Festschrift-90
Sergio Mascarenhas

Uma jornada das moléculas às amostras que pensam através da física

A comunidade de Biofísica Molecular em 1977

- Sergio Mascarenhas
  - Jose Antonio Fornes
  - Joaquim Procópio de Araujo Filho
  - Silvio Quezado
  - Roberto Pires
  - José Nelson Onuchic
  - Sanchez
  - Izabel

Comunidade Biofísica

- Robert (Bob) Lee Zimmerman
  - José Marques Póvoa
- Otaciro Rangel Nascimento
  - O. Baffa
  - Ignez Caracelli
- Marcel Tabak
  - João Ruggiero Neto
  - Janice Perussi
- Rosemary Sanches

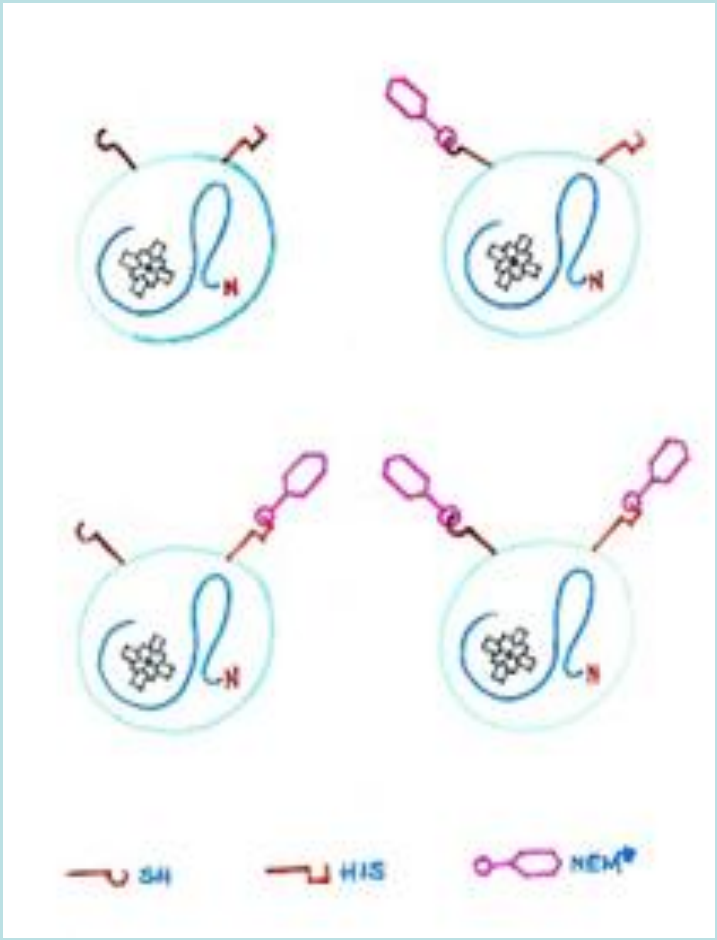
Form & Function

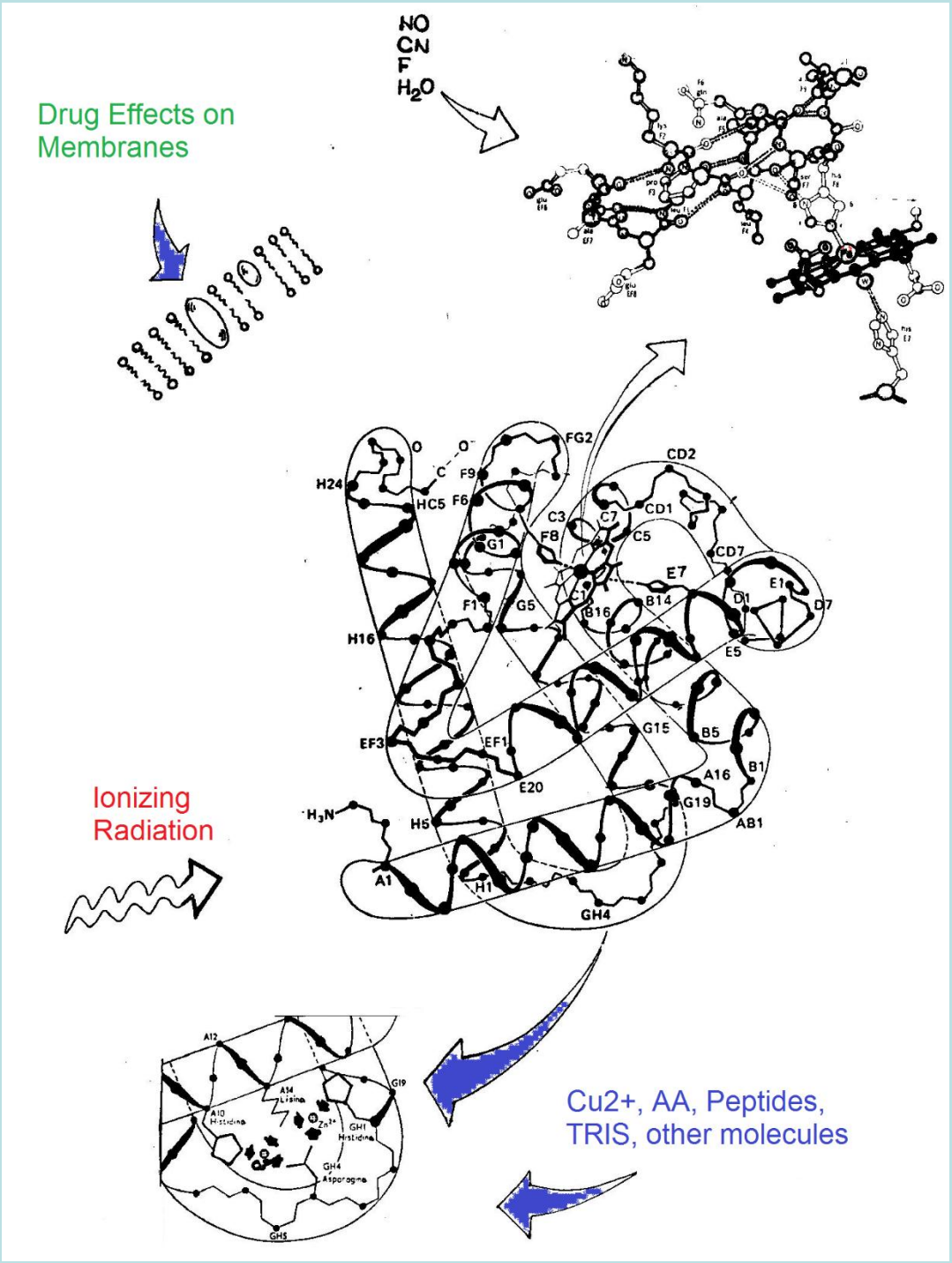
- The binomial form and function occupies a prominent place in biology and many other areas.
- There are several physical techniques for determining the "form" with atomic precision. Molecular Biophysics. *Crystallography, Optical Spectroscopy, Magnetic Resonance, etc…*
- Hemoproteins (myoglobin and hemoglobin) were the first biomolecules intensively studied.

As pesquisas…

- Biofísica da água
  - Corrente termicamente esti
  - Pressao
  - Microbalança de quartzo
- Estudo de hemoproteinas espectroscopicas
  - Otica UV-Vis e EPR

