

Seafloor sedimentation during Mesoarchean to Paleoproterozoic: Comparative among Pilbara, Flin Flon, and Berimian belts

Shoichi Kiyokawa^{1*}, Ryo Sakamoto¹, Takashi Ito², Minoru Ikehara³, Hiroshi Naraoka¹,
Kosei E. Yamaguchi¹, Yusuke Suganuma⁴

¹Kyushu Univ. Earth and Planet., ²Ibaraki Univ. Education, ³Kochi Univ. Core center,

⁴Toho Univ. Science/JAMSTEC/NASA AstroBio

The Mesoarchean to Early Proterozoic has very changeable environments on earth surface, such as oxidized atmosphere, formation of continent and biosphere. We try to identify these changes from deep ocean sedimentary sequence from following three localities; 3.2 Ga Dixon Island ? Cleaverville formations in Pilbara Australia, 2.0 Ga Flin Flon belt in Canada and 2.2-2.0 Ga Berimian greenstone belt in Ghana.

The 3.2 Ga Dixon Island ?Cleaverville formations, in west Pilbara, we did scientific drilling, which is called - DXCL drilling project-, at 2007 summer (Yamaguchi et al, 2009). This drilling project had been selected two coastal sites; CL site at lower part of the Cleaverville Formation, and another is DX site at the upper Dixon Island Formation (Kiyokawa et al., 2006). In detail lithology from the drill core, the CL and DX contains is different type of organic rocks. The CL 1 and CL2 core sample mainly consist of the organic-rich massive black shale bed (20cm in thickness) with few cross-laminated fine volcanoclastic sandstone, and the DX core sample contains thin alteration of very thin laminated black shale and thin pyrite lamination. This sulfide-containing black shale is not found in surface outcrops, and therefore the first discovery of new lithology of those geologic units. Preliminary Organic Carbon and pyrite S data shows as follows:d13C: -32 - -26per mil, d13Corg: 0.6-1.4per mil,d34S: -1.9 - +4.4per mil.

From 2.0 Ga Flin Flon belt, we described 400m long cores from Trout Lake section near Flin Flon town. There are fining upward turbidite sequence with quartz sandstone and organic rich black shale. There is continental derived quartz sand within turbidite bed. From 2.2-2.0 Ga Berimian greenstone belt in Ghana, we identified more than 400m thick volcanoclastic sequences along the Three Point coast. The volcanoclastic sedimentary sequence identified mostly subaqueous condition and deeper to the top. Lower portion partly identified from subaerial condition. This sequence identified oceanic island arc slope condition. Black shale layers preserved within fine tuff beds.

The DXCL drilling shows the Cleaverville-Dixon Island formations indicate the buried history along the relatively deeper hydrothermal setting submarine floor in the immature island arc. The ocean was very stratified condition from anaerobic-stagnant basal layers to cyanobacteria rich oxidized ocean surface layers. This stratigraphic sequence might be record of -oxygen producing factory- in Mesoarchean ocean. On the other hand, even in anoxic condition, early Proterozoic sequences were affected by water current. The stagnant anoxic layer of bottom of ocean floor might not be developed at these early Proterozoic sequences. We will try to identify more detail about depositional depth of these sequences.

Keywords: Archean, Proterozoic, BIF, Black shale, hydrothermal activity, redox environments