ESRF	**Experiment title:** The study of metal distribution in cellulose fibers in relation to different structural phases of cellulose	**Experiment number:** CH 235
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Names and affiliations of applicants (* indicates experimentalists):

Anders Rindby Chalmers University of Technology, Göteborg, SWEDEN
Per Engström ESRF, Grenoble, FRANCE

Report:

A series of samples of wood tissues has been studied by means of microdiffraction and microfluorescence set-up at ID13. The aim of the study was to investigate the degree of, crystallinity, and preferential orientation of the cellulose molecules in the tissue at a microscopic level and in correlation to the distribution of trace metals witbin the tissue. The samples, which consisted of sections of wood tissue, transversal, radial and longitudinal cuts, had been chemically treated in different ways (H_2SO_4 EDTA etc) in order to effect the metal distributions within the tissue.

Preliminary evaluation shows strong variation of the trace element distribution and significant differences between different traces. The distribution and average concentration level of the traces were strongly effected by the chemical treatment. The figure below shows the distribution of manganese (left) over a few cells at the border between early wood and late wood from spruce. The figure at the right shows the density variation, as recorded from the scattered radiation, over same area.

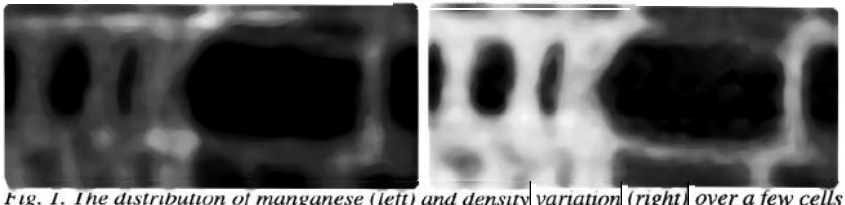

Fig. 1. The distribution of manganese (left) and density variation (right) over a few cells in plant tissue from spruce. The large cell in the middle (slightly to right) is in the first row of cells generated at the onset of the growths-period in the spring, while the smaller cell to the left represent the dens area or so called latewood. Image dimensions are 100x50 micrometers

The distribution of trace elements mainly goes along with the cell walls, however, some of the elements seems to appear in localized areas rather then being evenly distributed in the organic material. For the transversal cuts (like fig. 1) the fiber-axis is perpendicular to the image plane. In these cases the diffracted radiation operates as an indicator for the fiber-axis orientation. While scanning over an individual cell wall, there is a small but significant indication of a shift in the fiber orientation.

In order to understand the metabolism and translocation of the trace elements it is necessary to determine exactly where in the tissue these elements appear and how the micro-distribution looks like. Fig. 2 shows an example of the distribution of calcium and titanium around a "transportation" channel in the tissue. While calcium seems to be related to the organic part, titanium appears in clusters (small inorganic particles) which seems to have accumulated around the channel. In same cases the diffracted radiation has indicated the presence of small inorganic crystals (titanium-oxide, quarts etc).

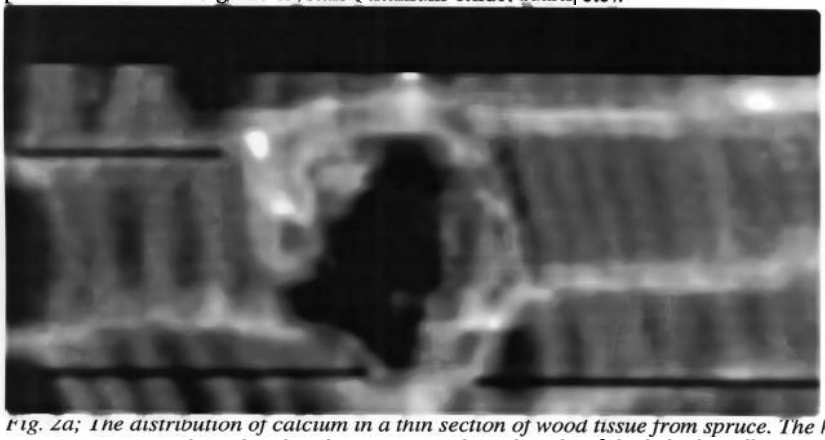

Fig. 2a; The distribution of calcium in a thin section of wood tissue from spruce. The hole in the middle is a "transportation " channel within the tissue. On the right side of the hole the cells are more densely packed as compared with the cell rows on the left side. The image dimensions are 200x100 micrometer.

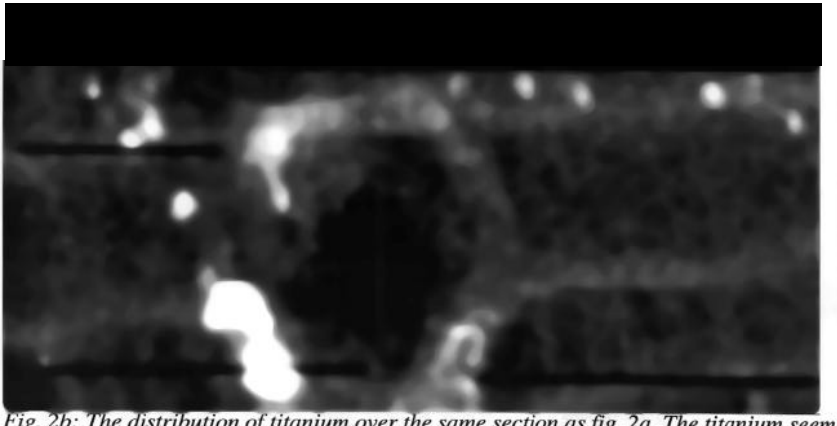

Fig. 2b; The distribution of titanium over the same section as fig. 2a. The titanium seems to appear in clusters (or particles) which has accumulated around the central channel.