Pyrite Chemostratigraphy in the McArthur Basin: A New Exploration Tool for Stratiform Zn-Pb Deposits

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McArthur Basin, Northern Australia, hosts one of the world's largest stratiform Zn-Pb-Ag deposits (McArthur River deposit). It has drawn attention of researchers in the past, attempting to understand the basin's sedimentology, tectonics, and ore-forming mechanisms. As this basin is one of the premier Zn-Pb provinces in the world, exploration companies continue to carry on their search for base metals. Major outcomes of past research are various lithogeochemical (element/alteration halos), isotopic (C, O, Sr, S, and Pb) and geophysical signatures of rocks hosting and surrounding the ore body, which have refined exploration techniques. Pyrite trace element (TE) chemistry, too, has aided researchers to construct ore-deposit models and solve conjectures related ore-genesis. This is because of the ubiquitous presence of the mineral in a broad spectrum of ore-forming processes including SEDEX-style Zn-Pb deposits.

Considering the above, and that stacked ore lenses separated by pyritic and carbonaceous shale/siltstone are one of the major defining features of the McArthur river deposit prompts a study of pyrite TE chemistry in black shales. Differences in pyrite TE chemistry in barren and base metal laden black shales could possibly be attributed to effects of mineralization and hydrothermal activity. To test the above, pyritic shales from two drill holes (MBXDD001 and LY1) across the unmineralized horizon of Barney Creek Fm. (host to McArthur River deposit) and mineralized horizon were sampled for TE analyses in pyrite using LA-ICPMS. This paper discusses the background chemistry of the Paleoproterozoic ocean and the effect of hydrothermal exhalation on the sedimentary pyrite chemistry.