

**Characterization of the Serra Pelada Meteorite by Raman: Implications for Planetary Formation and Hypotheses of Water Origin.** C. Roque<sup>1</sup>; B. L. Nascimento-Dias<sup>2</sup>, B. Mayato<sup>3</sup>, E. Zucolotto<sup>3</sup>, Biology, Federal University of Rio de Janeiro<sup>4</sup>, Rio de Janeiro, Brasil. Department of Physics, Federal University of Juiz de Fora<sup>2</sup>, PPGF, Brazil and National Museum of Rio de Janeiro<sup>3</sup>, Brazil.(caiqueroque@gmail.com)

**Introduction:** The Serra Pelada is a meteorite classified as an achondrite belonging to the HED group (Howardites, Eucrites and Diogenites), being more specifically recognized as a Eucrite among the group of meteorites from the asteroid Vesta. This asteroid is as old as the time of planetary formation, hence the great importance of its study. The purpose of the work is to perform the chemical and mineralogical characterization of the Serra Pelada meteorite, analyzing the implications of this meteorite for astrobiology, in order to contribute with relevant information on the issues of planetary formation and the hypothesis of water origin [1].

**Methodology:** A slice of the meteorite was analyzed under the microscope using a standardized 633 nm laser and a 20X objective lens. The output power was 20 mW and the integration time was 10s, with a spectral resolution of 4 cm<sup>-1</sup>. The results were obtained by scanning the sample with the laser beam while the equipment acquired the spectra of a pre-selected area. The interpretation of the Raman spectra consisted in comparing them with pure mineral spectra, identifying peaks similar to the same type of vibration. The obtained spectra were compared with the RRUFF and Handbook of Raman Spectra databases for identification of vibrational modes. The OriginPro 2019b program was used to treat the spectrum and perform deconvolution of the peaks recorded in the spectra. The Serra Pelada Meteorite used for development of this study was a fragment acquired from the National Museum, which confirmed its mineralogical correspondence and texture description in the Meteoritical Bulletin [2].

**Results:** The following minerals were found in the Serra Pelada: plagioclase, pyroxene (augite, diopside), olivine, ilmenite, magnetite, coesite, silica glass, hematite, goethite and quartz. Thus, from the comparison of the pure mineral spectra in databases with the results obtained, it was possible to generate assignments on the chemical and mineralogical composition of the meteorite Serra Pelada (Figure 1).

#### **Discussion:**

The augite when found in igneous rocks could be one of the first crystallized minerals to form. The presence of the mineral augite can be considered of great astrobiological interest, because it can be linked to possible evidence of water in hydrothermal flows [4]. It is valid to emphasize that silica minerals, such as quartz,

have only been found so far in a single eucrite the Serra de Magé [5].

The secondary minerals hematite and goethite detected in the meteorite Serra Pelada, may suggest configurations of an environment that, at some time, went through processes of weathering. Among the processes of transformation by weathering that may have generated, for example hematite, hydrothermal environments and magmatic processes may be considered the main agents. Goethite may have undergone the same formation processes or be provenient of contamination of post collision shock process and metamorphism. [6]

**Conclusions:** Based on the data developed it is possible to suggest that a significant amount of water could be formed endogenously on the Vesta asteroid. This data has implications, perhaps for how water could have existed on Earth and Mars, since Vesta went through the same planetary differentiation processes as these bodies. Thus, hypotheses such as the absorption of water by grains in the accretion disk would be consistent with the data of endogenous water formation. Although water could be formed from endogenously in a significant amount, apparently, the major part of it would need to come from outside based on the results obtained through the Serra Pelada meteorite.

**Acknowledgments:** The authors thank CAPES for the help and support provided for the development of this research.

#### **Reference**

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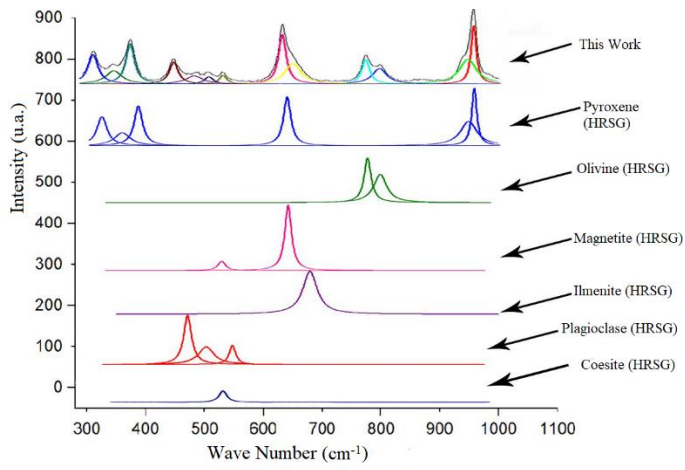


Figure 1- Raman spectrum collected from the meteorite Serra Pelada