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ELECTRON MICROGRAPHS OF A CYSTINE UROLITH
JOHN H. L. WATSON*

These first electron micrographs1 to be taken of kidney calculi illustrate a method for studying the structure of uroliths and other body concretions by the electron microscopy of carbon replicas. They show in cystine calculi in particular that, where the stones are opaque to x-rays and hard, these properties are due to efficient packing of the microscopic cystine tablets into the macroscopic stone. The series shows the cystine crystalline layers at a variety of inclinations to the observer. There did not seem to be any overt changes in morphology from location to location in this stone nor was any core structure determined as such. There were very few granular areas. There was no visible evidence of colloid, the stone being a product of true crystallization from solution. In stones of other genesis it might be that colloidal structures would be demonstrable.

To prepare the carbon replicas the stone was split and the split surface polished and etched in KOH. A carbon film was evaporated upon it from an arc in a vacuum. The film was removed by immersing the calculus in a solution of KOH and mounted from the surface of this solution upon a usual electron microscope specimen screen. These films are carbon replicas which faithfully record the structures of the surfaces upon which they were originally deposited.

The micrographs are positives and wherever the image is lighter in density the carbon film is thinner. The replicas give an illusion of three dimensions which may be exploited in stereoscopy of them. The sloping areas present effectively thicker targets to electrons and are darker in the micrographs, the flat planes are lighter in intensity. The very light areas are regions where the carbon has been effectively 'shadowed' by the structures. The black areas represent deep, abrupt holes or slopes.

REFERENCES

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† Three of these micrographs were accepted for exhibition at the 26th Annual Meeting of the Biological Photographic Association, Inc. and one of them, Figure 8, won a ribbon in the Photomicrography Class.

The length of the line in the lower right hand corner of each figure indicates one micron at the print magnification. One micron = 0.0001 cms.
Figure 1

A carbon replica of a cystine urolith x12,000. L-cystine has an hexagonal trapezohedral structure with crystals occurring as tablets with perfect basal cleavage along the (0001) planes. This micrograph illustrates this cleavage and shows piles of hexagonal tablets.
Figure 2

A carbon replica parallel to the (0001) planes of a cystine urolith, x12,000. The homogeneity and close packing of the structures are illustrated.
A carbon replica parallel to the (0001) planes of a cystine urolith, x12,000. Hexagonal depressions and piles of hexagonal platelets are seen, several ‘grain boundaries’ are observed.
A carbon replica of the split surface of a cystine urolith oriented at an angle of about 75 degrees to the observer so that the (0001) planes are still predominated in the field. The lines of cleavage in the crystal are shown, x12,000.
Figure 5

A carbon replica of the split surface of a cystine urolith with the layers tilted so that the edges of the (0001) planes rather than their surfaces are becoming predominant, x12,000.
A carbon replica of the split surface of a cystine urolith where the tablets are at an angle of about 15 degrees to the observer. The tips of the tablets have been etched or broken to protrude so far that they throw long shadows (light triangles), x12,000. Some structure is observable perpendicular to the (0001) planes.
Figure 7

A carbon replica of a cystine urolith split at an angle of about 15 degrees to the observer, to show compact tablet nature of the crystal, x12,000.
A carbon replica of a cystine urolith, observed perpendicularly to the (0001) planes to show the edges of these planes, x12,000. Some structure is visible at right angles to these planes.
Figure 9

A carbon replica of a cystine urolith to show one of the few areas in which granular material and tiny crystals were seen oriented at random, x12,000.