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Electron Probe X-Ray Microanalysis in Pathology and Research

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A variety of frequently encountered clinical problems lend themselves readily to investigation by analytical electron microscopy. e.g., a combination of scanning or transmission electron microscopy and energy dispersive x-ray microanalysis. The most common application is identification of xenobiotics or exogenous substances, such as localization and quantitation of inorganic particulates in lung tissues in patients with pneumoconiosis; identification of foreign materials within granulomas; and analysis of foreign bodies. Electron probe X-ray microanalysis (EPXMA) is also useful in the study of tissue reactions to various surgical implants of foreign materials. A variety of metals and other elements may be detected with energy dispersive X-ray analysis, including copper in tissues of patients with Wilson's disease, thorium and gadolinium [1] in patients injected with radiographic contrast agents (Figure 1), or gold in patients treated with long-term chrysotherapy. Endogenous particulates such as urinary calculi (Figure 2), gallstones, intraarticular and periarticular crystalline deposits in patients with rheumatic disease, dystrophic or metastatic calcifications, and hemosiderin may be analyzed rapidly and efficiently by means of EDX [2,3]. Certain organometallic drugs such as amiodarone (iodine) or sodium stibogluconate (antimony) may also be detected in human tissues. Analytical electron microscopy has been a useful adjunct to forensic pathology for many years in diverse areas such as identification of trace evidence constituents or detection of arsenic or lead in victims with heavy metal poisoning. The detailed elucidation of anatomic, physiologic, and pathologic conditions provided by analytical electron microscopy is a useful diagnostic and investigative tool in clinical medicine; the analytical results often have diagnostic, therapeutic, and/or medicolegal implications [4]. This imaging technology should grow in utility in the future as it is complemented by other techniques such as mass spectrometry, and laser Raman and infrared microspectroscopy.

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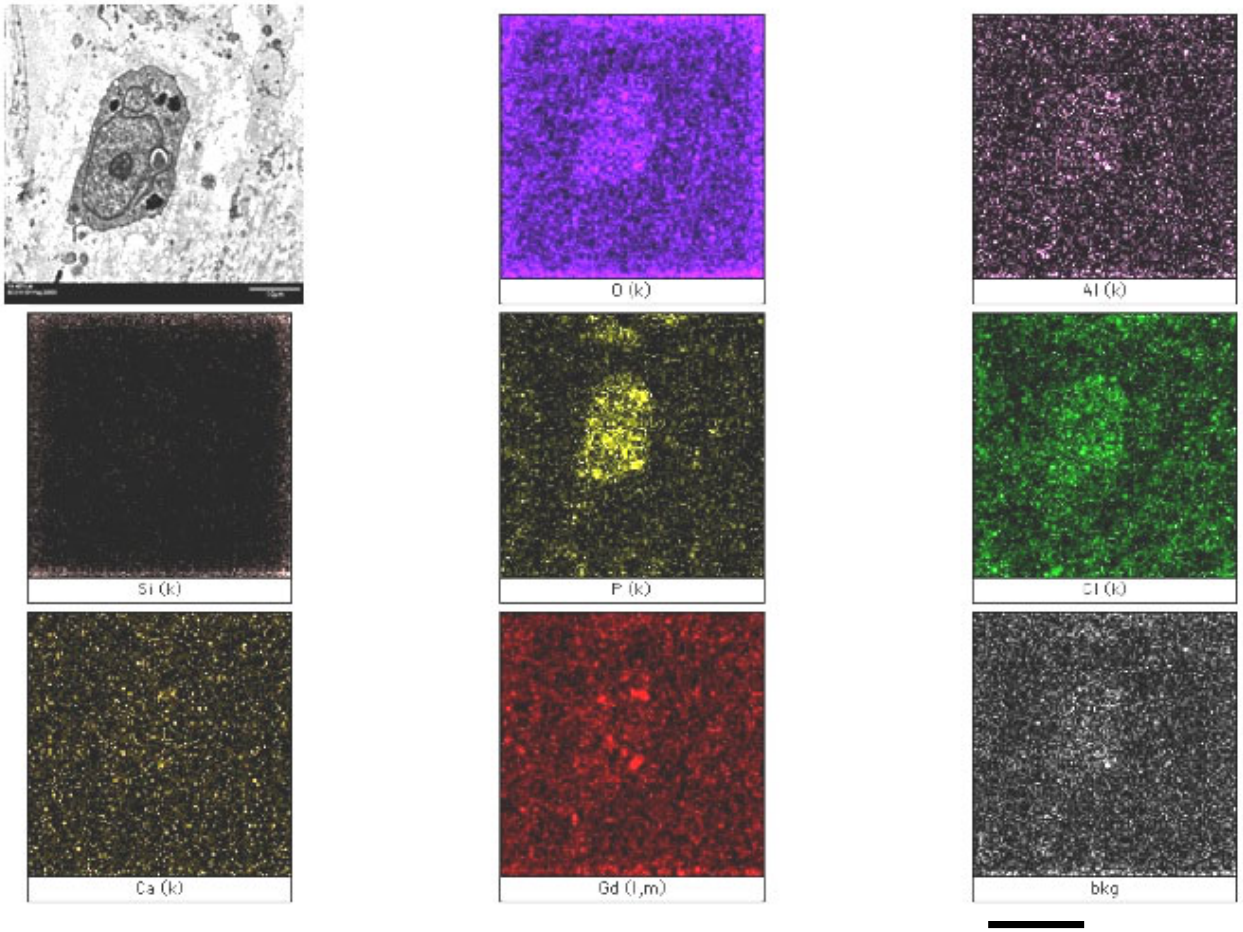

