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ABSTRACT BOOK

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Poster Presentation

Interrogating sedimentary silica-rich rocks using a multi-technique approach: first insights on preservation of organic molecules in heterogeneous geological systems.

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In recent years, experimental silicification of microorganisms proved organic molecules (OMs) preservation under its early entombment and subsequential induration of silica [1]. Thus, sedimentary silica-rich rocks (chert) are considered a record of life in past geological times. The occurrence of OMs has been advocated as evidence of biogenic origin for microfossils founded on Archean chert [2]. Contrarily, such OMs could have also been sourced by abiotic processes [3].
During its precipitation, silica interacts with OMs via adsorption controlled by electrostatic interactions [4]. Such OM-silica composites undergo low-temperature processes (diagenesis), leading to both porosity reduction as the crystallization of more stable SiO2 polymorphs [5] to become sedimentary rock. Reduction of permeability occurs as the pore throat closes, isolating the porosity network from exogenous fluids [6] and precluding mobility of OMs [7].
However, studies dealing with chert do not address the structural control of silica – porosity system as a potential preservation mechanism for OMs. Thus, we have characterized chert using (U)SAXS, WAXS, Raman, mass spectrometry, TGA, SEM and XRD. Samples were collected from Pacific Ocean´s locations.
Samples are composed of microcrystalline quartz spheres supporting a network of sub-micrometrical pores, which have a fractal geometry as SAXS data exhibit a power-law behaviour. GC-MS shows aliphatic carbons suggesting veritable preserved OMs [3]. Raman and MALDI-TOF suggest amide, lipids, and peptide occurrences. OMs are adsorbed onto quartz spheres [TGA data].
Geochemical homogeneity points to the microspheres-pore network as the source of X-ray scattering. (U)SAXS data show spatial heterogeneities suggesting dissimilar diagenetic effects. Accordingly, shifts in I(q) shown by sample 27c could reveal a nanopore control on mineral precipitation. A similar shift was reported for OMs-mediated carbonate precipitation on amorphous silica substrates [8].

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Keywords:

Silica-rich sedimentary rocks, SAXS, WAXS, Raman, GCMS, MALDI-TOF, TGA, XRD, SEM, porosity, fractal geometry, hierarchical materials