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Calcified Aorta, Urine Lithiasis and Hydroxyapatite Stars

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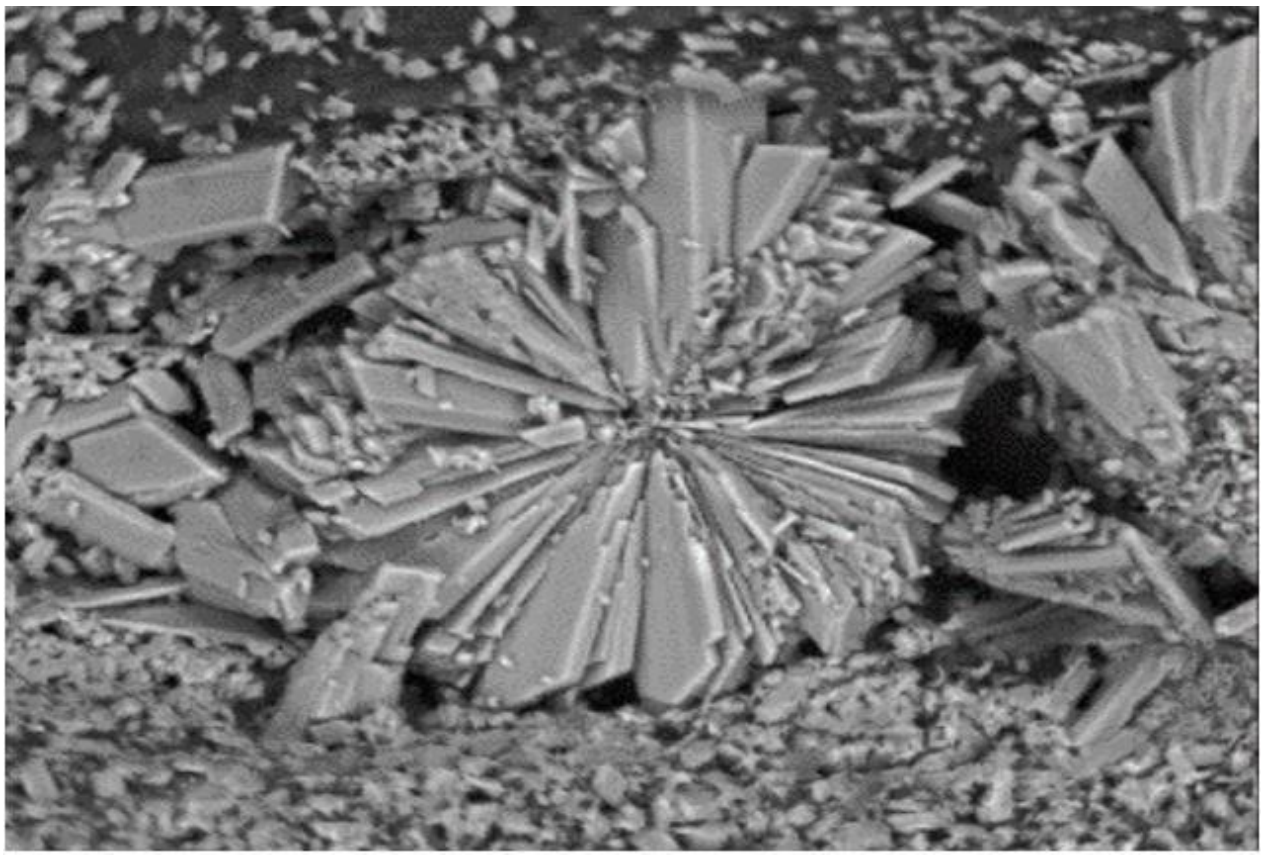

Figure: This SEM images illustrated star morphology HAP crystal in a calcified human aortic valve, obtained at the Petrology Laboratory of the Institute of Geophysics at the Universidad Nacional Autónoma de México.

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Calcification is a key process in the development of degenerative aortic stenosis. Spherical crystalline particles, composed of calcium (Ca^{2+}) and phosphorus (PO_4^{3-}) and, in smaller portions, a compacted material of magnesium (Mg), carbon (C) and fibers are the starting point of the aortic calcification process.

Hydroxyapatite (HA) is a very versatile mineral formed by calcium phosphate in amorphous (the most frequent) or crystalline structures. The morphology of HA crystals depends on Ca/P molar ratios, temperature, pH, movement and pressure. In artificial conditions, we are able to obtain HA crystallization in acicular shapes for medical applications (bone, dental and filler material). Changing environment variables, we can get also long plate-like crystals, hexagonal prism-like crystals, and flakes forms.

Finding star-shaped HA crystals in nature is uncommon. In humans, we had only observed this form in urine and now, by of SEM (scanning electron microscopy), in the aortic valve of patients with degenerative stenosis. As crystal shape depends on environmental conditions, knowing the shared factors that lead to certain morphologies could us better understand mechanisms of calcification in biological tissues.