

HUMAN KIDNEY STONE STUDIES BY SEM/EDX AND LA-ICP-MS METHODS

DONATELLA BARCA^{1*}, MAURO FRANCESCO LA RUSSA²

¹Dip. di Scienze della Terra Università della Calabria, Rende (CS), 87036, Italy

²Dip. Scienze della Terra Università della Calabria, Rende (CS), 87036, Italy

d.barca@unical.it

In this paper we describe the compositional and morphological characteristics of nine human kidney stones.

The study has been conducted using different analytical techniques: X-ray diffraction, Scanning Electron Microscopy, EDX analysis and LA-ICP-MS analysis. These different analytical methodologies allowed us the identification of the crystalline components; the morphological analysis and the determination of major and trace element composition.

Four of the nine samples were embedded on resin and cut to obtain a thin section to be studied by optical microscopy and by LA-ICP-MS; another part of the samples were used to analyze them with scanning electron microscopy (SEM) coupled with an energy dispersive X-ray spectrometer (EDX, Link 10000). Powder was analyzed by FTIR spectroscopy and X-ray diffraction. All the kidney stones studied show millimetric dimensions and characteristic red-brown colour, in particular, the stones studied were composed of pure calcium oxalate monohydrate and calcium oxalate dehydrate respectively whewellite, ($\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$), and weddellite ($\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$) as the dominant phase, which are the most common kinds of mineral phases composing human kidney stones. Six stones are composed of numerous small spherulites and each spherulite shows a strongly pronounced concentric lamination with a great number of crystallite growth around a nucleus of variable nature, on the contrary the other three samples show a structure a rose.

The aim of this work was to carry out interdisciplinary studies in order to describe composition, morphology and the possibility to individuate, by trace elements composition, the correlation between the disease and the environmental pollution. The significance and role of trace elements in renal stones has been studied by LA-ICP-MS. However trace elements are distributed in human tissue in very low concentration, they play a significant role in most biological processes, previous studies show that the concentration of trace elements, such as Zn, Sr, Fe, and Cu, in renal stones depends on their chemical composition, but the existence of toxic elements such as lead in organisms may be caused either by environmental pollution.

Keywords: kidney stones, SEM-EDX, LA-ICP-MS