Myoglobin Molecule





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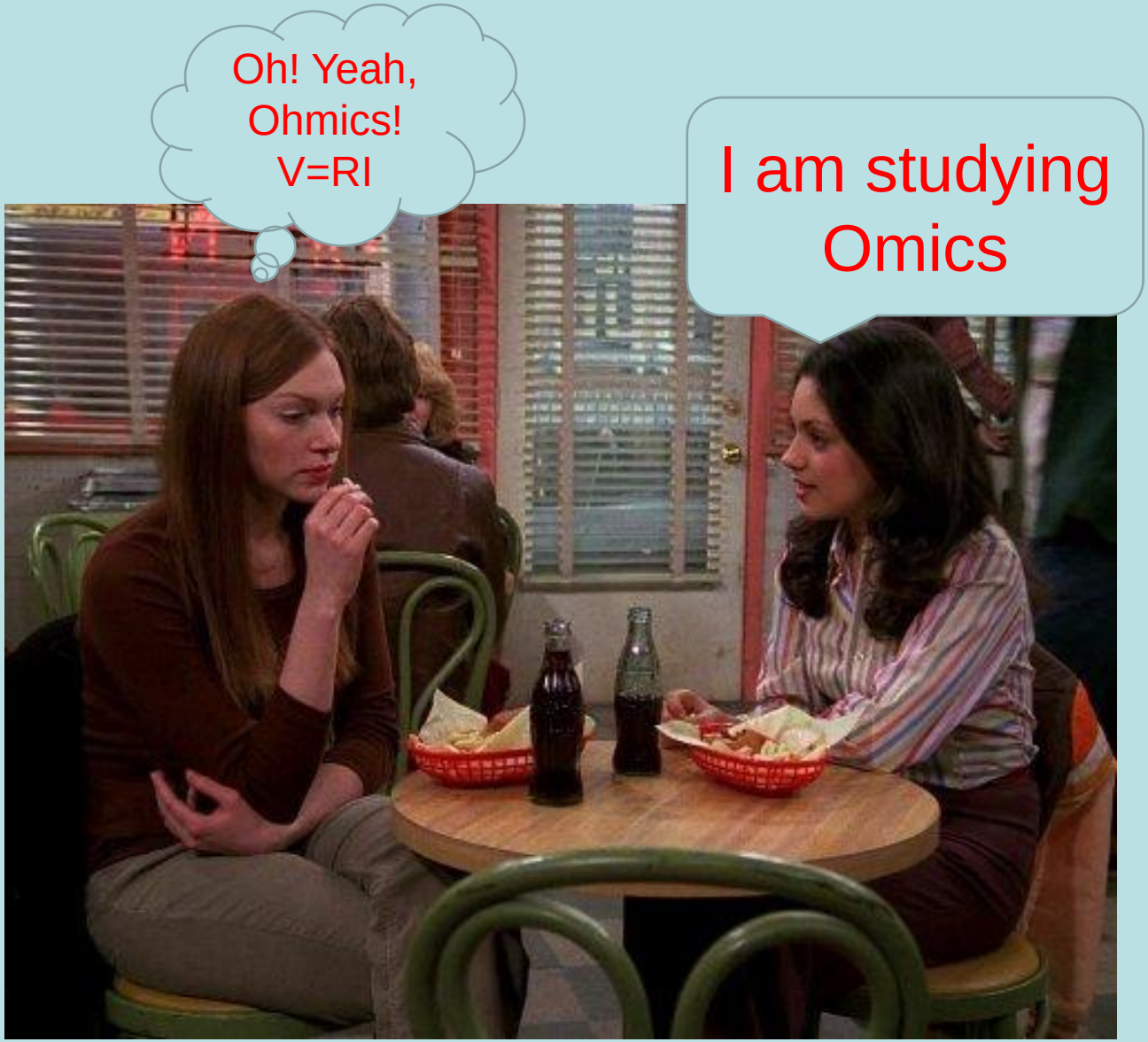
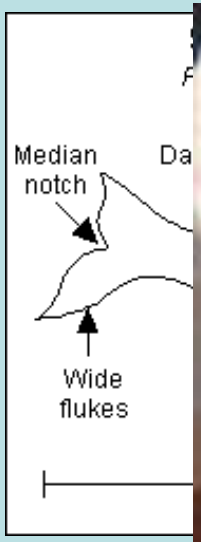


That '70s Show

Whales, Turtles, Aplysia and Worms...

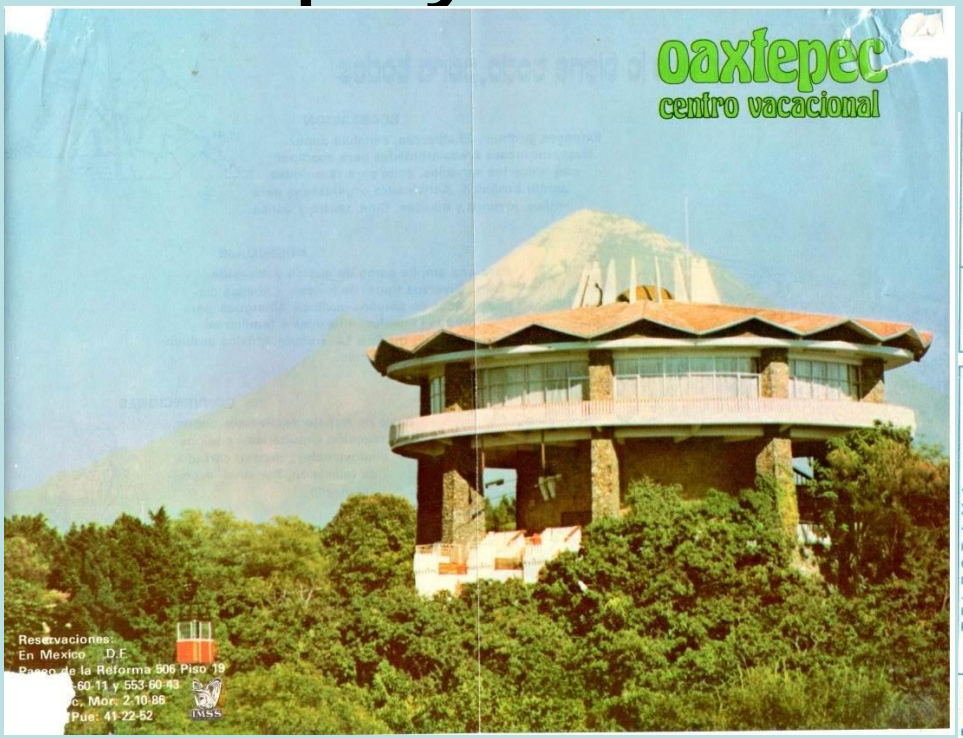


Formação de Pessoal

- Escolas
  - México 1981
  - ICTP 1982
  - Brasília 1995
- Congressos
  - Reuniões da SBBf 1978
  - SBF
- Eventos
  - Métodos Computacionais em Biofísica (E. Clementi)
  - Workshop em Biofísica e Física Médica (JNO&OB)

Congresso da SBBf 1978
Ouro Preto

International School of Biophysics Carlos Chagas 1981



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OSWALDO BAFFA FILHO
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13.560 SAOCARLOSSPO BRASIL

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INTERNATIONAL SCHOOL OF BIOPHYSICS
CARLOS CHAGAS
Oaxtepec, Mor., Mex. August 17-22, 1981

