

Nuclear Techniques Applied to the Study of Paget Disease of Bone

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Desde 1977 ao serviço da Saúde do futuro



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Objectives

The purpose of this study is to clarify the etiology of Paget Disease of Bone (PDB). PDB is the second most common bone disease after osteoporosis and the symptoms include, among others, bone deformities, bone pain and deafness. In PDB, bone remodeling is abnormal, and this justifies the importance of calcium kinetics studies as a tool for a better understanding of the disease. In PDB there are some important histological abnormalities that might induce modifications on concentration values of major and minor elements on bone. This supports quantitative and qualitative analysis of bone samples affected with PDB to identify a characteristic pattern of the disease which can contribute to a focused therapy.

Methodology

Accelerator Mass Spectrometry (AMS) is a high sensitivity nuclear technique applied to the study of calcium metabolism that involves administration of a long – lived radioisotope, ^{41}Ca , to a number of patients with PDB, and collection of urine samples in the dates established in the protocol. Urine samples are chemically treated, converted to CaF_2 and analyzed for ^{41}Ca content.

Particle Induced X-ray Emission (PIXE) is applied to qualitative and quantitative analysis. Bone samples are polished, dried and then analyzed under vacuum conditions at the microprobe (CTN/IST). For a small selected area of bone sample we have many information: X-Ray spectrum, mapping and line profile of the elements.

Expected Results

Some preliminary studies were performed with a femoral head of a Cat. A slice of the femoral head was analyzed at the microprobe and the X-ray spectrum was recorded (Fig.1). We also obtained maps and line profiles for major elements, Ca and P (Fig.2). These are the type of results we will get for patients with PDB.

The idea is also to compare the calcium metabolism of patients with PDB with normal calcium metabolism and we expect to find differences that will help to answer some unsolved problems related to PDB.

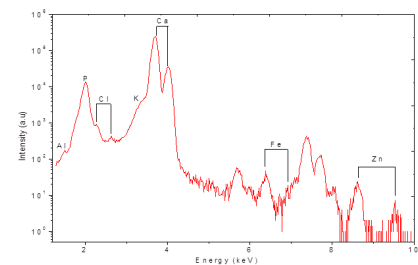


Fig.1) PIXE spectrum from a selected area of the bone sample.

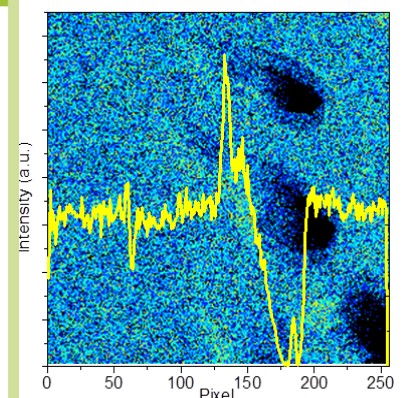
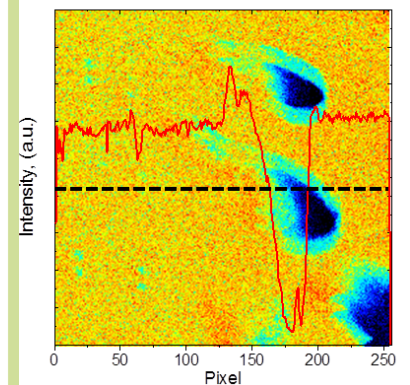


Fig.2) 2D Elemental distribution and line profile of Ca and P ($1060 \times 1060 \mu\text{m}^2$).