Geophysical Research Abstracts
Vol. 16, EGU2014-4859, 2014
EGU General Assembly 2014
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Age, geochemical and isotopic variations of arc volcanoes in the Coastal Range of Taiwan: Implications for magma evolution in the northernmost part of the Northern Luzon Arc

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Volcanoes in the Coastal Range of Taiwan were the northernmost part of the Northern Luzon Arc. Four volcanoes named Yuemei, Chimei, Chengkuangao and Tuluanshan in the Coastal Range have erupted low-K tholeiite to medium-K calc-alkaline series basalts to dacites. Major and trace elements and Sr-Nd isotope data suggest the different processes of crystal fractionation and source contamination in these four volcanoes.

Volcanic rocks were from the same magma source with εNd value about +9.6 to +8.8 produced by South China Sea Plate subducted beneath into the Philippine Sea Plate. All volcanic rocks show enrichment in LILE, Th, Pb and depletion in HFSE indicate arc compositional signatures. Four volcanoes went through different processes in each magma chamber before their eruption. There is no significant crystal fractionation and sediment contamination occurred in the Yuemei and Tuluanshan volcanoes. In Chimei and Chengkuangao volcanoes, the K2O contents, LREE, LREE over HREE and neodymium isotopic values show enrichment, moreover, the MgO, $Fe2O_3$, CaO and TiO_2 contents and compatible trace elements show decreasing while the SiO_2 contents increasing. Fractionation processes are different in these two volcanoes based on their variations of geochemical data. According to the 40Ar/39Ar and zircon U-Pb dating results, the final eruption in each volcano was 7.2 Ma (Yuemei volcano), 4.2 Ma (Chimei volcano), 6.2 Ma (Chengkuangao volcano) and 8.5 Ma (Tuluanshan volcano) ago.

Two components are suggested as the end members of the source contamination: the depleted mantle wedge and maximum to 0.5% of the South China Sea terrigeneous sediments increasing with time. In Yeumei and Tuluanshan volcano, magmas left their magma source in the earlier stage and show less affected by the sediments. In Chimei and Chengkuangao volcanoes, the effect of source contamination persisted and increased from 16.0 Ma to 6.6 Ma or 7.4 Ma ago, respectively. After these ages, the other unknown component involved in the magma source and continuously affected until the end of eruptions. Thus, magma evolution model in the northernmost part of the Northern Luzon Arc can be reconstructed.