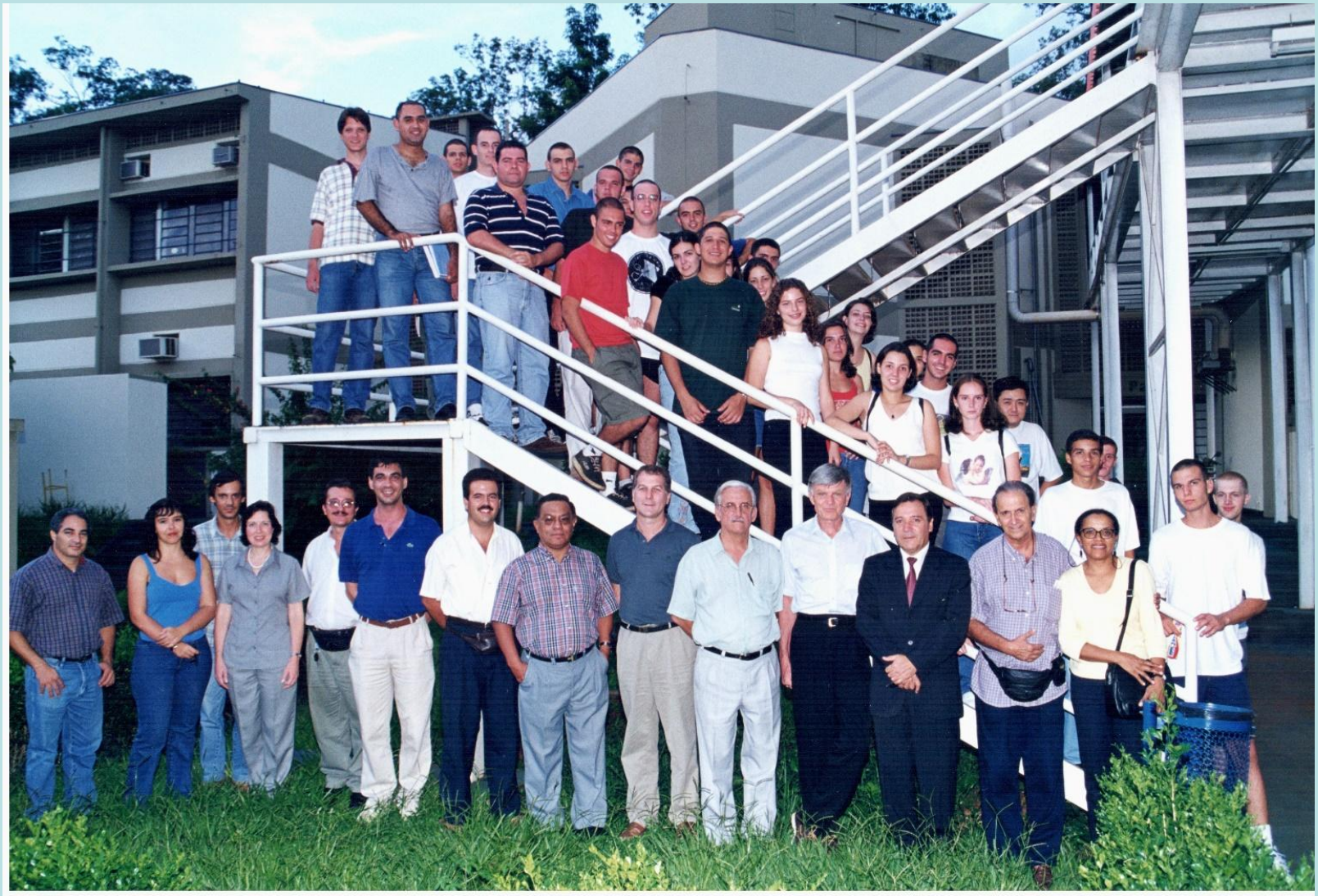
OSWALDO BAFFA

BRASIL

DISCUSSION GROUP II


TRIESTE
AUGUST

Escola Internacional de Biofísica Brasilia 1995



Mais memórias…

DESENVOLVIMENTOS CIENTIFICOS E TECNOLOGICOS
EM FISICA MEDICA E BIOLOGICA

Simpósio em homenagem ao Professor Sérgio Mascarenhas

10 de Agosto de 1992,

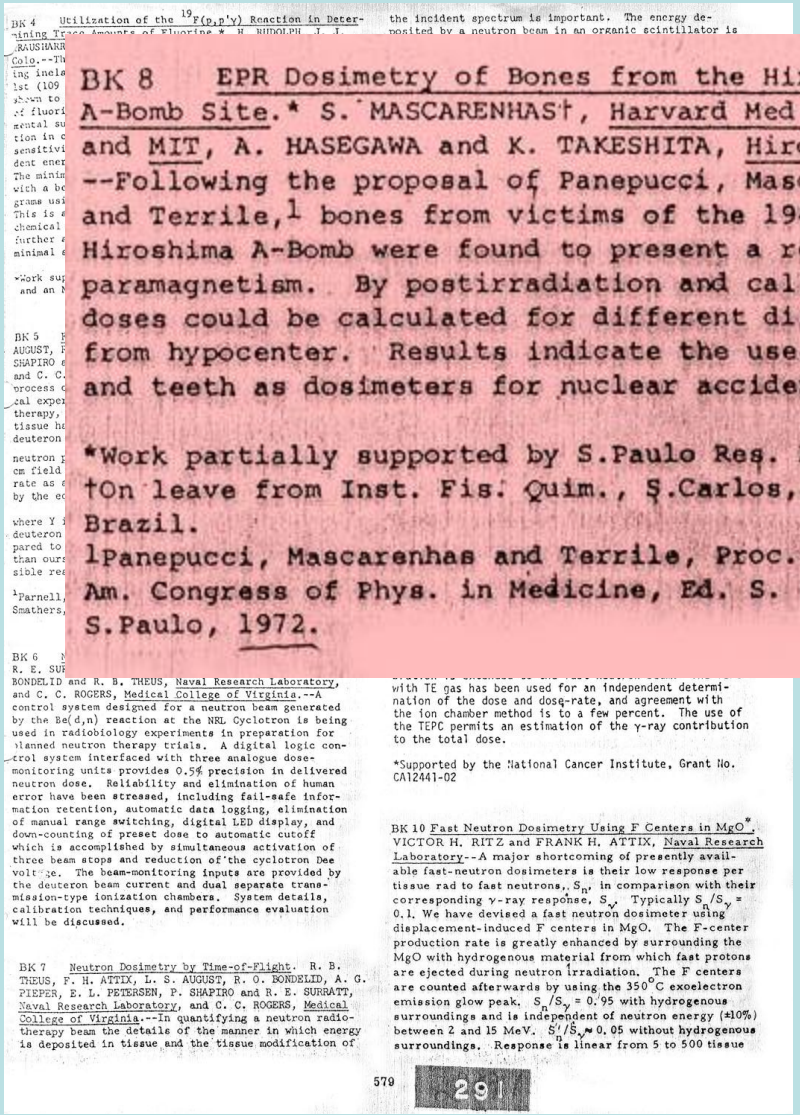
Faculdade de Filosofia, Ciencias e Letras de Ribeirão Preto

Universidade de São Paulo

Nos anos 80

- Intensifica-se atividade de pesquisa em dosimetria e datação arqueológica que nos levaria de Hiroshima à Pedra Furada

ESR Dosimetry of A-Bomb Victims 1973



BK 8 EPR Dosimetry of Bones from the Hiroshima A-Bomb Site.* S. MASCARENHAS†, Harvard Med. Center and MIT, A. HASEGAWA and K. TAKESHITA, Hiroshima U. --Following the proposal of Panepucci, Mascarenhas and Terrile,[1] bones from victims of the 1945 Hiroshima A-Bomb were found to present a residual paramagnetism. By postirradiation and calibration doses could be calculated for different distances from hypocenter. Results indicate the use of bone and teeth as dosimeters for nuclear accidents.

*Work partially supported by S.Paulo Res. Found.
†On leave from Inst. Fis. Quim., S.Carlos, S.P., Brazil.
[1]Panepucci, Mascarenhas and Terrile, Proc. I Latin Am. Congress of Phys. in Medicine, Ed. S. Watanabe, S.Paulo, 1972.

BK 4 Utilization of the $^{19}F(p,p'\gamma)$ Reaction in Determining Trace Amounts of Fluorine *. H. RUDOLPH, J. J. KRAUSHAAR, Colo.--The ing inela 1st (109 shown to of fluori mental su tion in c sensitivi dent ener The minim with a be grams usi This is a chemical further minimal

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[1]Parnell, Smathers,

BK 6 R. E. SU BONDELID and R. B. THEUS, Naval Research Laboratory, and C. C. ROGERS, Medical College of Virginia.--A control system designed for a neutron beam generated by the Be(d,n) reaction at the NRL Cyclotron is being used in radiobiology experiments in preparation for planned neutron therapy trials. A digital logic control system interfaced with three analogue dose-monitoring units provides 0.5% precision in delivered neutron dose. Reliability and elimination of human error have been stressed, including fail-safe information retention, automatic data logging, elimination of manual range switching, digital LED display, and down-counting of preset dose to automatic cutoff which is accomplished by simultaneous activation of three beam stops and reduction of the cyclotron Dee voltage. The beam-monitoring inputs are provided by the deuteron beam current and dual separate transmission-type ionization chambers. System details, calibration techniques, and performance evaluation will be discussed.

BK 7 Neutron Dosimetry by Time-of-Flight. R. B. THEUS, F. H. ATTIX, L. S. AUGUST, R. O. BONDELID, A. G. PIEPER, E. L. PETERSEN, P. SHAPIRO and R. E. SURRATT, Naval Research Laboratory, and C. C. ROGERS, Medical College of Virginia.--In quantifying a neutron radiotherapy beam the details of the manner in which energy is deposited in tissue and the tissue modification of the incident spectrum is important. The energy deposited by a neutron beam in an organic scintillator is with TE gas has been used for an independent determination of the dose and dose-rate, and agreement with the ion chamber method is to a few percent. The use of the TEPC permits an estimation of the γ-ray contribution to the total dose.

*Supported by the National Cancer Institute, Grant No. CA12441-02

BK 10 Fast Neutron Dosimetry Using F Centers in MgO*. VICTOR H. RITZ and FRANK H. ATTIX, Naval Research Laboratory--A major shortcoming of presently available fast-neutron dosimeters is their low response per tissue rad to fast neutrons, S_n, in comparison with their corresponding γ-ray response, S_γ. Typically $S_n/S_\gamma = 0.1$. We have devised a fast neutron dosimeter using displacement-induced F centers in MgO. The F-center production rate is greatly enhanced by surrounding the MgO with hydrogenous material from which fast protons are ejected during neutron irradiation. The F centers are counted afterwards by using the 350°C exoelectron emission glow peak. $S_n/S_\gamma = 0.95$ with hydrogenous surroundings and is independent of neutron energy (±10%) between 2 and 15 MeV. $S_n'/S_\gamma \approx 0.05$ without hydrogenous surroundings. Response is linear from 5 to 500 tissue

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Am. Congress of Phys. in Medicine, Ed. S. Wata
S.Paulo, 1972.

Information for a paper BK-8
"EPR Dosimetry of Bones from the Hiroshima A-Bomb Site"

To be presented at the American Physical Society Meeting in Washington, D.C. April 23-26, 1973.

HIROSHIMA A-BOMB VICTIMS STILL HAVE A "MAGNETIC MEMORY" IN THEIR BONES OF THE RADIATION THEY RECEIVED

The bones of your body can be used to measure the radiation you receive from x-rays or from a nuclear accident. Scientists from Harvard Medical School and Hiroshima University in a joint collaboration have studied the weak magnetism in the bones from victims killed by the atomic bomb that devastated Hiroshima in 1945. By comparing the small amount of magnetism still remaining in the bones to the magnetism from a known amount of radiation from a Cobalt-60 gamma ray source, they were able to get an estimate of the radiation the victims received. The magnetic memory effect in bone has previously been investigated by many basic scientists and may now be very important for detection of radiation effects in nuclear accidents or in radiotherapy. Professor Sergio Mascarenhas, a physicist working at Harvard Medical School, Department of Orthopaedic Survery, on leave from the University of Sao Paulo at Sao Carlos, Brazil, proposed that the magnetic memory effect induced in bone might be put to use in a practical way by using bone itself as a dosimeter to measure radiation. Professor Mascarenhas and his colleagues in Brazil found that the teeth could also be used as a dosimeter. At present the sensitivity of the technique is not sufficient to measure the radiation from a single dental x-ray but they are hopeful that the method can be improved to a much higher sensitivity.

In their work they measure thr residual magnetic memory using a method developed by physicists and chemists for purely basic investigations called electron paramagnetic resonance (EPR). This method has found a large number of applications in industry and medicine. The use of EPR of bone and teeth for a radiation dosimeter is just another recent application of the method.

