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Micro-facies and origin of some Archaean Cherts (Pilbara, Australia)

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Four chert samples (Marble Bar, Towers Formation; North Pole Dome, Dresser Formation; Apex Basalt, Apex Formation and Kittys Gap, Panorama Formation) were studied for micro- and nano-mineralogy and geochemistry to determine their protoliths and to provide insights into the physico-chemical and biological conditions of their depositional environments. The Marble Bar chert was formed at the interface with a basaltic rock by hydrothermal fluids, having leached major and trace elements from the basalt and silicified the protolith under reducing conditions. Stromatolite like micro iron oxide-bands are composed of magnetite and carbonates and co-precipitated REE, Cr, Ni, Pd and Au under reducing and alkaline conditions. Relict fluids precipitated quartz intergrown with K-feldspars. Later oxidizing fluids replaced the precursor minerals by Fe-Mn oxyhydroxides, partly of vermicular micro-textures. At nanoscale, filaments composed of hematite host carbon nodules, revealing several thousands of ppm of N and C, and C/N ratios similar to those observed in organic matter from marine sediments. The two black cherts from Dresser and Apex formations, sampled from hydrothermal dykes, had a black shale precursor, as suggested by their REE, trace metal characteristics and organic matter presence. They were entrained into the dykes by silicifying fluids. The North Pole chert from the chert-barite unit, was formed under reducing and alkaline conditions, indicated by clusters of bacteriomorphous nano-

sulfide structures on precursor calcite, web-like Fe-sulfides intergrown with sphalerite, As-pyrite and vaesite. The Apex Basalt chert was formed under oxidizing conditions, as indicated by the same bacteriomorphous clusters, but composed of Fe-oxides and showing a negative Ce anomaly. The black and white laminated Kittys Gap chert originated in a shallow marine to subaerial environment under slightly oxidizing (Ti-oxides and negative Ce-anomaly) and acid conditions (K-phyllosilicates), mainly by diagenetic silicification of a rhyodacitic volcaniclastic rock. Microbial mats and colonies developed on the sediment surfaces around precursor-K-feldspars, Ti-bearing biotites and amphiboles. Elevated Cu and Zn contents in the black laminae point to a limited influence from hydrothermal fluids.