

Reconstruction of organic matter? iron rich sedimentary sequence of 3.2 Ga Mapepe Formation, Fig Tree Group, Barberton G

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The Mapepe Formation, Fig Tree Group in the Barberton Greenstone belt (Lowe et al, 1999) is situated above deep volcanoclastic sequence. Komati section is well preserved and continuous outcrop along the Komati river side. In this study, we reconstruct the sedimentary environment from description of detail lithology, stratigraph, magnetic susceptibility and stable carbon isotope ratio.

The Komati section, the total 130m thickness is divided into 6 blocks bounded by layer parallel fault zones. Based on the grading structure in each bed, these blocks recognized stratigraphic continuous sequence. We identified following four rock types in this section. 1) White chart: consists of very fine chart and the structure is massive. 2) Red chart: It divides into laminated type, bedded chart with red color and white-red type, chart that changes its color from white to red with sharp boundary and partly with lenticular structure. 3) Black shale: It consists of clay-silt sized detrital quarts and clay minerals. It divides into laminated type, which has 100-300micron band made from silt size quarts grain and massive type, with no lamina. 4) Red-brown (ferruginous) shale. This area was affected green schist facies metamorphism (Hofmann, 2004). In this way, most black shale contains metamorphic chloritoid minerals. Each rock, however, still well preserved sedimentary structure and detrital grain.

The Komati section divides into 3 members, lower member (49m), middle member (48m), upper member (31m). The lower member contains alternated white chart and black and red-brown shale. The ratio of stratified red chart is increasing to the top. The middle member alternated 3cm white chart and 5cm black and red-brown shale in the lower part of middle member. The ratio of stratified red chart is increasing to the top. The upper member formed 3m banded iron formation in uppermost part. In the upper member, the thickness of black shale is around 20cm.

The lamina consisted with 30micron-50micron sized detrital quartz of black shale is increasing from bottom to the top of Komati section. The area ratio of detrital quartz grain measured from thin section is stable at 15.6% on average in lower member, increasing smoothly from 15.6% to 31.5% in middle member and stable at 36.2% on average in the upper member.

We measured magnetic susceptibility whole stratigraphic vertical section at 3cm intervals. It is only red chart that the value is higher than 10×10^{-3} . Some of laminated red chart is higher than 100×10^{-3} located 17.7m of lower member and 45m of middle member. The mag-sus of red brown shale in middle member is increasing to the top from 0.36×10^{-3} to 1.00×10^{-3} on average.

The total organic carbon content of black shale from all units is ranging between 0.10wt.% and 8.96wt.%, with an average of 1.73wt.% (n=211). In each member, these are 1.64 wt.%, 3.37 wt.% and 0.90wt.% on average. Along stratigraph, the $\delta^{13}\text{C}_{\text{org}}$ value has vertical movement the range is 5permill per 5m. The ^{13}C is depleted to the top, the $\delta^{13}\text{C}_{\text{org}}$ value in each member are -25.6permill, -26.7permill and -30.4permill on average. There are some exceptional very deplete one at lower member and upper member (ex. 11m of upper member, -38.9permill).

(Summary) The environment of Komati section might be anaerobic environment where organic carbon rich shale and chart precipitated. The increasing of quarts grain lamina implies that the effect from landward input increasing to the top. Stable carbon isotope composition suggests that cyanobacteria might be the origin of organic matter. Some lighter $\delta^{13}\text{C}_{\text{org}}$ value in the black shale indicates methanogen activity at organic rich ocean sedimentary sequence. The rich organic matter may lead the following iron precipitation. In this study, it suggest that the ocean floor environment of middle Archean is anaerobic and there is alternated precipitation of organic matter and silica, the precipitation of iron is smoothly increasing.

Keywords: Barberton, carbon isotope composition, organic carbon contents