	Experiment title: Investigation of Pb in human brain by µ-SRXRF	**Experiment number**: MD64
Beamline:	**Date of experiment**: from: 7.2.04 to: 10.2.04	**Date of report**: 18.02.2004
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Report:

Aim of the project was to investigate the distribution of trace elements in human brain slices. Among the variety of heavy metals, lead (Pb) is known to induce many adverse health effects in men. In fact, cognitive deficits are repeatedly described with Pb exposure, but little is known about the distribution of lead in brain and whether Pb is associated with the distribution of other heavy metals such as Zn, Fe etc. which could reveal some hints for Pb metabolism in brain.
Brain slices (20µm, imbedded in paraffin and mounted on Kapton foils) from areas of the frontal cortex, thalamus and hippocampus were investigated. Analyzing blank measurements in paraffin and Kapton, no Pb was detected. Energy to excite Pb sufficiently was set to17 keV, and was additionally sufficient to achieve low background signals at Pb La (10.5 keV). Beam size was 5/3.3 µm (horizontal/vertical). The measurements were performed in air. Thus, Ar and Kr lines were present in the spectrum.
Fig. 1 shows the microscope image (left side) and element maps of a plexus choroidei, a meshwork of vessels where the liquor cerebrospinalis is generated. A strong correlation between the distribution of S, Ca, Fe, Cu , Zn and Br can be seen. However Pb can only be found at singular points of this meshwork (see the bow in the lower left corner). Moreover some Pb 'hot spots', do not correlate with the structure (red point on the right side) and need further investigations of this structure in comparison with the histological slice of 1 µm thickness form this areas. The overall investigated area was 400 x 400 µm with a step width of 20 µm.

Fig. 2 shows the microscope image (left side) and element maps of an other investigated area which was presumable a blood vessel. The clear detection of Fe inside confirms this assumption. Again and in comparison with Fig.1 Zn, Ca, S and Br (with three hot spots) seem to correlate with the vessel wall. Inhomogeneities seem to be most likely the result of preparation and slice technique. But again isolated Pb concentrations were found partially within the vessel wall but also within brain tissue. Up till now it is not

clear whether they represent artefacts or special regions of Pb metabolism. Small step size scans revealed a correlation with Ca, Fe, Cu and Zn with Pb with a spot size of 10-20µm.

