

GEOCHEMICAL CHARACTERIZATION OF CHERTS FROM A RANGE OF DEPOSITIONAL ENVIRONMENTS TO ASSESS COMMONALITIES AND DIFFERENCES IN POSSIBLE BIOSIGNATURES

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Different types of ancient hydrothermal systems are preserved in terrestrial cherts that contain some of the most compelling microtextures indicative of early life on Earth. In volcanically derived hydrothermal deposits, cherts have undergone multiple alteration events often resulting in separate generations of quartz veins that are much younger than the host rocks. In some cases, multiple episodes of hydrothermal alteration can obscure otherwise syngenetic biosignatures and likewise create false signatures in the form of secondary carbon emplacement or diagenetic phase changes. To better identify biosignatures in hydrothermal deposits, we used confocal micro Raman spectroscopy and electron probe microanalysis to characterize the quartz fabrics, mineral phases and macromolecular carbon (MMC) in a suite of chert samples from different depositional environments: the ~400 Ma Rhynie chert, 1.88 Ga Gunflint Formation, ~3.42 Ga Strelley Pool Formation, ~3.46 Ga Apex chert, ~3.49 Ga Dresser Formation. Our results show that at least two main factors may hinder direct comparisons between the younger, unambiguously biotic samples with the older ambiguous samples: 1) the MMC in the younger cherts was originally more complex with a diversity of multicellular and unicellular organisms, whereas the MMC in the older cherts had much simpler structural origins, 2) the degree of geologic processing experienced by the older cherts resulted in alteration and recrystallization of the host quartz, MMC, and associated mineral assemblages, which is not seen in the younger cherts. Despite these factors, the possibility remains that we can establish biosignatures that are specific to each individual hydrothermally-influenced paleoenvironment. Hydrothermally-derived silicate deposits are of particular relevance to Mars analog studies and possible landing sites, and the unambiguous detection of biosignatures in these rocks is important for the success of upcoming missions.