Elemental Distributions in Cancerous Lung Tissue

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We have performed x-ray fluorescence (XRF) mapping to determine elemental distributions in cancerous lung tissue. Our studies compare tissue samples from three people who developed similar types of lung cancer: 1) a Chernobyl clean-up worker, 2) a person who lived in the area of radioactive fall-out associated with the Chernobyl disaster and 3) a person who developed the same type of lung cancer but who was not involved with the disaster. We are investigating whether or not a correlation exists between this cancer and elemental distributions as well as particulate shape and size. Located below is an optical micrograph of lung tissue from the third person. The cancerous regions are white while the healthy regions are dark. XRF scans were performed on this tissue with the box indicating the scan region. A wide variety of elements were detected, notably particles of Fe, Cu, and Zn. Furthermore, strong correlations between Fe and Zn, S, K and Cl as well as Ca and P were seen. On the right hand side of the figure are the specific maps for Fe, Cu, and Zn, aligned to show their correspondence to the boxed area in the optical micrograph. A correlation exists between all three elements in a diagonal region in the lower part of the box. This area is associated with the large white area in the optical micrograph, which is cancerous tissue. In other samples Zn, Ti, Cr, Fe, Ni, and Co particles are seen in both healthy and diseased regions. These particles are often in the 10 – 20 μm range, although some

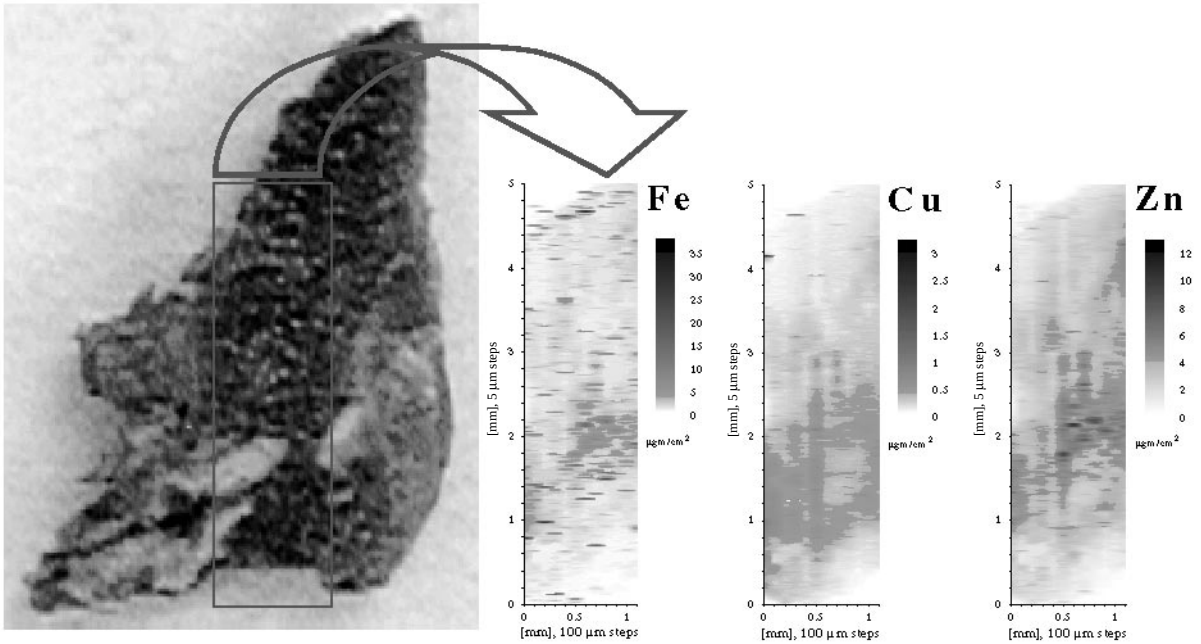

Figure showing an optical micrograph of lung tissue sample #3 with the box indicating the scan region. On the right hand side of the figure are the specific maps for Fe, Cu, and Zn, aligned to show their correspondence to the boxed area in the optical micrograph.

are larger. In some cases, the particles are composed of several elements. In addition, broad but relatively weak correlations are seen in some larger areas involving P, S, K, and Ca. Future work will focus on obtaining more detailed maps over larger areas of all samples, and determining the distribution of size, shape, and composition of the observed particles, their relationship to the healthy and diseased portions of the samples, and their relation to disease.

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