

## NANCY NATURAL RADIOCARBON MEASUREMENTS I

R. COPPENS, G. L. A. DURAND, and B. GUILLET

Centre de Recherches Radiogéologiques, Nancy-Vandoeuvre, 54 F

This paper is a list of the first results of age determinations made at the Centre de Recherches Radiogéologiques de Nancy (CRR). The Center is the result of a convention between the Commissariat à l'Énergie Atomique (CEA) and the University of Nancy. It is part of a group of research laboratories of Earth Sciences headed by Prof. M. Roubault.

### INTRODUCTION

The creation of a Natural Radiocarbon Laboratory was decided in 1960. The installation was completed in the new laboratories of the C.R.R. in 1961. A modification of the system for gas preparation and for counter filling was made in 1962 after calibrations had shown the poor quality of CO<sub>2</sub> obtained with the first equipment. In 1963 we spent the year in calibrations and checking measurement reproducibility. The first useful results were obtained in 1964 after improvement of the electronic system. In 1965 B. Guillet was able to present his "thèse de 3<sup>ème</sup> Cycle" on the "Datation of the Beillard peatbog."

All measurements were made in a cylindrical proportional counter, 70 mm in diameter and 310 mm long, the stainless steel wall of which makes the ground cathode.

The nickel central wire of .05 mm set in the axis of the counter is the anode brought to a positive potential of 5400 v. The counter has a capacity of 1,16 l. and is normally filled with CO<sub>2</sub> under a pressure of 736 mm of mercury. The counter, permanently set inside a lead shield, is connected by copper tubing, 20 mm in diameter, to a pumping system (rotary and mercury diffusion pumps with liquid nitrogen traps). The vacuum level inside the counter is directly determined as follows: the anodic tension is maintained during the pumping, the change of the discharge between the anode and the cathode is examined as the vacuum becomes better. For this purpose an oscilloscope is connected to the output of the counter. Previous calibration determines the exact vacuum level. At discharge extinguishment, the vacuum is better than 10<sup>-5</sup> mm of mercury.

The proportional counter is shielded by 20 cm of lead and covered by a bismuth shroud and layers of paraffin and boric acid (de Vries, 1957). Anticoincidence shielding is provided by 36 Geiger-Muller tubes surrounding the sample counter. The signal given by the counter is first amplified and then, after discrimination and anticoincidence, directed to 3 counting channels. We work with 3 discriminating thresholds corresponding to signals of 10, 15, and 25 mv at the input of the amplifier. This system provides 3 different counting results, giving 3 ages for the same sample. As a rule, these ages are almost identical in the case of a good measurement but are very different in the case of a mistake in the manipulation of the sample.

CO<sub>2</sub> is prepared according to the method described by Rafter (1953): burning the sample in oxygen, bubbling the gas in a soda solution and transforming the obtained sodium carbonate into Ba CO<sub>3</sub> with Ba Cl<sub>2</sub>, which is then stored. Sulfuric acid is used to liberate CO<sub>2</sub> from the Ba CO<sub>3</sub>. The CO<sub>2</sub> is purified on alumina and by fractional crystallization. After purification, the gas is stored in flasks for more than 30 days to eliminate the radon that may result from impurity of the reagents.

Filling of the proportional counter is made at the fixed pressure of 736 mm of mercury. Before each measurement, the occurrence of impurities in the gas is verified by measuring the activity of an external source (Pitchblende) placed at a given distance. The working voltage is adjusted accordingly.

The modern reference sample is a growth ring, dated from 1930, of a stem of Douglas fir (*Pseudotsuga Douglasii*) felled in 1956, grown in Provence far from any industrial area. We expect to use standard NBS oxalic acid very soon. Average values of measures made on the modern sample are reported here: 12,88 dpm, 12,07 dpm, 10,74 dpm.

The measurements of the background were made by using industrial CO<sub>2</sub> delivered in bombs and coming from cokeovens. The average values are: 7,48 dpm, 7,11 dpm, 6,47 dpm. The values for the "background" and for the "living sample" mentioned here correspond to the average results obtained with the values of the discriminating thresholds mentioned. The quality of the industrial CO<sub>2</sub> was tested in comparison with CO<sub>2</sub> prepared from a calcite found in druse in an outcrop of portlandian limestone of the "Côtes de Meuse." The background obtained with this gas is: 7,57 dpm, 7,15 dpm, 6,48 dpm. All samples were counted for 24 hrs and the period of radiocarbon used in the calculation is  $5560 \pm 30$  yrs.

#### ACKNOWLEDGMENTS

The apparatus was built and calibrated by Prof. G. Durand according to the instructions of J. Labeyrie and G. Delibrias from the Saclay Lab. to whom we express our acknowledgments. We also thank the scientists who have permitted us to publish the results obtained on samples submitted to this laboratory.