When Professor Mascarenhas arrived in Japan in August 1972 he tried to get in contact with Japanese scientists in nuclear medicine to obtain human samples from the atomic bomb site. He found support for his ideas from Professor Takeshita, a member of the Institute for Nuclear Medicine in Hiroshima. Professor Takeshita had himself been in the Nagasaki A-bomb explosion. Professor Takeshita provided Professor Mascarenhas with some valuable bone samples from different sites and in cooperation with Dr. Hasegawa of Hiroshima University they found a very clear and strong signal indicating the magnetic memory effect due to the A-bomb radiation. By comparing the amount of magnetism induced with a Cobalt 60 gamma ray source, they were able to estimate the dose received by the samples in 1945.

Professor Mascarenhas proposed to the Atomic Bomb Casualty Commission (ABCC) in Hiroshima that about twenty thousand A-bomb survivors could now be checked for the dose they received by measuring samples from their teeth. (The ABCC is jointly run by Japan and the U.S. National Academy of Sciences). Teeth are used because the enamel does not change appreciably with age as do other bones in the body. This would allow better treatment of the survivors as well as more adequate correlation of radiation effects such as cancer or genetic changes. The new method may be very important fornuclear accident dosimetry and if perfected, even to measure the accumulated radiation due to x-rays. The method may also be important for scientific proof of the radiation received from a nuclear reactor accident or other strong radiation source such as an excessive x-ray exposure. Professor Mascarenhas and his colleagues in Brazil are also using the method to study bone growth and the repair of bone after radiation in living rats. From this they hope they will be able to understand the complicated mechanism of bone repair after radiation exposure.

The first paper reporting research on ESR-Dosimetry in Brazil

On the Paramagnetism of Bone Irradiated In Vivo*

G. KÖBERLE, C. TERRILE, H. C. PANEPUCCI and SERGIO MASCARENHAS

Orthopaedic Department, School of Medicine of Ribeirão Preto, Ribeirão Preto and Physics Department, Institute of Physics and Chemistry of São Carlos, University of São Paulo, São Carlos, SP

(With 2 text-figures)

INTRODUCTION

It was found recently [1] that paramagnetic centres produced in bone and teeth by X-rays irradiation are very stable and that the number of centres formed can be correlated with the radiation doses. The authors thus concluded, that this effect of radiation on bone could be used in radiation dosimetry, in such application as radiotherapy or nuclear accidents. Nevertheless, as the experiments reported in [1] were carried out in dead bone samples of different origins, the question remained as to whether the same results would be obtained in experiments performed on the bones of living animals.

In this paper we report a series of "in vivo" experiments in albino rats. The results show that the same kind of paramagnetic centres are produced by irradiation "in vivo". Furthermore it was found that for the doses here employed, these centres were not affected after 21 days "in situ", during which the animals were kept alive. This shows that living bone could be used as biodosimeter with a memory of at least the periods measured by us.

* Received October 19, 1972. This work was supported by *Conselho Nacional de Pesquisas, Fundação de Amparo à Pesquisa do Estado de São Paulo, Banco Nacional de Desenvolvimento Econômico* (FUNTEC) and CAPES.

EXPERIMENTAL.

We irradiated sixty 150 g albino rats. The rats were anaesthetized by intraperitoneal injection of 2.33 mg/100 g rat of *Nembutal*®. In the first experiments we tried to irradiate the mid portion of femur and humerus, the position of the limbs on front of the tube however due to the difficulty in reproducing the position of the limbs in front of the tube window the results showed a relatively large dispersion. In view of this problem the experiments were repeated on tail vertebrae, which were much easier to position, thus reducing the dispersion of the results.

As a result of the irradiation set-up shown in Figure 1, three vertebrae were irradiated simultaneously, from which, after measurements, only the one showing the largest number of spins/mg was taken into account. Irradiation was done with a Müller MG 150 KV tungsten target X-ray unit. The samples were placed at 5 cm from the window and irradiated for 10 minutes at 19 mA, using 100 KV accelerating potential. In order to eliminate soft rays and get more uniform radiation a 5 mm bone filter was used. The resulting dose, under these conditions, was measured using a LiF thermoluminiscent dosimeter° and found to be about 1.8×10^4 R.

° Dosimeters used were type TLD-100 microrods kindly supplied by PROF. S. WATANABE from *Institute of Atomic Energy*, S. Paulo.

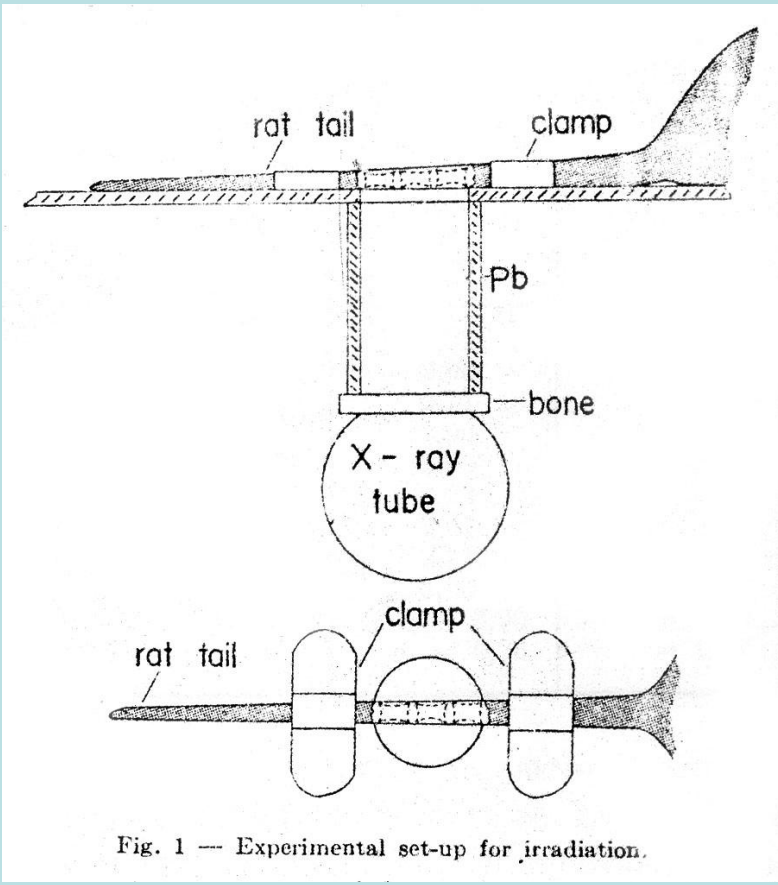

Fig. 1 — Experimental set-up for irradiation.

Annals of the Brazilian Academy of Sciences 1973

The first paper reporting research on ESR-Dosimetry in Brazil

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An. Acad. brasil. Ciênc., (1973), 45 (1):

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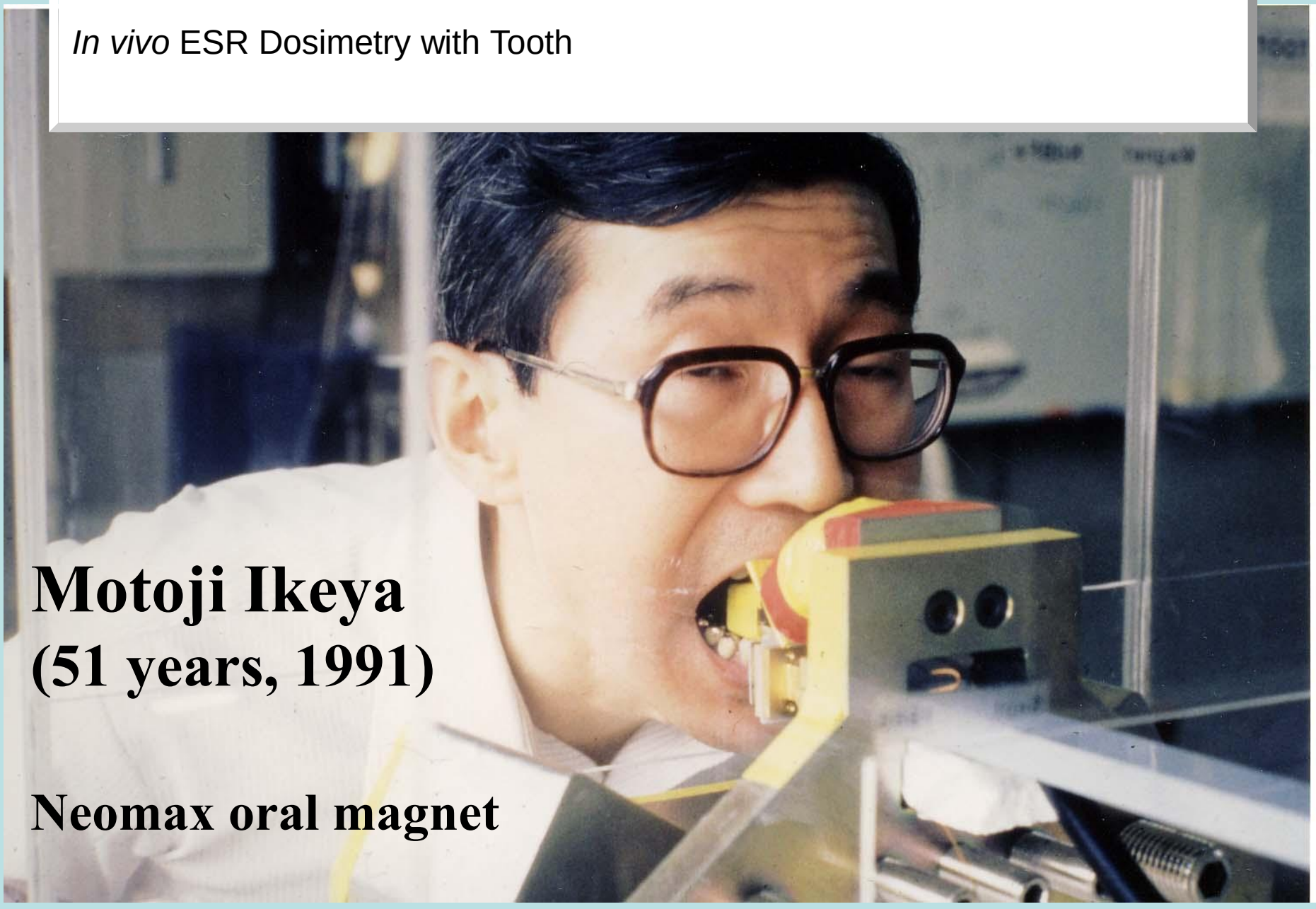
ESR Dosimetry of A-Bomb Victims
Bones from Hiroshima

