

Images in Nephrology
(Section Editor: G. H. Neild)

The mineralogy and internal structure of kidney stones

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Keywords: calcium oxalate monohydrate; damage epithelium; inner structure; papillary stones

Two female patients (21 and 57 years old, respectively) had similar cases of naturally passing kidney stones (size: $4.0 \times 4.0 \times 2.0 \text{ mm}^3$).

X-ray diffraction analysis was used for identifying the crystalline components of these stones, which mainly consisted of calcium oxalate monohydrate (whewellite, $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$), but a small amount of organic matrix could be found, too.

The petrographic thin section [1] of these stones (Figures 1 and 2) was examined with a polarizing microscope in order to provide information on the shape and the internal structure of the crystals, the location of the components and the close relationship between crystals and the organic matrix.

The results show that these kidney stones consist of a core with a concentric layer and a whewellite columnar striated layer. Both of them are more evident in the first case (Figure 1). Special attention was given to identifying the position of the core, that is not situated in the central zone and is basically constituted by an organic matrix and small whewellite crystals.

Because of their composition and fine inner structure as well as the occurrence of a decentered core, such kidney stones can be classified as whewellite papillary stones [2].

The formation of this kind of core type represents the first and perhaps the most important step in the development of a papillary whewellite stone and, moreover, provides information about a clearly distinguishable site of attachment to the kidney wall.

This type of core can only be formed on sites with altered (damaged or just slightly injured) epithelium [3]. The cells of damaged epithelium tend to accumulate calcium, thus creating favourable conditions for the formation of kidney stones containing crystals.

These, when combined with urinary conditions suitable for crystallization, produce an important deposit of material on the damaged epithelium, which serves as a substrate for further nucleation of whewellite stones [3].

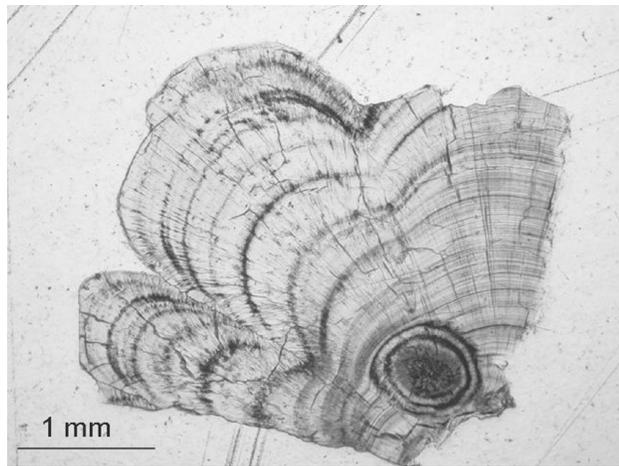


Fig. 1. Polarizing microscope image on the petrographic thin section of stone no. 1. The excentric core, located near the point of attachment to the papillae, and a radially striated compact layer can be seen.

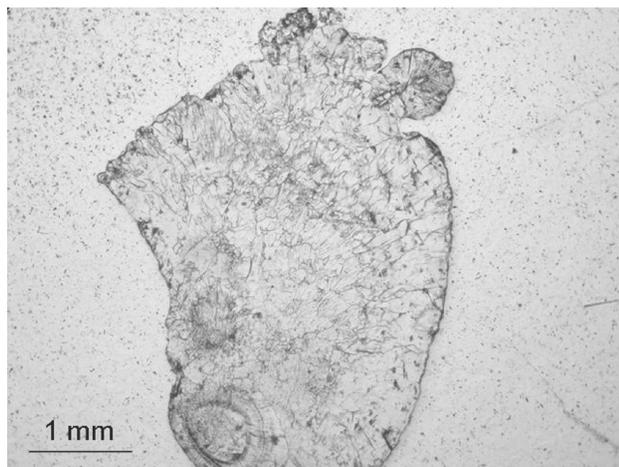


Fig. 2. Polarizing microscope image on the petrographic thin section of stone no. 2. The excentric core, located near the point of attachment to the papillae, can be seen.

Conflict of interest statement. None declared.

References

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Received for publication: 22.4.09; Accepted in revised form: 19.5.09