#### SAMPLE DESCRIPTIONS

##### 1. GEOLOGIC SAMPLES

**Ny-11. Mercy le Bas, Mainbotel,  
Meurthe-et-Moselle**

**1850 B.C.  
3800 ± 230**

Peat from the "vallée de la Crusnes" at Mainbotel (49° 23' 53" N Lat. 3° 24' E Long). Coll. 1927 by Gardet; subm. 1962 by G. Jurain, Faculté des Sciences, Nancy. *Comment:* palynologic study of sample shows *Fagus-Abies* with *Alnus*, *Corylus*, and *Pinus* of the Sub-Boreal or Sub-Atlantic period.

**Le Beillard series, Vosges**

Sphagnum peats at Le Beillard near Gerardmer in the Cleuric valley (48° 05' N Lat. 4° 28' E Long) overlying glacial deposits. Pollen analyses of these peats were made by B. Guillet (1965). Coll. 1962 and subm. 1963 by B. Guillet. Depth in cm from surface is given in each heading.

**Ny-28. Le Beillard, 30 cm** **4110 ± 230**  
**2160 B.C.**

Fibrous peat with pollen of *Quercus*, *Tilia*, *Corylus*, without *Fagus*.

**Ny-29. Le Beillard, 160 cm** **7550 ± 350**  
**5600 B.C.**

Fibrous yellowish brown peat with *Quercus*, *Tilia*, *Ulmus* pollen.

**Ny-30. Le Beillard, 180 cm** **7680 ± 370**  
**5730 B.C.**

Compact peat with pollen of *Pinus*, *Betula*, and *Corylus*.

**Ny-31. Le Beillard, 200 cm** **8310 ± 370**  
**6360 B.C.**

Compact peat; beginning of *Corylus* indicates Boreal period.

**Ny-32. Le Beillard, 210 cm** **8060 ± 440**  
**6110 B.C.**

Sandy peat with *Pinus* overlying glacial sand.

*General Comment:* peaty formation begins in Boreal period with *Pinus*, *Betula*, and *Corylus*. During Atlantic period, from 160 cm to the surface, peat growth was very rapid. The 4110 ± 230 level (Ny-28) is contaminated by present roots.

**Ny-42. Geological Survey of Canada** **12,450 ± 460**  
**10,500 B.C.**

Wood (GSC 1) subm. 1964 by W. Dyck for inter-laboratory calibration. Comparison of results given by other laboratories:

Lamont Geological Observatory	12,150 ± 250
Isotopes, Inc.	12,000 ± 400
G.S.C. Laboratory	12,400 ± 200
Nancy Radiocarbon Laboratory	12,450 ± 460

**Ny-53. Belle-Ile-en-Mer, Morbihan** **2890 ± 230**  
**940 B.C.**

Peat from top of "Anse de Ster wras" peat bog; (46° 55' 20" N Lat, 5° 35' 10" W Long). Coll. and subm. 1964 by Y. Coppens. *Comment:* dated by Radiocarbon Laboratory of Saclay at 730 B.C. (unpub.).

**Ny-65. Anloa, Cameroun** **> 32,000**

Lignite in argillaceous sand with vivianite from Anloa from valley of Margol river (7° 28" N Lat, 13° 25' 42" E Long). Coll. and subm. 1965 by J. Sarcia, Bureau de Rech. Géol. et Min., Paris.

**Saint-Gilles series**

Dates of 3 Post-Wurmian peat layers of the Camargue sediments between Arles, Beaucaire, and Saint-Gilles. Coll. by A. Bonnet and subm. 1966 by H. Alimen, Lab. Géol. Quat. CNRS, Paris.

**Ny-71. Chemin coté, 0,9** **1110 ± 200**  
**A.D. 840**

Fen peat coll. at -3 m in "Chemin coté 0,9" boring (43° 40' 15" N Lat, 2° 5' 50" E Long).

**Ny-69. Chemin de Halage, -7 m** **4550 ± 340**  
**250 B.C.**

Fen peat coll. at -7 m in the "Chemin de Halage" boring (43° 40' 20" N Lat, 2° 5' 45" E Long).

**Ny-70. Chemin de Halage, -9 m** **5920 ± 400**  
**3970 B.C.**

Fen peat coll. at -9 m in the "Chemin de Halage" boring.

*General Comment:* by dating these 3 peat horizons, A. Bonnet, 1966, was able to make precise studies on the stratigraphy and chronology of sedimentation in the Rhone delta in Camargue.