In vivo ESR Dosimetry with Tooth



PLOS one

PLOS ONE

RESEARCH ARTICLE

Electron spin resonance (ESR) dose measurement in bone of Hiroshima A-bomb victim

Angela Kinoshita[1,2☯*], **Oswaldo Baffa**[1☯], **Sérgio Mascarenhas**[3☯]

1 Departmento de Física, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, São Paulo, Brazil, **2** Pró Reitoria de Pesquisa e Pós-Graduação, Universidade Sagrado Coração, Bauru, São Paulo, Brazil, **3** Instituto de Física de São Carlos, Universidade de São Paulo, São Carlos, São Paulo, Brazil

☯ These authors contributed equally to this work.
* angelamitie@gmail.com

OPEN ACCESS

Citation: Kinoshita A, Baffa O, Mascarenhas S (2018) Electron spin resonance (ESR) dose measurement in bone of Hiroshima A-bomb victim. PLoS ONE 13(2): e0192444. https://doi.org/10.1371/journal.pone.0192444

Editor: Sergey Sholom, Oklahoma State University Stillwater, UNITED STATES

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Published: February 6, 2018

Abstract

Explosion of the bombs in Hiroshima and Nagasaki corresponds to the only historical moment when atomic bombs were used against civilians. This event triggered countless investigations into the effects and dosimetry of ionizing radiation. However, none of the investigations has used the victims' bones as dosimeter. Here, we assess samples of bones obtained from fatal victims of the explosion by Electron Spin Resonance (ESR). In 1973, one of the authors of the present study (SM) traveled to Japan and conducted a preliminary experiment on the victims' bone samples. The idea was to use the paramagnetism induced in bone after irradiation to measure the radiation dose. Technological advances involved in the construction of spectrometers, better knowledge of the paramagnetic center, and improvement in signal processing techniques have allowed us to resume the investigation. We obtained a reconstructed dose of 9.46 ± 3.4 Gy from the jawbone, which was compatible with the dose distribution in different locations as measured in non-biological materials such as wall bricks and roof tiles.

https://www.washingtonpost.com/news/retropolis/wp/2018/05/02/a-single-jawbone-has-revealed-just-how-much-radiation-hiroshima-bomb-victims-absorbed/?utm_term=.e5cf4cdb7be5

much radiation Hiroshima bomb victims absorbed

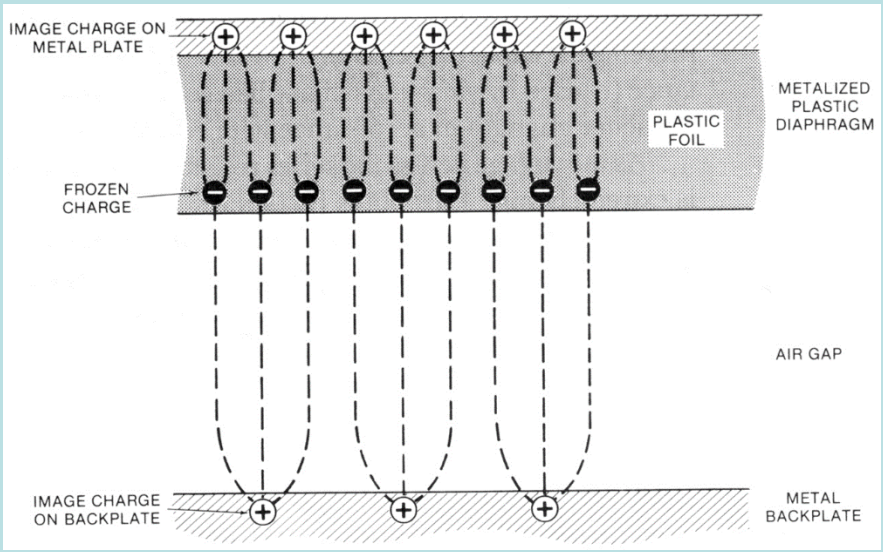
By Kristine Phillips May 2 at 1:30 PM Email the author

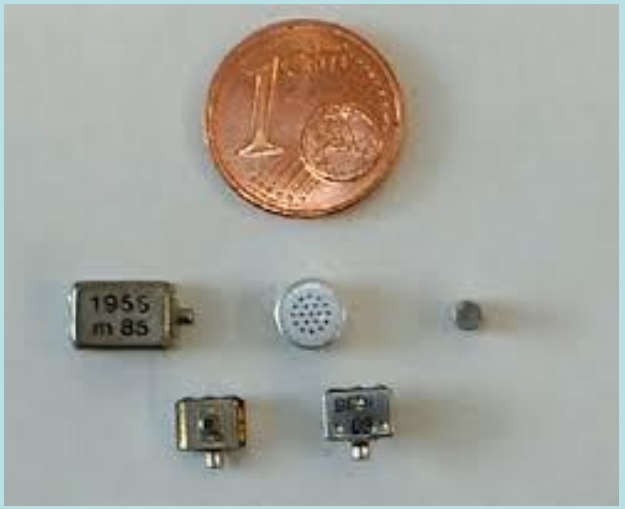
A man stands in the rubble surrounding a former movie theater in Hiroshima, Japan, a month after the atomic bomb was dropped, in September 1945. (Stanley Troutman/AP)

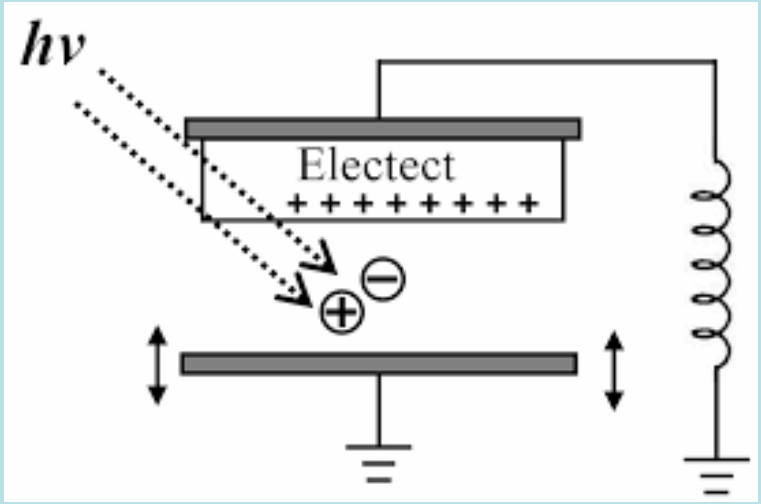
At 8:15 a.m. on Aug. 6, 1945, the United States dropped the first combat atomic bomb, "Little Boy." It exploded 43 seconds later, creating a massive fireball that incinerated much of Hiroshima. Nearly 350,000 people were in the Japanese city that day, and most were civilians.

Twenty-seven years later, a scientist from across the Pacific Ocean arrived in Hiroshima with what was considered then a novel idea. Brazilian physicist Sérgio Mascarenhas, at the time a visiting professor at Harvard University, said that exposure to radiation makes human bone magnetic, and that "magnetic memory" existed in the bones of atomic bombing victims years after the explosion. Scientists could measure radiation exposure by examining the bones of victims, Mascarenhas proposed.

