

VN 9 000006

**VIỆN NĂNG LƯỢNG NGUYÊN TỬ QUỐC GIA**  
**VIET NAM ATOMIC ENERGY COMMITTEE**

---

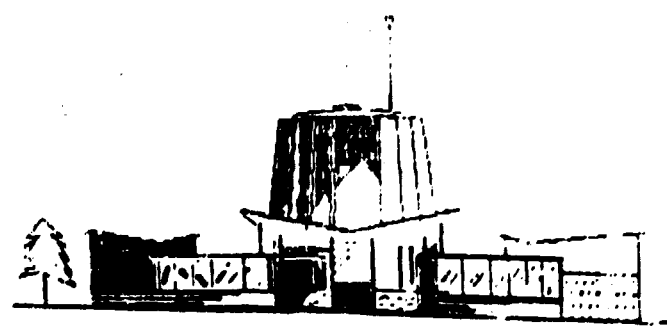
**VIỆN NGHIÊN CỨU HẠT NHÂN ĐÀ LẠT**  
**DALAT NUCLEAR RESEARCH INSTITUTE**

**RADIOCARBON DATING OF ARCHAEOLOGICAL  
GEOLOGICAL AND GROUNDWATER SAMPLES**

Nguyen Kien Chinh, Ho Huu Dung  
Hua Minh Quan, Tran Kim Thuy

Isotope Hydrology Section  
Center of Nuclear Technique, HoChiMinh Cit;

NINR -- E 071 - 89.



**RADIOCARBON DATING OF ARCHAEOLOGICAL,  
GEOLOGICAL AND GROUNDWATER SAMPLES**

Nguyen Kien Chinh, Ho Huu Dung  
Hua Minh Quan, Tran Kim Thuy

Isotope Hydrology Section,  
Center of Nuclear Techniques,  
Ho Chi Minh City.

In the context of the Project VIE/8/003 sponsored by the IAEA, a regular and complete C-14 laboratory was installed at the Center of Nuclear Techniques in 1986.

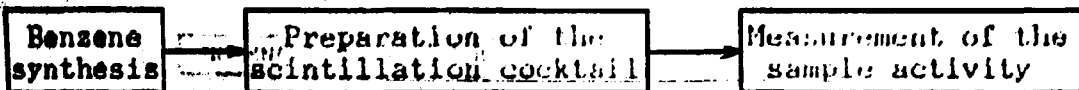
In this paper, the authors present the procedure of sample treatment and sample activity measurement of the Radiocarbon method and some preliminary results obtained after more than one year of operation of the laboratory.

**I. PROCEDURE OF SAMPLE TREATMENT AND SAMPLE ACTIVITY MEASUREMENT:**

In general, materials containing carbon can be dated by the Radiocarbon method. Until now we have only realized the dating of the two following types of samples:

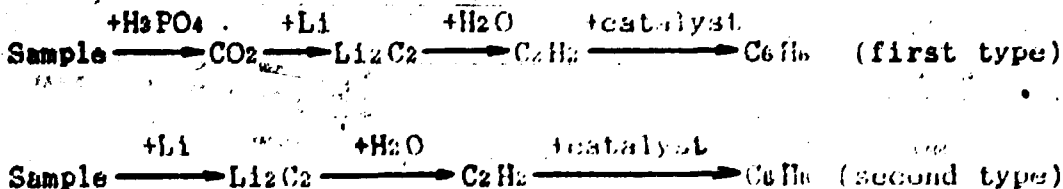
- Shells, corals and dissolved carbon in groundwater.
- Woods, coals, charcoals and peats.

This procedure consists of the following steps:



**1/ Benzene synthesis:**

The samples pretreated by diluted NaOH and HCl to remove contaminations [1] (fulvic acid, humic acid, some other organic acids, ...) are synthesized in the following chains [2]:



In order to have 1-4g of sample benzene we used generally 10-20g of sample.

2/ Scintillation cocktail:

The scintillation cocktail consists of dead benzene, sample benzene and 1% Butyl PBD scintillator. The counting volume is 4ml and we used 7ml Teflon-copper vials.

3/ Equipment for measuring the sample activity:

This equipment is the 1217 LKB Wallac Kangaroo, 256 channel liquid scintillation spectrometer with an anticoincidence circuit (the coincidence resolution time is 20ns).

The system (measurement chamber and two multiplier phototubes) is shielded to decrease the background and the optical cross-talk effect. For reducing the dark current noise of multiplier phototubes, this system is kept at 20°C by a cooler unit. The count variation is less than 0.2% a day (not including random errors).

The high voltage of multiplier phototubes set at 945V (the saturation point) gave an efficiency (C-14) of 70%, background of 3.10cpm and a factor of merit of 1850.

We used the secondary standard 2313dpm/g CsHe supplied by the Departement de Geologie Dynamique, Universite Pierre et Marie Curie, Paris. This standard was controlled in many international laboratories.

II. SOME PRELIMINARY RESULTS:

Some of our results were compared with those of some international laboratories (see Figure 1) [3]. A good correlation between them was found.

