Salivary and Kidney Stones: Insights into Pathologic Biomineralization

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Introduction

- Randall's plaque (RP), salivary stones, and calcium phosphate (CaP) based kidney stones are all predominantly composed of the same material.
- Patients with salivary stones are 4.74 fold more likely to have nephrolithiasis (Acta Otolaryngol. 2016; **136**: 497–500).

Objectives

To correlate Randall's plaque and calcium phosphate based kidney stones to salivary stones using multiple advanced imaging modalities.

Materials and Methods

- N = 5 salivary stones, N = 5 oxalate stones with RP stem, and CaP based kidney stones were used.
- **Correlative Imaging**: Light Microscope, Scanning Electron Microscope, X-ray micro-computed tomography (micro-CT), Energy Dispersive X-ray (EDX) mapping; Correlated mineral density and elemental maps

Figure 1: Hierarchical Structure of Salivary, Phosphate, and Stem Stones

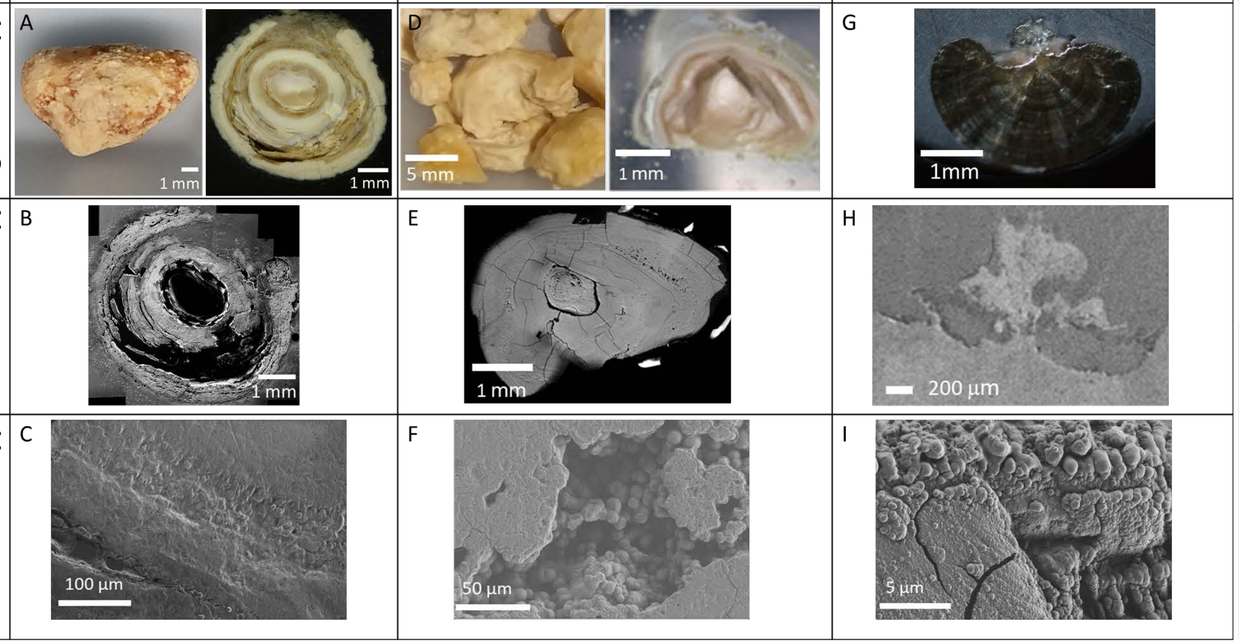
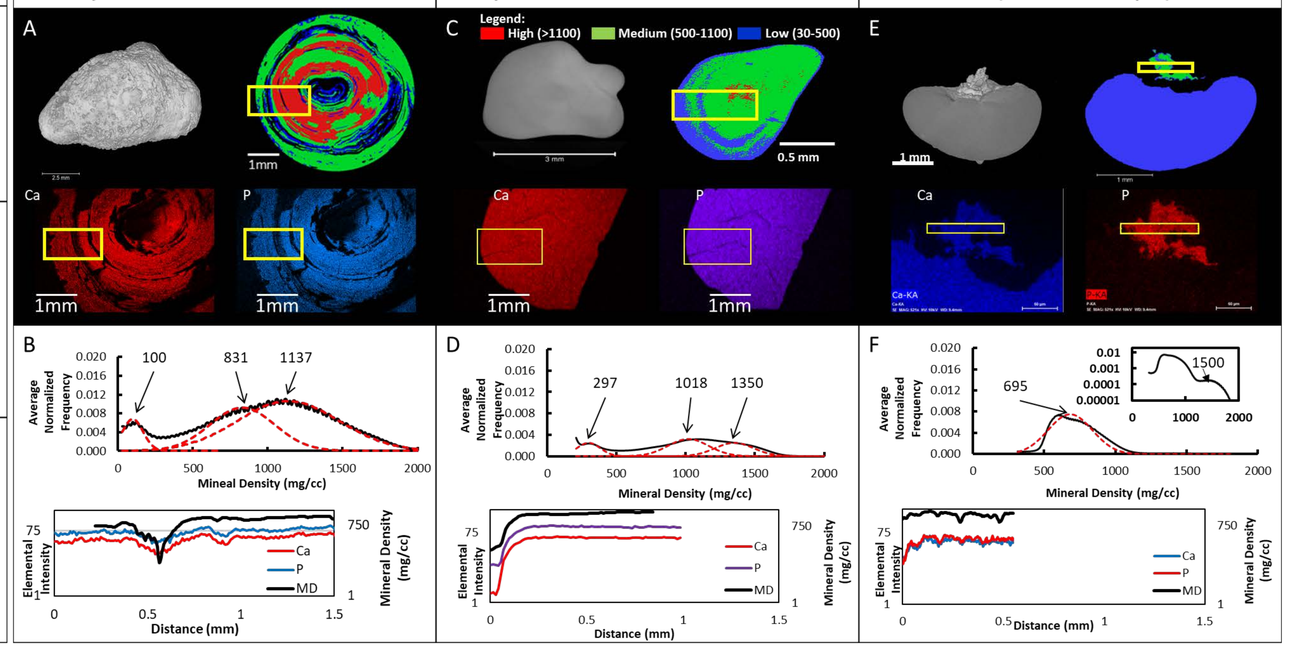


Figure 2: 3-Dimensional Features, Mineral Density, and Chemical Composition of Salivary Stones and Kidney Stones



Results

- Sialoliths and CaP nephroliths showed layer-by-layer apposition (Figure 1, A, D, G)
- EDX confirmed CaP composition of RP, sialoliths, and CaP nephroliths (Figure 2, A, C, E).
- Mineral density (MD) profiles were trimodal (low, medium and high MDs, Fig 2, upper graphs B, D, F) for all stone types and ultrastructural features were similar across kidney and salivary stones (Fig 1 C, F, I); **Low**: plate-like formations; **Medium**: spherulitic particles; **High**: packed spheres.
- EDX based Ca and P were spatially correlated with micro-CT based MD profiles (Figure 2, lower graphs B, D, F).

Conclusions

Kidney and salivary stones follow a common hierarchical archetype suggesting a shared mechanistic process for biomineralization.

Funding: NIH NIDDK R21DK109912 (SPH*, MLS) *corresponding principal investigator