Electret Dosimeter



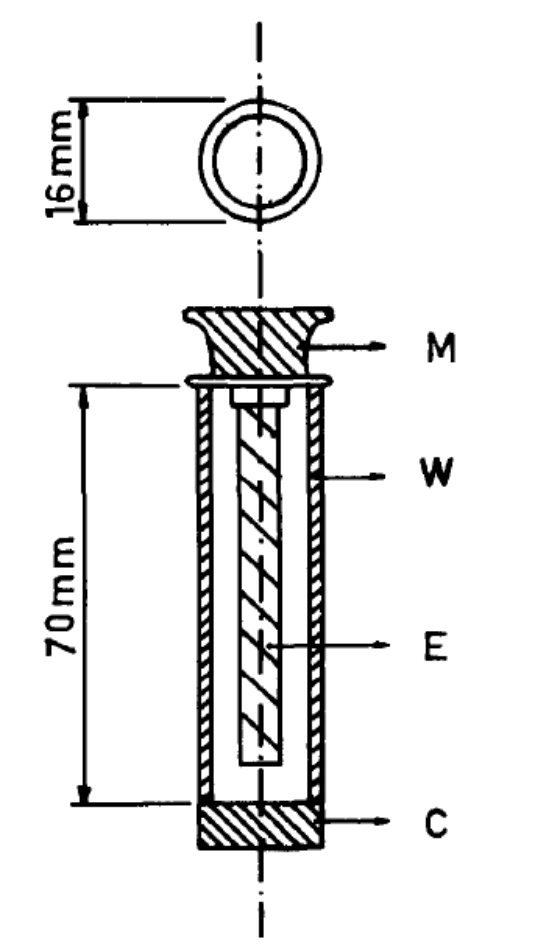


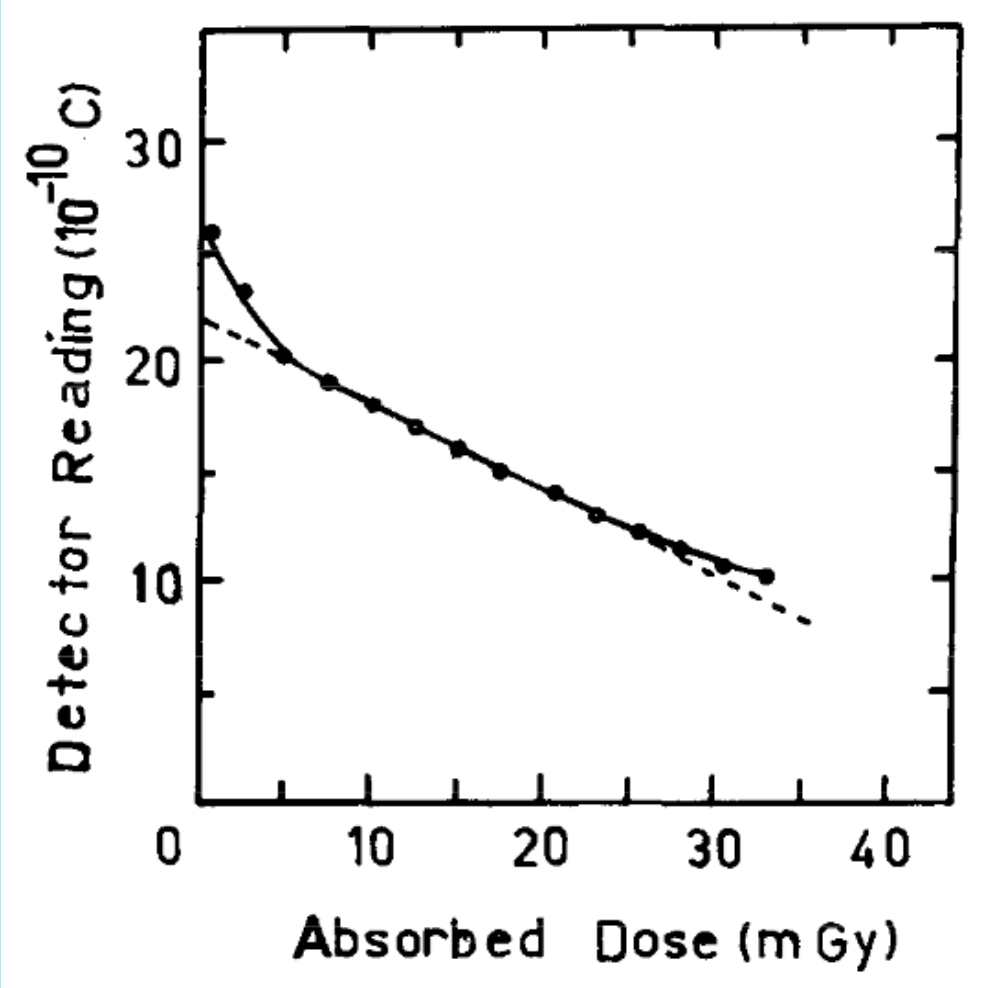


INVESTIGATION OF TEFLON ELECTRET DETECTORS FOR BETA DOSIMETRY

Leticia L. CAMPOS, Linda V.E. CALDAS and Sergio MASCARENHAS *

Nuclear Instruments and Methods in Physics Research A245 (1986) 210-212

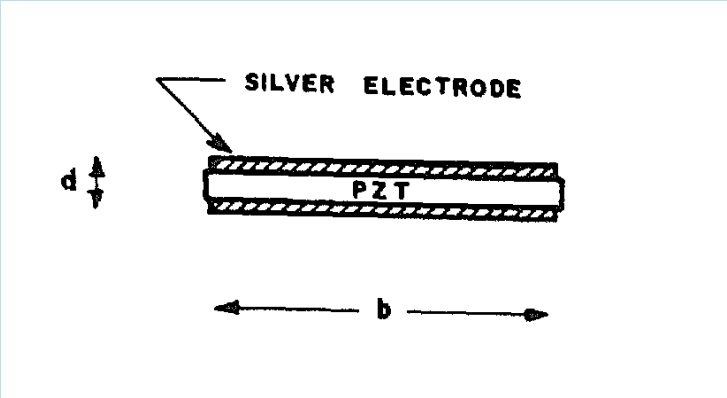


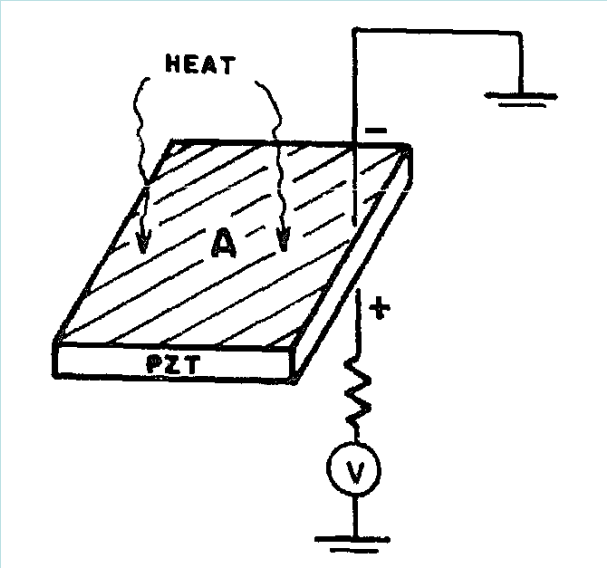


Detector exposed to ^{90}Sr +^{90}Y radiation source.