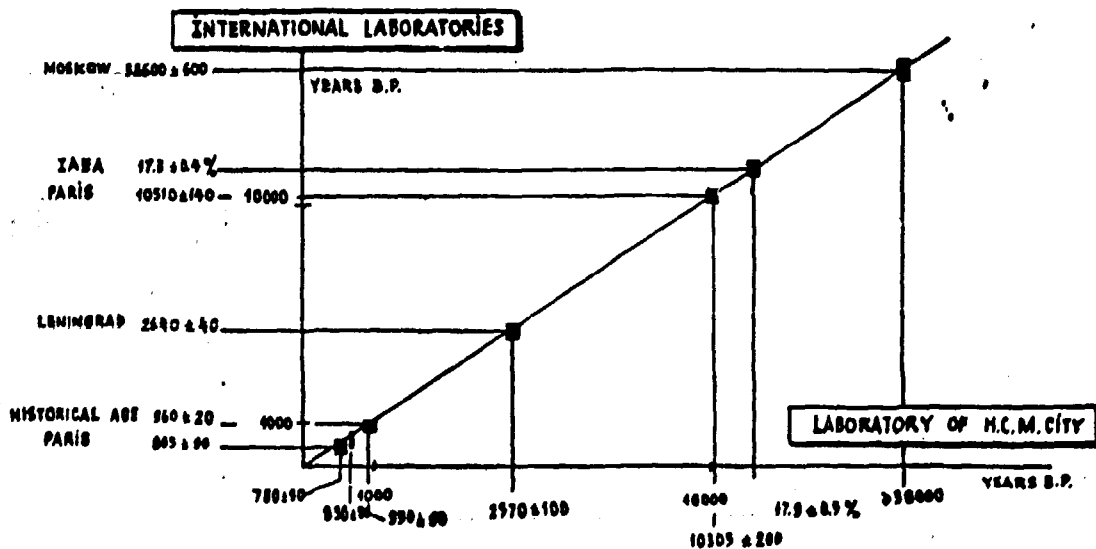


Fig. 1. Comparison between the results of Ho Chi Minh City Laboratory and those of International Laboratories.

- In the hydrological field, we have dated some groundwater samples to contribute to the study of groundwater in Mekong Delta.

- While dating the Bung Bac historical vestiges (Dong-Nai province, South of Vietnam) by C 14 method, some Vietnamese archaeologists doubted about the results measured by the laboratory of Leningrad Archaeological Institute, so these results were checked by our Section. The results were shown in Table 1..

Samples	Depth(m)	Leningrad Lab. (A)	H.C.M. Lab. (B)
84 BBT5-2M1	1.00	2 310 ± 40 (BP)	2 450 ± 40 (BP)
84 BBT5 2M2	0.90	2 770 ± 40 (BP)	
84 BBT5 2M3	0.80	2 640 ± 40 (BP)	2 570 ± 100 (BP)
84 BBT5 2M5	0.80	3 088 ± 40 (BP)	2 376 ± 40 (BP)
84 BBT5 2M4	0.70	3 010 ± 40 (BP)	

Table 1. Results measured by Leningrad and Ho Chi Minh City laboratories.

These results showed that:

- The sample 84 BBT5-2M5 in column A is too old (3088 ± 40 years B.P.) compared with the civilization of this vestige (about 2400-2600 years B.P.).

- The existed-time of this vestige in column A is too long (about 700 years) compared with the thickness of charcoal layer of this vestige (in the opinion of Vietnamese archaeologists, the existed-time is about 200 years).

The results in column B were in more agreement with the rules of the depth and the cultural development process in Vietnam [4] and did really help confirm the age of this historical vestige.

### III. CONCLUSIONS:

In the interval of age ranging from 40,000 years ago to present day, with its high accuracy, the established laboratory has contributed effectively to the study of Hydrology in Mekong Delta and to some different fields in Geology, Archaeology of Vietnam.

### ACKNOWLEDGEMENTS:

We wish to thank Mr. J.F. Saliege, Departement de Geologie Dynamique, Universite Pierre et Marie Curie, Paris, for his cordial help on scientific problems relative to this method.

REFERENCES:

- [1] N.G. MOOK, H.J. STREURMAN  
"Physical and chemical aspects of radiocarbon dating".  
General aspects, part 8. II.1., pp. 31-53.
- [2] J.-CH. FONTES  
"Un ensemble destine a la mesure de l'activite du  
radiocarbone par scintillation liquide"  
Revue de Geographie Physique et de Geologie  
Dynamique, Vol. XIII, Fasc. 1, pp. 67-68, Paris, 1971.
- [3] J.F. SALIEGE  
"Rapport au Gouvernement du Vietnam Projet  
'Hydrologie Isotopique' (VIE/8/003)", Paris, 1986.
- [4] BUI CHI HOANG, PHAM QUANG SON  
"Report on the disinterment of Bung-Bac historical  
vestiges (Dong-Nai province, South of Vietnam)".  
Ho Chi Minh City, 1986.