

# Origin of black cherts from the Marble Bar Drill Core #1 (Pilbara, W-Australia)

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Black carbonaceous matter bearing cherts are abundant in Archean hydrothermal environments and may host traces of early life. In order to elucidate their origin, we studied black cherts from the Marble Bar drill core #1 (Archean Biosphere Drilling Project depths: 75.1 m, 94.2 m, 96.7 m, 100.4 m). Two types of black chert can be distinguished: (1) laminated black chert having preserved its sedimentary texture (75.10 m) and (2) hydro-brecciated black chert (94.2 m, 96.7 m, 100.4 m). The laminated chert is composed of alternating bright and dark layers, separated by wavy mat-like surfaces. Each layer is characterized by a pyroclastic texture with preserved protomineral shapes (100-500µm). In dark layers, protominerals are more abundant showing grain contacts and are less-matrix supported than in bright layers. Protomineral shapes reveal the presence of former amphiboles and plagioclase. Rapid silicification preserved the texture and led to the precipitation of micro-quartz, disseminated µm Ni-Co-As bearing pyrite, Ti- and Fe-oxides, sphalerite, galena, Fe-Mn-Mg carbonates, monazite and xenotimes. A second and third fluid influx occurred parallel and perpendicular to the lamination. Due to these fluids, K-feldspars, mica and illite precipitated around secondary pyrite and at the interface between dark lamina and a quartz vein. Laminated cherts have lower Se/S-ratio ( $10^{-5}$ ) compared to brecciated ones ( $10^{-4}$ ), indicating an increased hydrothermal influx. C1-normalized REE patterns of laminated and brecciated cherts show a strong positive Eu anomaly. The REE patterns and  $La_{(N)}/Yb_{(N)}$  ratios (0.75-1.6) of the laminated cherts resemble those of silicified basaltic precursor rocks. ( $La_{(N)}/Yb_{(N)} = 1.51$ ; and clearly differ from those of black cherts with black shale precursors ( $La_{(N)}/Yb_{(N)}: 6.7-9.06$ , [1]). Brecciated black cherts ( $La_{(N)}/Yb_{(N)} = 3.25-6.3$ ) are enriched in LREE compared to the laminated ones. The studied cherts have a pyroclastic precursor of basaltic composition, silicified during hydrothermal fluid-rock interaction under reducing conditions. Si-CO<sub>2</sub> bearing fluids remobilised metals (LREE, Fe, S, Pb, Zn..) from the laminated facies and mineralized the brecciated black chert.

## References

[1] Orberger B., Rouchon, V., Westall, F., De Vries, S., Pinti, D.L., Wagner, C., Wirth, R., Hashizume, K., (2006) GSA Special Paper, N° 405.