Calorimetry- Neutron Detection

Electrical configuration of a pyroelectric detector



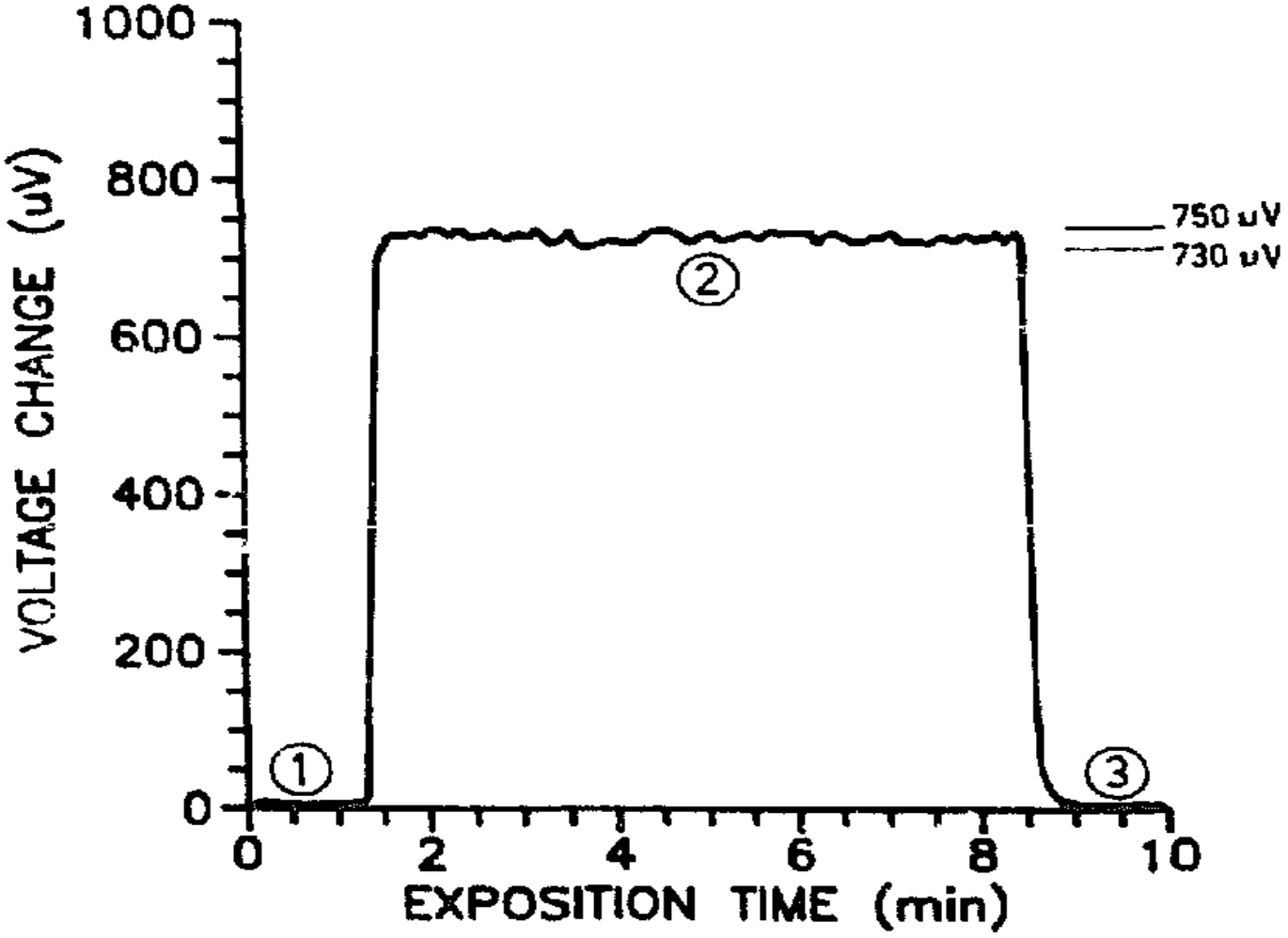


Nuclear Instruments and Methods in Physics Research A311 (I992) 558-562

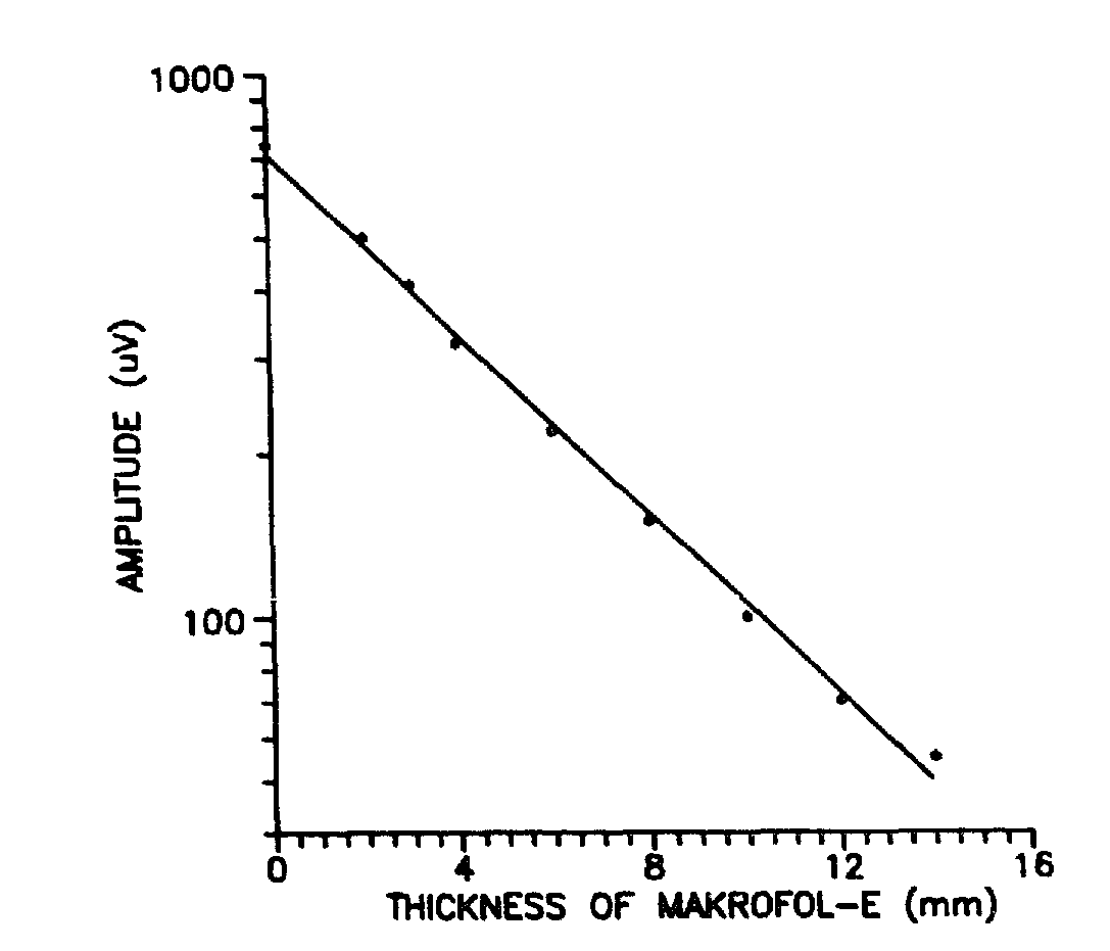
A new technique for thermal neutron detection using pyroelectric ceramics

S.B. Crestana, S. Mascarenhas , L.P Geraldo and A. De Carvalho

Diagram of the neutron detector system



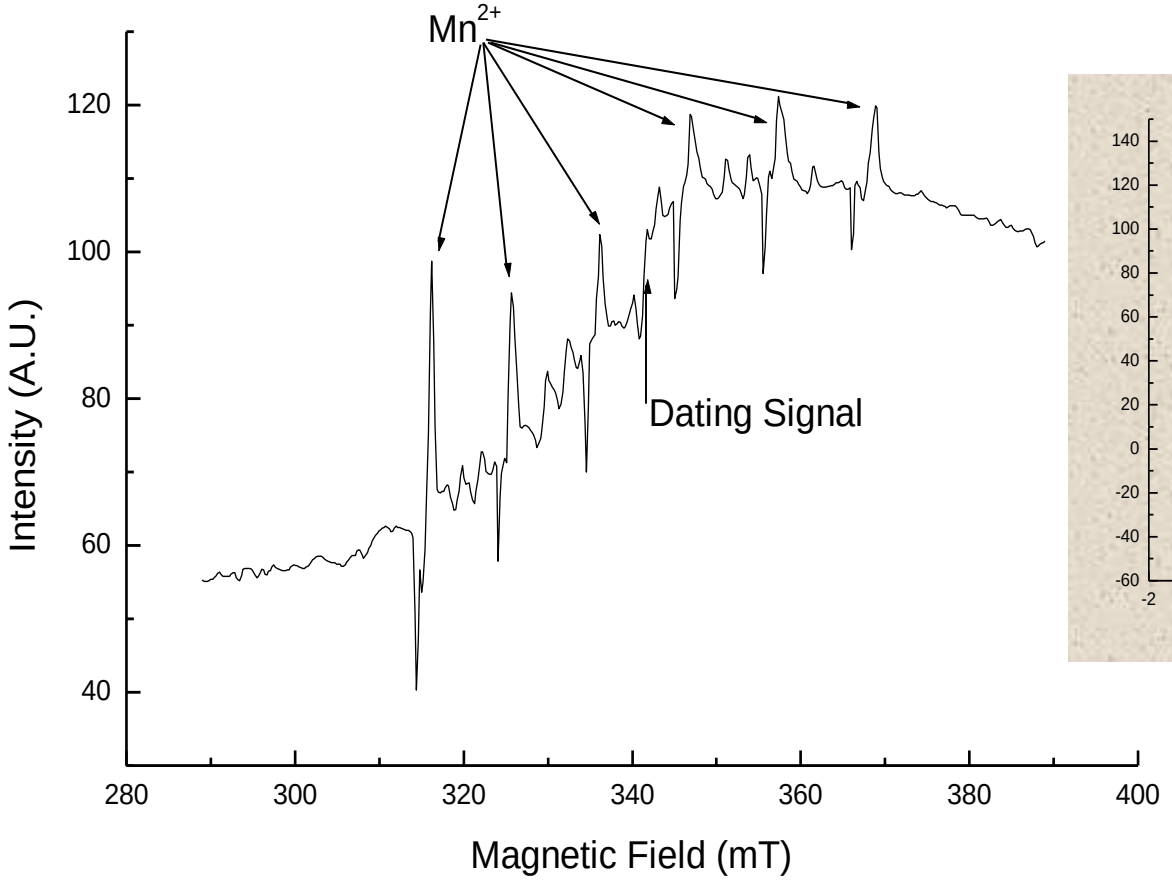
Pyroelectric signal amplitude as a function of Makrofol- E thickness

