

**CHARACTERIZATION AND COMPOSITION OF MINERAL INCLUSIONS IN MEXICAN COLUMNAR CACTI.** Teresa Terrazas(1), Ana-B Soto(2), Rosa-M Picaso(1). (1)Programa de Botánica, Colegio de Postgraduados, 56230, Montecillo, Mexico State, Mexico; (2)Departamento de Física, Centro de Investigaciones y de Estudios Avanzados (CINVESTAV-IPN), Apdo. Postal 14-740, Mexico City, 0700 Mexico.

Mineral inclusions in angiosperms are a feature related to plant cell metabolic processes, been the most common the calcium oxalate. Several review papers have been prepared for higher plants [1] or particular groups of plants [2]. However, accounts for other minerals such as silica have been recognized in various organs of different plants [3,4,5]. In particular for the Cactaceae family the reports suggest that this family produces enormous amounts of calcium oxalate [1,6]. Whewellite and weddellite oxalate crystals in different genera of Cactaceae have been described [7,8,9] and authors suggest that are useful characters to distinguish genera in the Rhipsalideae [9]. Within Pachycereeae tribe, authors have recognized the significance of mineral inclusions to distinguish among genera [10,11]. In this tribe, the species of genus *Stenocereus* are recognized by the presence of silica bodies, while the species of *Cephalocereus* and *Neobuxbaumia* by their prismatic crystals. In both cases, plant anatomists recognized their composition by inference of polarized light [10,11,12]. However, their composition is unknown. We studied mineral inclusions by x-ray analysis to establish their chemical nature in addition to their morphology through optical and electron microscopy. Stem segments of 13 species representing the genera *Cephalocereus* (*C. apicicephalum*, *C. columna-trajani*, *C. nizandensis*, *C. senilis*, *C. totolapensis*), *Neobuxbaumia* (*N. mezcalaensis*, *N. multiareolata*), and *Stenocereus* (*S. beneckeii*, *S. eruca*, *S. gummosus*, *S. montanus*, *S. kerberi*, *S. pruinosus*) were collected in their natural populations. Samples were fixed in formalin-acetic acid-ethanol, dehydrated and embedded in paraffin to identify the morphology and distribution of mineral inclusions by light microscopy with an Olympus BMX50 microscope. For scanning electron microscopy and area-restricted x-ray analysis by energy dispersive spectrometry (EDAX), transverse stem segments of each sample were dehydrated in ethanol and coated with gold in the usual way and studied with a Jeol JSM6300 instrument with attached energy dispersive x-ray analytical system containing a lithium-drifted silicon detector an acceleration voltage of 10kV. Results showed that prismatic crystals, one or more per cell, were present in the species of *Cephalocereus* and *Neobuxbaumia* (Fig. 1a, c), however idioblasts with druses were also common in the cortical tissue. Prismatic crystal composition had a high percentage of Ca (34%), followed by C (37%) and O (29%) (Fig. 1e). Druses revealed a more balance composition of these minerals: Ca (33%), C (33%) and O (33%). These results are in agreement with the composition described by other authors for crystals in the Cactaceae [8,9]. Although in the *Stenocereus* species silica grains have been described by their shape and considered as one of the unique features that evolved in this group [11], EDAX revealed that in addition to Si (0.41-5%) other elements as Ca, C and O are present. This composition differs of the  $\alpha$ -quartz describe in *Wiggingia thephracantha* [11] as well as in their shape and appearance. Another finding with EDAX was the identification of Si in the five species of *Cephalocereus*, which showed aggregates composed of Si (0.56-2.38%), C (75-90%), O (0.69-9%), Mg (0.08-0.25%), and Na (0.12-0.57%). The distinctive aggregation of these elements is probably related with a response to stress. We conclude that EDAX should be applied to other species to better understand the mineral composition diversity in the Cactaceae family.

## References

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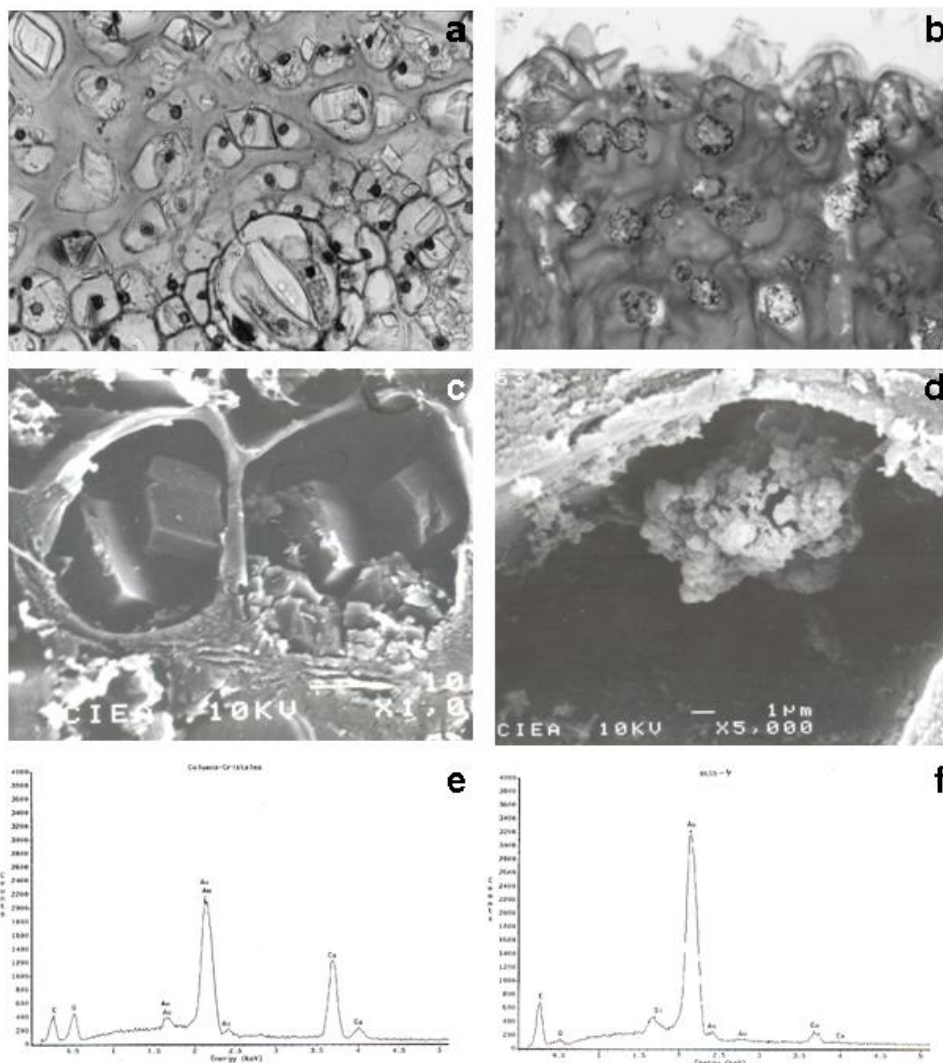


Figure 1. Mineral inclusions in Cactaceae. a,c,e. Calcium oxalate. b,d,f. Silica bodies. a. *Neobuxbaumia mezcalaensis*, c,e *Cephalocereus columna-trajani*. b. *Stenocereus pruinosus*, d,f. *S. beneckei*.