## II. ARCHAEOLOGIC SAMPLES

**Ny-4. Richardmenil, Meurthe-et-Moselle** **4280 ± 350**  
**2330 B.C.**

Trunk of oak in sand of the Moselle river near Richardmenil (48° 35' N Lat, 3° 50' E Long). Coll. 1960 and subm. 1962 by G. Vaucel, ENSG, Nancy. *Comment:* dated in 1960 by Radiocarbon Laboratory of Saclay at 4270 ± 300 (G. Vaucel, 1960).

**Ny-6. Saint-Gildas de Rhuys, Morbihan** **2290 ± 270**  
**340 B.C.**

Charcoal found near the "four à augets" No. 16 of the 1964 inventory, on the Saint Gildas de Rhuys beach (47° 29' 20" N Lat, 5° 10' 15" W Long). Subm. 1964 by Y. Coppens, Museum Hist. Nat., Paris. *Comment:* "four à augets" was probably used by Celtic people of Brittany in the salt industry.

**Ny-15. Pierre la Treiche, Meurthe-et-Moselle** **7950 ± 530**  
**6230 B.C.**

Dorsal vertebra of *Ursus spelaeus* found in the Sainte Reine cave at Pierre la Treiche near Toul (48° 39' N Lat, 3° 35' E Long). Sample from the collection of the ENSG Museum. Coll. 1865 by P. Husson. *Comment:* a complete description of the Sainte Reine cave is given by P. Husson (1865) who identified abundant mammals.

**Ny-67. Bassin du Tchad** **4260 ± 360**  
**2290 B.C.**

Shells presumed end of Neolithic (15° 43' N Lat, 15° 09' 15" E Long). Coll. and subm. 1966 by S. L. Schneider, Bureau Rech Géol. et Min., Fort Lamy, Tchad.

**Ny-68. Bassin du Tchad** **5260 ± 410**  
**3290 B.C.**

Shells presumed of Lacustrine Neolithic (15° 17' 30" N Lat, 19° 01' 30" E Long). Coll. and subm. 1966 by J. L. Schneider (in press).

**Ny-74. Bassin du Tchad** **Modern**

Fish-bones from terminal Lacustrine sediments in "Pays Bas of Tchad." (16° 41' 30" N Lat, 18° 11' 15" E Long). Coll. and subm. 1966 by J. L. Schneider. *Comment:* fishes presumed older than few hundred yrs.

**Ny-73. Jebel Irhoud, Morocco** **>32,000**

Bones of mammals from upper layer of Jebel Irhoud cave (31° 53' 34" N Lat, 8° 51' 38" W Long). Coll. 1962 and subm. 1966 by Prof. E. Ennouchi, Faculté des Sciences, Rabat, Maroc. *Comment:* remains of two *Homo neanderthalensis* were found in this layer with a classic Mousterian industry and about 3000 bones of various animals (E. Ennouchi, 1962).

**Ny-76. Ain Boucherit, Saint Arnaud, Algeria** **5120 ± 310**  
**3170 B.C.**

Charcoal in archaeological layer with many snails from Ain Boucherit (36° 11' 34" N Lat, 5° 45' 11" E Long). Coll. and subm. 1966 by Prof. G. Camps, Faculté des Lettres et Sciences Humaines, Alger. *Comment:* expected age 5050 to 6050 B.C. would date a particular level of Upper Capsian in Algeria.

#### REFERENCES

Date lists:

GSC I	Dyck and Fyles, 1962
Isotopes I	Walton, Trautman, and Friend, 1961
Lamont V	Olson and Broecker, 1959
Sa clay I	Delibrias, Guillier, and Labeyrie, 1964

Bonnet, A., 1966, Structure de la Camargue entre Arles, Beaucaire, et Saint-Gilles du Gard: *CRsom. Soc. Géol. de France*, v. 7, p. 258-259.

Delibrias, G. and Perquis, M. T., 1958, Datage par la méthode du 14-C, *BIST du CEA*: no. 21, p. 1013.

Ennouchi, E., 1962, Un Néanderthalien: l'homme du Jebel Irhoud: *L'Anthropologie*, v. 66, no. 3-4, p. 279-299.

Guillet, B., 1965, La méthode de datation par le 14-C. Application à la détermination de l'âge de la Tourbière du Beillard: Thèse 3e Cycle, Nancy.

Schneider, J. L., 1966, Rapport de synthèse de la carte hydrogéologique de reconnaissance Mao, au 1/500000, Tchad, BRGM, Fort Lamy.

Vaucel, G., 1960, Contribution à l'étude géologique de la région de Bayon: DES, Nancy, 59 p.

de Vries, H., 1957, Further analysis of the neutron component of the background of counters used for 14-C age measurements: *Nuclear Physics*, v. 3, p. 63.