ESRF	**Experiment title:** Analysis of bone architecture in osteoporotic patients treated by biphospsonate after one and two years	**Experiment number:** LS 877
Beamline: ID19	**Date of experiment:** from: 26/03/98 to: 28/03/98	**Date of report:** 1 sept 98
Shifts:	**Local contact(s):** José BARUCHEL	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Marie Helene LAFAGE-PROUST*, Saint Etienne Hospital
Professor ALEXANDRE, Saint Etienne Hospital
Françoise PEYRIN*, CREATIS, INSA & ESRF
Murielle SALOME*, CREATIS, INSA & ESRF
Anne-Marie LAVAL-JEANTET, CREATIS, INSA
Peter CLOETENS*, ESRF & EMAT, RUCA, BELGIUM
Guillermo BORRAS*, CREATIS INSA

Report:

Osteoporosis which is a bone fragility disease due to decreased bone mass associated with micro-architectural changes yields to spontaneous bone fractures. New treatments such as biphosphonates (ETIDRONATE) have proved their efficiency to reduce the fracture risk but little is known on their action on architecture. The purpose of this work was to study the influence of osteoporosis treatment on bone architecture using 3D Synchrotron Radiation Computed MicroTomography (SR CMT) at ESRF.

The samples were provided by Bellevue Hospital in Saint-Etienne (Dr. M-H Lafage-Proust, Pr. C. Alexandre). Thirty five iliac crest biopsies from osteoporotic women before and after one and two years of etidronate treatment were selected. They correspond to fifteen patients with at least two biopsies, and five patients with three biopsies.

In experiment LS 587 (1997) fourteen of these biospies were imaged at ESRF. The pixel size on the detector was set to 10.13 microns, leading to a field of view of Icmxlcm. The energy was set to 20 keV. In this new experiment, twenty one biospies were imaged in the same experimental conditions. The complete data set represents 70 Gigabytes.

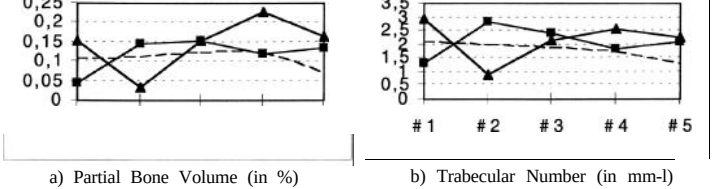
(512)3 Region of Interest of a trabecular region of these images were reconstructed. The cubic voxel size is 10.13 microns. As an illustration, figures la), b) and c) show three 3D displays of an iliac crest sample from an osteoporotic women before and after one and two years of treatment.

a) before b) after one year c) after two years

Figure 1 : Portion of trabecular architecture from 3D SR CMT images

3D image analysis is now undertaken to quantify the trabecular structure. Conventional histomorphometric parameters were already implemented for the analysis of vertebral bone images. They provide on each slice of the volumes morphological and topological parameters such as Partial Bone Volume, Trabecular Thickness, Trabecular Number, and skeleton length. The computation of new direct 3D parameters is under development. Currently a 3D MIL (Mean Intercept Length) method has been implemented. The program which provides a 3D evaluation of morphological parameters as well as 3D MIL parameters and anisotropy degrees, is in the process of being applied to the whole data set.

Figures 2a)-b) represent the evolution of Partial Bone Volume, and Trabecular Number before, after one and two years of treatment on five different biopsies. The results are in agreement with what is expected since the two parameters tend to be increased with the treatment.



a) Partial Bone Volume (in %) b) Trabecular Number (in mm-l)

Figure 2 : 3D Parameters extracted from the 3D biopsy images before (black), after one (gray), and after two years (dotted gray) of treatment