Figure 1. TEM+EPXMA maps from thin section of a skin biopsy w/ Gadolinium

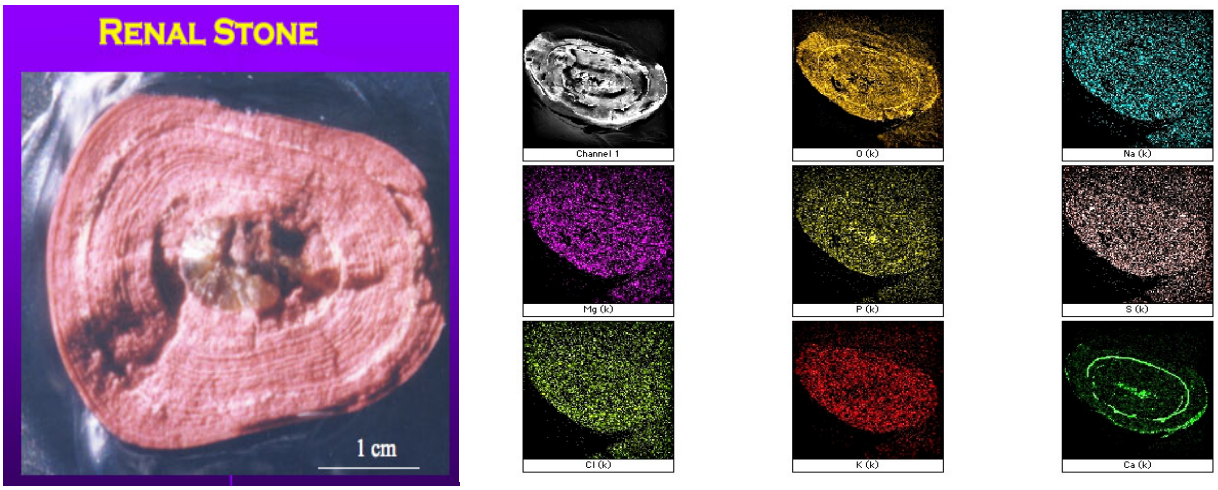

Figure 2. Light Microscopy SEM+EPXMA Maps from a similar Renal Stone

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