SEG 2022 Conference: Minerals For Our Future

Carbonate-Apatite in the Southwestern Ordos Basin, China: Link with Life and Its Significance

Chao Zhang[1], Xiaobin Wu[1], Baojin Zhao[1, 2]
1. Southwest Petroleum University, Chengdu, Sichuan Province, China, 2. Department of Environmental Sciences, University of South Africa, Johannesburg, South Africa

The enrichment of life in ancient sedimentary rocks has been widely recognized, but the direct link between mineralization and organism remains unknown for many cases. The shale of the 7th member of the Triassic Yanchang Formation from the Ordos basin in China is selected for the study of apatite whose morphologies and chemical compositions were examined by SEM/EDS, together with XRD and other methods. The typical apatite assemblages comprise at least four types alike: 1) Cylinder; 2) Rod; 3) Nodule, with an outer shell, uncompleted inner kerogen shell, and cauliflower core; and 4) Teeth, while their overall sizes of >10 micrometer are much larger than microorganisms of 1 to 5 micometer. We concluded that 1) The carbonate apatite resemble the body parts of organisms; 2) The mineral chemistry is characterised by enrichment of carbon, so that it is bio carbonate apatite ($Ca_5(PO_4, CO_3)_3(F)$, which is significantly different from the igneous origin ($Ca_5(PO_4)(F, OH, Cl)$; 3) Kerogen in bio-carbonate apatite is typically derived from microorganisms, animal remains or plant sources; 4) Bio carbonate apatite is a typical amorphous form rather than crystals so that there is no hydrothermal activities involved in the formation; 5) Phosphate mineralisation by life in shales, specifically in the marine environment is an important type of mineralisation, which is useful in future exploration of phosphate deposits in the similar environment; 6) Existence and enrichment of apatite in oil shale the Ordos bains or others might be useful for agricultural cultivation; and 7) Apatite in the life cycling of phosphate in the Ordos basin can be further analysed for its oxygen isotopes as original temperature proxy and REE for determination of the sedimentary environmental in the near future.