Systematic REE study of Archaean (>3.0Ga) carbonaceous black cherts in the Pilbara Craton: Implications for the origin and depositional environment of black chert containing putative microfossils

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Archaean black carboneceous cherts contain significant amount of carbonaceous material which can give information about early biosphere. Despite the importance of black cherts, their origin and depositional environment, together with the biogenisity of carbonaceous material inside, are controversial. Especially, the possibility of hydrothernal origin for black cherts raises critical problem on biological origin of carbon because natural abiotic processes may replicate biological morphology and carbon isotopic ratios [1, 2]. In this study, in order to understand origin of Archean carbonaceous black cherts, we performed REE analyses of black cherts systematically collected from the 2.97Ga Farrel Quartzite in the East Pilbara Craton, Western Australia, including three types of black cherts such as laminated chert (LC), massive chert containing putative microfossils, associated with evaporite (EC) [3] and chert vein (VC).

REE+Y patterns of EC are devoid of hydrothermal signatures, but have slight sea-water like signatures. LC, which occurs in the stratigraphically higher horizon, shows sea-water like signatures. VC does not show distinct hydrothermal signatures. The results indicate different origins and depositional environment of these three types of cherts. A change of depositional settings of the black cherts from shallow-water setting infulenced with continental run-off and/or low-temperature hydrothermal solution (EC) to open ocean (LC) is suggested.

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Exsolution of Fe-Mg olivine in Longang basalt, NE China

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Exsolution of Fe-Mg olivine has long been an enigma. Since Magnusson suggested the possibility of Fe-Mg olivine exsolution in 1918, people have found no evidence for this argument for a long time before Peteav *et al.* [1] found a case of Fe-Mg olivine exsolution in Divnoe meteror. However more cases of Fe-Mg olivine exsolution are hardly reported, even Peteav [2] examined various olivines in meterors and basalts. A recent study on thermodynamics is also controversal on the formation of Fe-Mg olivine exsolution under reasonable PT condition [3]. Here we report a new case of Fe-Mg olivine exsolution found in alkaline basalts, Longgang Volcanoes, Northeast China (Fig. 1).

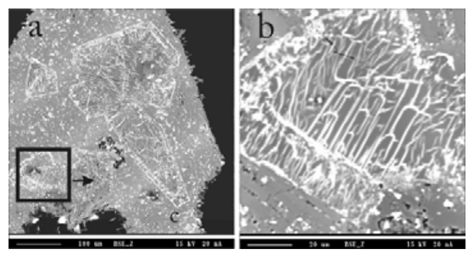

Figure 1: Exsolution of Fe-Mg olivine. a. olivine xenocrysts; b. exsolution structure.

Fig. 1 (BSE pictures) shows the exsoution stucture of olivine. The light stips are the exsoluted olvine. Electronic probe data show that the olvince xenocrysts are foterite with $Fo_{94.6-99.1}$, while the exsoluted strips have much more Fe and less Mg, with $Fo_{79.5-82.5}$. Compositions of CaO, MnO, NiO are less than 1 wt% in all analysis.

According to the thermodynamic studies [3] exsolution of Fe-Mg olivine should only be possible in low-temperature. However, low-temperature means ultra-long reaction time and hence hardly any exsolution in olivine, in natural and experimental enviroment. The rare case of Fe-Mg olivine exsolution found in Longgang basalt provides us with a good chance to discuss the topic.

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[1] Petaev *et al.* (1994) *Science* **266**, 1545-1547. [2] Petaev (1996) *Meteoritics & Planetary Science* **31**, 807-815. [3] Dachs *et al.* (2007) *American Minerologist* **92**, 699-702.