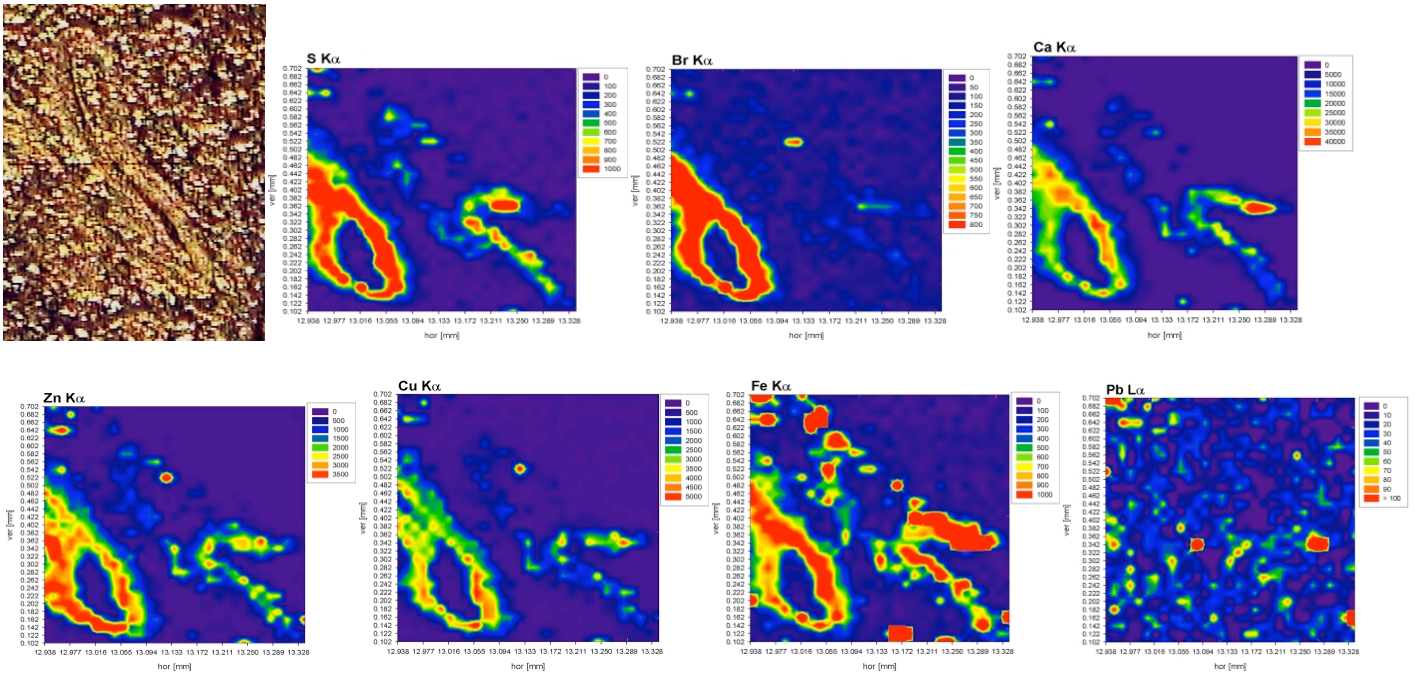

Fig.1 Microscope picture and elemental maps of plexus choroidei adjacent to thalamus area.
Scanned area: 400 x 400 µm, step size: 20 µm, measuring time: 5 s

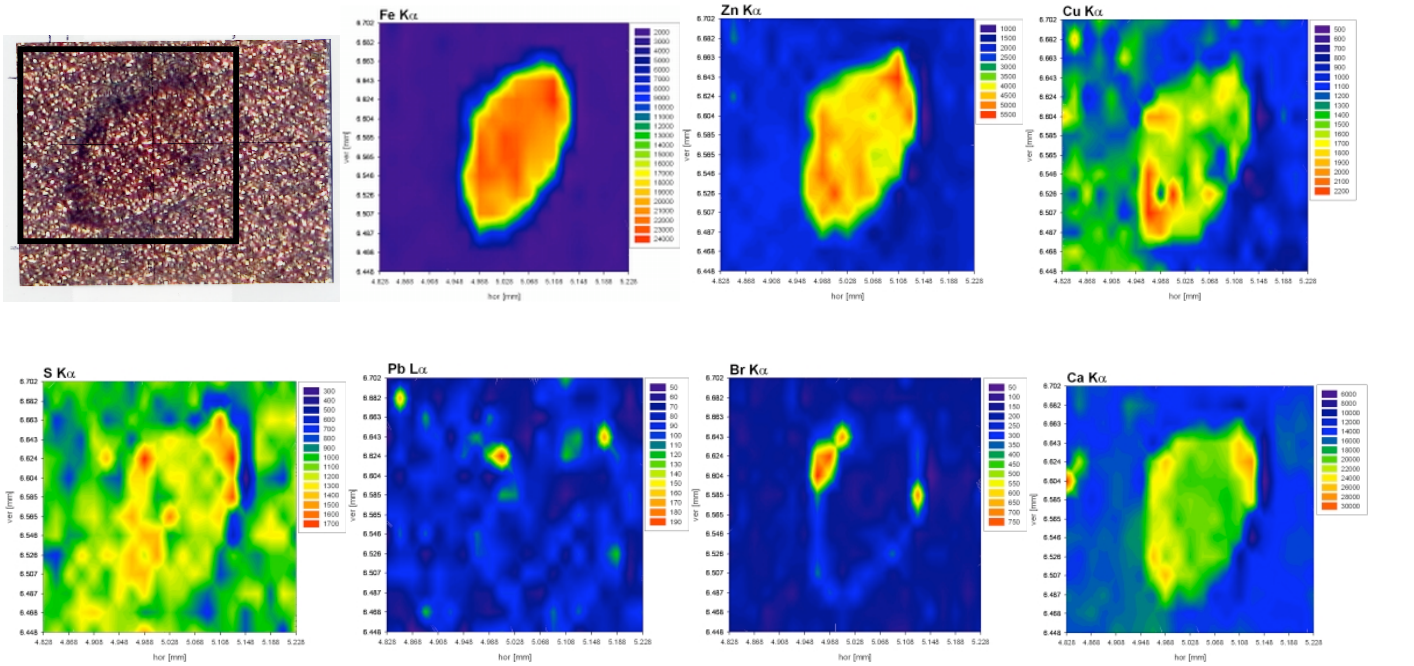

Fig.2 Microscope picture and elemental maps of a blood vessel in the Hippocampus area
Scanned area: 400 x 400 µm, step size: 20 µm, measuring time 5 s

In conclusion the experiment was very successful and promising. Pb could be detected in all investigated brain areas: frontal cortex, thalamus and hippocampus. Surprisingly Pb was not homogenously distributed and this more singular distribution correlated individually with various elements. Therefore it seems necessary to investigate oxidation stages of Pb and Pb-compounds which characterize these inhomogeneities. XANES measurements are a valuable tool for these investigations and are important to understand the metabolism of Pb.

All in all 20 areas in three different brain regions were investigated resulting in 2000 spectra during each scan. Thus, 80 million spectral data had to be analyzed. This was only possible with the perfect support of the available software at ID 22 and the local team.