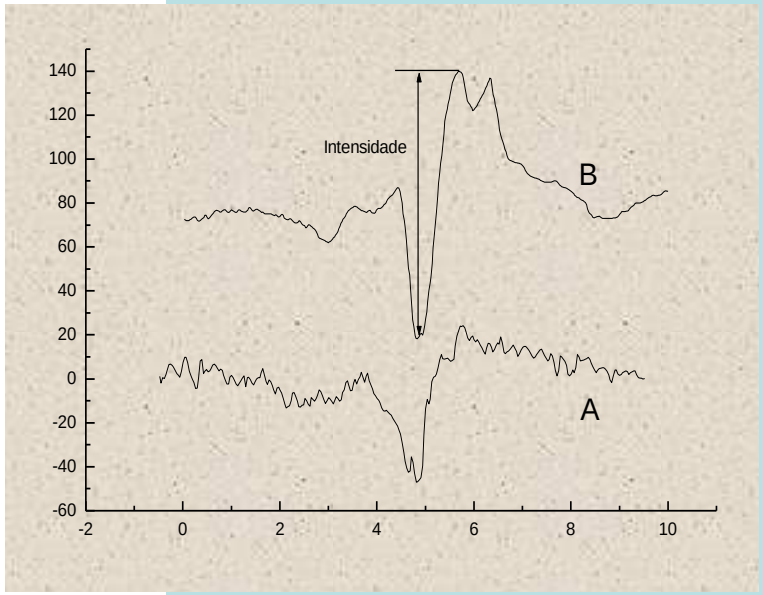


Detector made with (U20%) at a modulation frequency of 3.0Hz

Dating of Sambaquis

ESR Spectra of a Piece of a Fossil Skull Bone ~ 2Ky-bp

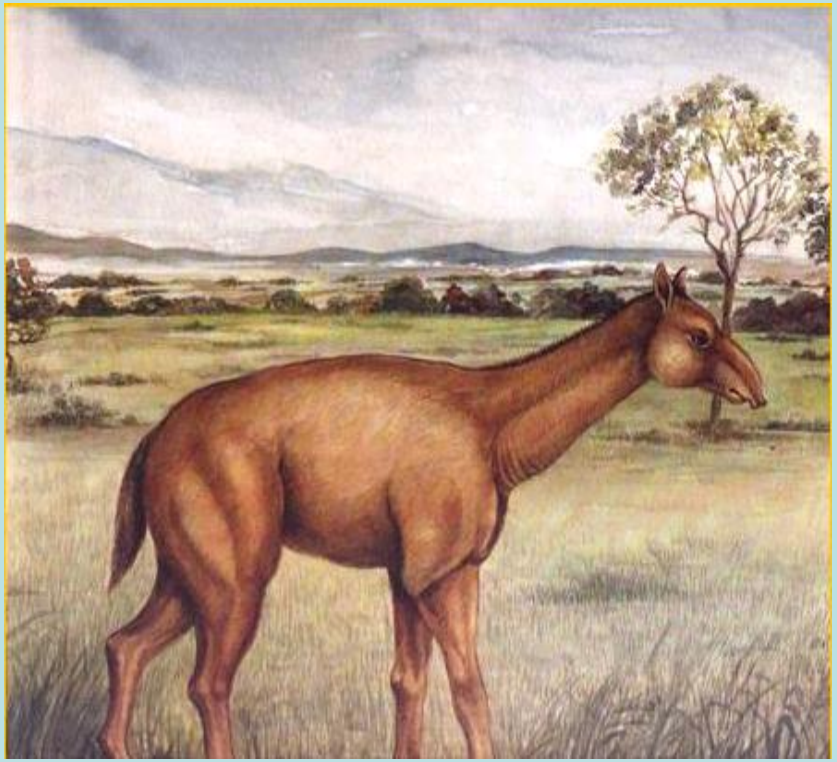




Brazilian Megafauna

Tooth samples of Haplomastodom and Macraucheniidae from Puxinanã (PB)

Brazilian Megafauna



Haplomastodon waringi (Holland)

Xenorhinotherium (Cartele & Lessa)

ESR DATING AT K AND X BAND OF NORTHEASTERN BRAZILIAN MEGAFAUNA

Angela Kinoshita, Alcina Magnólia Franca, José Augusto Costa de Almeida, Ana Maria Figueiredo, Patricia Nicolucci, Carlos F. O. Graeff1 and Oswaldo Baffa

Rock Painting-São Raimundo Nonato

Boqueirão da Pedra Furada

Toca do Serrote da Bastiana with calcite deposits

Moendas..

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Dating human occupation at Toca do Serrote das Moendas, São Raimundo Nonato, Piauí-Brasil by electron spin resonance and optically stimulated luminescence

Angela Kinoshita [a, b], Anne R. Skinner [c], Niede Guidon [d, e], Elaine Ignacio [d, f], Gisele Daltrini Felice [d, g], Cristiane de A. Buco [d, #], Sonia Tatumi [h], Márcio Yee [h], Ana Maria Graciano Figueiredo [i], Oswaldo Baffa [a, *]

[a] Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Av. Bandeirantes, 3900, 14040-901 Ribeirão Preto, São Paulo, Brazil
[b] Universidade Sagrado Coração, Rua Irmã Arminda 10-50, 17011-160 Bauru, São Paulo, Brazil
[c] Chemistry Department, Williams College, 47 Lab Campus Drive, Williamstown, MA 01267, USA
[d] FUMDHAM – Fundação Museu do Homem Americano, Centro Cultural Sérgio Motta, 64770-000 São Raimundo Nonato, Piauí, Brazil
[e] Ecole des Hautes Etudes en Sciences Sociales (EHESS), 54, Boulevard Raspail, 75006 Paris, France
[f] UNIVASF – Universidade do Vale do São Francisco, Av. José de Sá Maniçoba, S/N – Centro, 56304-205 Petrolina, Pernambuco, Brazil
[g] UFPi – Universidade Federal do Piauí, Campus Universitário Ministro Petrônio Portella, Bairro Ininga, 64049-550 Teresina, Piauí, Brazil
[h] Universidade Federal de São Paulo, Campus Baixada Santista, Avenida Saldanha da Gama, n 89, Ponta da Praia, 11030-400 Santos, SP, Brazil
[i] Instituto de Pesquisas Energéticas e Nucleares (IPEN), Cidade Universitária, Av. Lineu Prestes, 2242, 5422-970 São Paulo, São Paulo, Brazil

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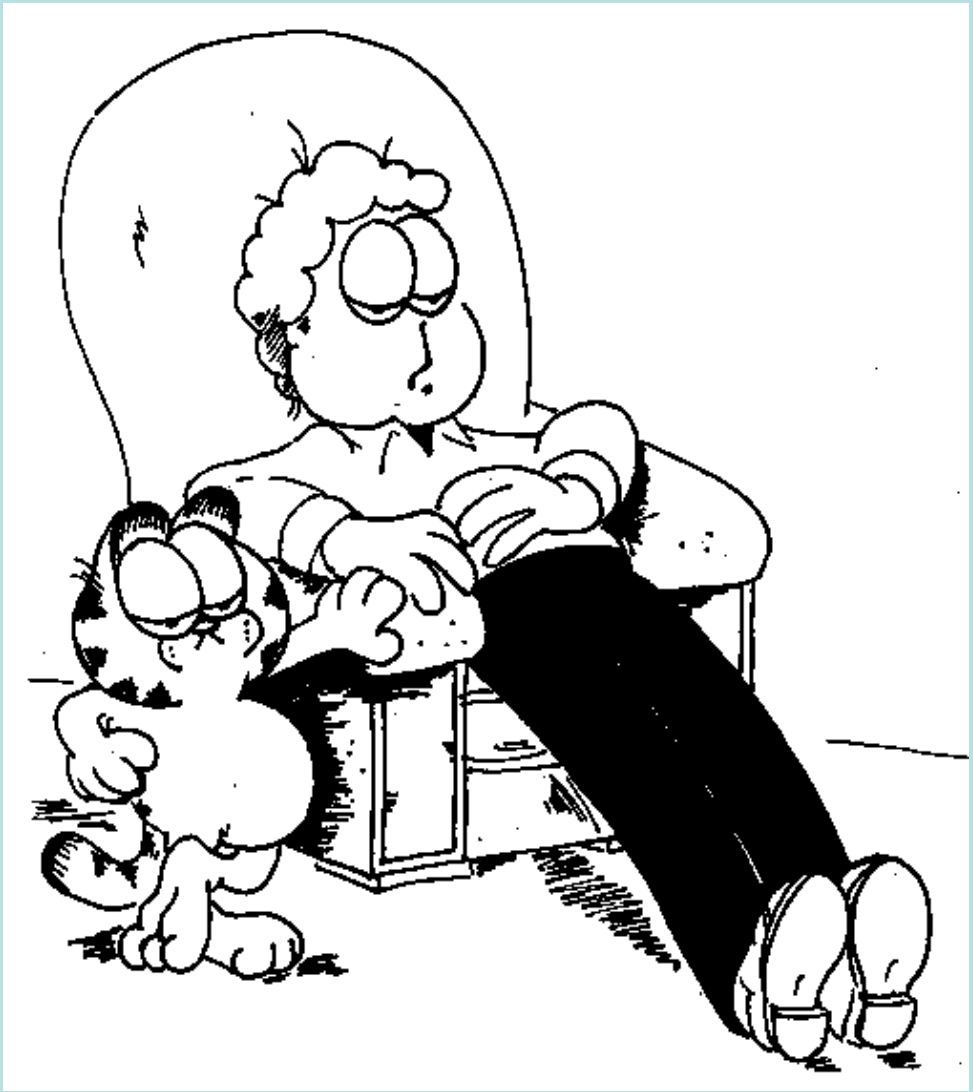
ABSTRACT

Excavation of Toca do Serrote das Moendas, in Piauí state, Brazil revealed a great quantity of fossil wild fauna associated with human remains. In particular, fossils of a cervid (*Blastocerus dichotomus*) were found, an animal frequently pictured in ancient rock wall paintings. In a well-defined stratum, two loose teeth of this species were found in close proximity to human bones. The teeth were independently dated by electron spin resonance (ESR) in two laboratories. The ages obtained for the teeth were 29 ± 3 ka (thousands of years) and 24 ± 1 ka. The concretion layer capping this stratum was dated by optically stimulated luminescence (OSL) of the quartz grains to 21 ± 3 ka. As these values were derived independently in three different laboratories, using different methods and equipment, these results are compelling evidence of early habitation in this area.

Fim !



Acorde o vizinho!

Acabou !

Media Coverage

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Sputnik News (Rússia) - 29 de Abril de 2018

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