Lithology and Depositional Age of Paleoproterozoic Volcaniclastic Sequence from Ashanti Belt of Birimian Supergroup, Southwest Ghana

*Satoshi Yoshimaru[1], Shoichi Kiyokawa[1], Shiono Sakai[1], Takashi Ito[2], Minoru Ikehara[3], Kenji Horie[4], Mami Takehara[4], Takashi Sano[5], Frank K Nyame[6], George M Tetteh[7]

1. Department of Earth and Planetary Science, Kyushu University, 2. Ibaraki University, 3. Kochi University, 4. National Institute of Polar Research, 5. National Museum of Nature and Science, 6. University of Ghana, 7. University of Mines and Technology

Paleoproterozoic Birimian volcaniclastic successions occur along the coast near Cape Three Points, in Ashanti belt, southwest Ghana. In this study, the depositional environments and bioactivities recorded in the c.a. 2.3 Ga rocks were investigated. We reporrt the structure and stratigraphy in the area, improved depositional age of the sediments by zircon U-Pb dating and C isotope features of the bioactivities in the paleo-ocean.

The Ashanti belt, generally showing NE-SW strike, composed mainly of andesitic basalts, volcaniclastic rocks and belt type granitoids (Perrouty et al., 2012). The greenstone is uncomformably overlain by Tarkwaian conglomerates and metasedimentary rocks. The maximum depositional age of the overlying metasedimentary rocks and the oldest age of the intruded rock into Birimian volcanics in the Sekondi region is 2154±2 Ma and 2174±2 Ma, respectively (U-Pb zircon: Oberthür et al., 1998).

Detailed field investigations were performed to reconstruct about 1000m out of over 2000m thick stratigraphy of the volcaniclastic sequence in the Cape Three Points area. The rocks, affected by greenschist-facies metamorphism, generally strike N-S, mainly dip 60-80º to the east and show fining upward stratigraphy. Using a west vergent thrust fault which occurs in the central part of the area, we sub-divided the area into two, a western zone and an eastern zone. The eastern zone consists of approximately 800 m thick fining upwards sequence which appears to have been repeated two times within the sequence. Thick basaltic lava in the lowermost part of the sequence is replaced by or changes into sediments produced by gravity flows. The uppermost part of the sequence reveals thick basaltic andesite and/or pyroclastic layers which then changes to fine altered volcaniclastics containing organic material. The western zone has not yet been reconstructed the stratigraphy.

TiO_2/Al_2O_3 ratios from EPMA analyses of chromite in basaltic rocks suggest that these rocks originated in a volcanic arc system. Whole-rock trace element compositions tend to show low concentrations of Nb and high LREEs, which also supports derivation from volcanic arc.

A foliated porphyritic dyke which occurs in the Cape Three Points area was dated by SHRIMP at the National Institute of Polar Research. Zircon grains in the dyke yielded a weighted mean ^{204}Pb-corrected ^{207}Pb ^{206}Pb age of 2265.6±4.6 Ma (95% confidence), which suggests that the volcaniclastic sequence was deposited before 2265.6±4.6 Ma and was deformed afterwards. This age is the oldest in the Ghanaian greenstone terrane (Loh and Hirdes, 1999). It would seem, therefore, that rocks in the Cape Three Points area record the history of early volcanic activity in the Birimian greenstone terrain.

We measured organic carbon isotope ratio of some black shale samples. The TOC varies from 0.02 %- 0.3 % and the δ^{13}C values are -35 ‰- -15 ‰(N=5). These low concentrations of the organic matter suggest dilution by the continual influx of volcanogenic clastics.

The thick finning-upward volcaniclastic sequence and chemical compositions may suggest the Cape Three Points Formation was deposited on mid-deep sea floor beside an oceanic volcanic arc. The deposition may have occurred before 2265.6±4.6 Ma suggesting these sediments record oceanic environmental changes from Makganyene glaciation toward Lomagundi Event (2.3 Ga -2.06 Ga, Bekker and Holland, 2012 and Kopp et al., 2005).

Keywords: Birimian Supergroup, Ghana, Paleoproterozoic

