 ± 13
Gif-2048	TA-III-65	Oct.	1-6	1965	675	(−11)	628 ± 13
Gif-2049	TA-I-66	Jan.	4-10	1966	680	(−11)	633 ± 13
Gif-2050	TA-II-66	Apr.	4-10	1966	715	(−11)	667 ± 13
Gif-2051	TA-III-66	July	1-5	1966	670	(−11)	623 ± 13
Gif-2052	TA-IV-66	Oct.	7-11	1966	640	(−11)	594 ± 13
Gif-2053	TA-V-66	Dec.	28-31	1966	670	(−11)	623 ± 13
Gif-2054	TA-I-67	Apr.	1-3	1967	620	(−11)	575 ± 13
Gif-2055	TA-II-67	July	1-5	1967	710	(−11)	662 ± 14
Gif-2056	TA-III-67	Oct.	1-5	1967	670	−10.20	621 ± 14
Gif-2057	TA-I-68	Jan.	3-5	1968	627	(−11)	582 ± 13
Gif-2058	TA-II-68	Apr.	4-8	1968	617	(−11)	572 ± 13
Gif-2059	TA-III-68	July	3-7	1968	614	−11.4	570 ± 13
Gif-2060	TA-IV-68	Oct.	3-7	1968	616	(−11)	571 ± 13
Gif-2061	TA-I-69	Jan.	4-8	1969	617	(−11)	572 ± 13
Gif-2062	TA-II-69	Apr.	11-15	1969	557	−13.6	522 ± 13
Gif-2063	TA-III-69	July	9-13	1969	537	−12.9	500 ± 13
Gif-2064	TA-IV-69	Oct.	10-14	1969	561	−12.3	521 ± 13

* δC^{13} assumed

General Comment: curves of artificial C^{14} values vs. time obtained in Terre Adélie and in Kerguelen are not as smooth as might be expected if transfer from N to S hemispheres is the sole process. Observed variations seem to indicate stratospheric injections not far from these lats.

There is no significant difference between artificial C^{14} values for Terre Adélie and Kerguelen, these curves are very similar to those obtained, e.g., at Makara, New Zealand (41° 18′ S Lat, 74° 14′ E Long) (Rafter and O'Brien, 1970). Values in 1967 and 1968 are higher in Terre Adélie than in France. Coincidence of Antarctica values with those in N hemisphere appears approximately at end of 1967. Hence it may be estimated that entire troposphere reached fairly uniform C^{14} concentration ca. 5 yr after cessation of main (N hemisphere) nuclear atmospheric tests.

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Spitsbergen series

Atmospheric CO_2 samples obtained by G. Lambert, Centre des Faibles Radioactivités, Gif-sur-Yvette, who participated in C.N.R.S. expedition in 1966 at Ny-Alesund, in Spitsbergen (78° 55′ N Lat, 12° 00′ E Long).

Date no.	Sample no.	Month	Day	Year	$\delta C^{14}‰$	$\delta C^{13}‰$	$\Delta‰$
Gif-2082	SP_1	July	7-8	1966	871	(−11)*	819 ± 14
Gif-2083	SP_2	July	28-29	1966	832	(−11)	781 ± 14
Gif-2084	SP_3	Aug.	4-5	1966	846	(−11)	795 ± 14
Gif-2085	SP_4	Aug.	17-18	1966	826	(−11)	775 ± 14
Gif-2086	SP_5	Aug.	26-27	1966	878	(−11)	824 ± 14

* δC^{13} assumed

Comment: these Spitsbergen values are ca. 10% higher than those of I. Olsson (R., 1970, v. 12, p. 283) during same period. Discrepancy has not yet been explained.

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