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Organic minerals and their direct nondestructive detection in rocks using Raman spectroscopy - possible use in exobiological studies

J. Jehlicka (1), H. G. M. Edwards (2), V. Zacek (3)

(1) Charles University in Prague, Institute of Geochemistry, Mineralogy and Mineral Resources, Prague, Czech Republic, (jehlicka@natur.cuni.cz), (2) University of Bradford, Chemical and Forensic Sciences, Bradford BD7 1DP, UK, (H.G.M.Edwards@bradford.ac.uk), (3) Czech Geological Survey, Klarov 5, Prague , Czech Republic (zacek@cgu.cz)

Organic minerals can be considered as a forgotten group of organic compounds in the geological record. The survival of organic minerals such as salts of carboxylic acids, terpenoid hydrocarbons and aromatic minerals in the geological record is important for an appreciation of the diversity of molecular compounds that need to be assessed in the search for life detection signatures not only in terrestrial but more importantly extraterrestrial scenarios. Raman spectral signatures have been identified for simple hydrocarbons: evenkite (n-tetracosane), different salts of carboxylic acids including mellite (hydrated aluminium salt of benzenehexacarboxylic acid), terpenoids, fichtelite (norabietane) and hartite (a-phyllocladane). Medium to high-temperature transformation processes can be documented by the presence of idrialite (complex polycyclic aromatic hydrocarbonaceous mineral), anthracene, phenenthrene, kladnoite (phthalimide) and hoelite (9,10-antraquinone). More attention can be given to Raman data aplication in the exobiological context - to detect several fragments or key structures which can be considered as having relevance to biogenesis. Detection of all kind of organic compounds and their radiation or heat transformation products could be of major importance. Obtained results suggest that further studies of organic minerals would be beneficial and appropriate for extension and inclusion in databases of biomolecular signatures which may have relevance to the adoption of Raman spectroscopic techniques for inclusion in instrumentation for life-detection and recognition of biological

evidence in the geological records of extraterrestrial material .