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Study of Carbonaceous Material in cherts from Barberton Greenstone Belt and the Astrobiological Implications.

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Carbonaceous matter is present in chert deposits of Barberton Greenstone Belt (BGB), South Africa. This is a famous place in the world for its Archean geology, wich represents around 3.5 billion years of earth′s history. Therefore this area provides us the opportunity to study and understand an important part history of our planet, and also allow to compare with the geological history of other planets in our solar system [1].
Raman micro-spectroscopy has proved to be a very important and non-destructive powerful tool for distinguish micro-sized particles of C-polymorphs, as it is very sensitive to the nature of carbon bonding [2]. The connection between the Raman characterization of these carbonaceous phases with ancient biogenic activity it′s of special interest.
Cherts of BGB have been interpreted as precipitates or diagenetic replacements of preexisting sedimentary and pyroclastic deposits in a silica saturated Archean ocean [3]. Several layered Samples of cherts from BGB utility for the present study were collected during the expedition carried out in August 2010 sponsored by CNES and ESA.
A detailed Raman spectral analysis of carbon C-C vibrations has been performed in the first (1200-1800 cm-1) and second (2500-3200 cm-1) order regions [4]. The results show important changes in the G-D bands in the layered structure of chert. Additionally a UPLC-ESI-QTOF-MS was carried out trying to introduce new insight in the Raman interpretation of the bands and in the possible assignments to particular molecular groups which could be related with biotic or abiotic origin of the carbonaceous material.
Among the tentative compounds obtained from UPLC-ESI-QTOF-MS study it is worth to mention hydroxy-lycopene and the hydroxyl derivative of β-carotene (i.e. β-cryptoxanthin), which are carotenoids produced by cyanobacteria. These results are consistent with the presence of 22-Hopanol and Tetrahymanol, which are characteristic hopanoids of photosynthetic cyanobacteria and have been found in 2.7 billion year old rocks in Pilbara (Australia) [5]. The chromatographic behavior and exact mass coincidence of the m/z values found in this study give support, at least partially, the identification proposed.
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