Geochemical and Isotopic Studies of the Cretaceous Igneous Rocks in the Yeongdong basin, Korea: Implications for the origin of magmatism in a pull-apart basin

H. Sagong[1*], S.-T. Kwon[1], C.-S. Cheong[2], S. H. Choi[1]

[1] Department of Earth System Sciences, Yonsei University (sagong@ysgeo.yonsei.ac.kr)

[2] Korea Basic Science Institute, Daejeon

The Yeongdong basin is one of the pull-apart basins in the southwestern part of the Korean Peninsula that has developed during Cretaceous sinistral fault movement. The bimodal igneous activities (basalts and rhyolites) in the basin appear to be closely associated with the basin development. Here, we discuss the origin of the igneous rocks using chemical and radiogenic isotope data. Basaltic (48.4-52.7 wt% SiO_2) and rhyolitic (70.3-70.8 wt% SiO_2) rocks are slightly alkalic in a total alkali-silica diagram. The rhyolitic rocks with have unusually high K_2O contents (5.2-6.0 wt%). The basaltic rocks show an overall pattern of within-plate basalt in a MORB-normalized spider diagram, but have distinct negative anomaly of Nb, which indicates a significant amount of crustal component in the magma. The basaltic rocks plot within the calc-alkaline basalt field in the Hf/3-Th-Ta and Y/15-La/10-Nb/8 discrimination diagrams. The eNd(T) values of the basaltic rocks (-13.6 to 14.3) are slightly higher than those of the rhyolitic rocks (-14.7 to 15.2), and the initial Sr isotopic ratios of the former (0.7085-0.7093) are much lower than those of the latter (0.7140-0.7149). However, the initial Nd and Sr isotope ratios of the igneous rocks in the Yeongdong basin are similar to those of the nearby Cretaceous igneous rocks in the Okcheon belt. The Pb isotope ratios plot within the field of Mesozoic granitoids outside of the Gyeongsang basin in Pb-Pb correlation diagrams. Since a basaltic magma requires the mantle source, the enriched isotopic signatures and negative Nb anomaly of the basaltic rocks suggest two possibilities for their origin: enriched mantle lithospheric source, or depleted mantle source with significant amount of crustal contamination. However, we prefer the first possibility since it would be difficult for a basaltic magma to maintain its bulk composition when it is significantly contaminated with granitic crustal material. The slightly more enriched isotopic signatures of rhyolitic rocks also suggest two possibilities: differentiate of the basaltic magma with some crustal contamination, or direct partial melting of the lower crust. Much larger exposed volume of the rhyolitic rocks, compared with the basaltic rocks, indicates the latter possibility more favorable.