Geochemistry Study of Cross-castic Magma Alkalinity Evolution

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Abstract	The discrimination of magmatic alkalinity is a classic study that has never stopped for the past ninety years. Various methodologies have been developed since Shand's classification using the method of alumina saturation to approach silica saturation and the methodology without involving alumina and silica such as K2O vs. Na2O and others, while the aim is to find out the evolution of alkalinity during the magmatic differentiation. The classical magmatic alkalinity evolution has been known as a castic magma alkalinity evolution, where the initial magma in the form of magma-X(a) will evolve along the stages of differentiation and remain a derivative of the initial magma {magmaX(a)}. The same philosophy is also explained in the ternary AFM diagram. Is the magmatic differentiation, followed by fractional crystallization, always an evolution of alkalinity based on caste? This question often raises current debates. This study takes the example of cogenetic volcanic and albitites. The application of the cogenetic volcanic using the selected diagram, which is `Three in one an overlaid diagram'. The output of the diagram presents the differentiation of magma which based on the evolution of Mg-series and Fe-series in a discontinuous branch of Bowen 1922 that can take place the castic and cross-castic, e.g. (a) from Mg-series to Mg-series {castic}, (b) from Mg-series to Feseries {cross-castic}, (c) from high-Mg tholeiitic basalt to calc-alkaline series {cross-castic}, (d) from Fe-series to Fe-series {castic}. While the evolution of magmatic alkalinity based on the continuous branch and refer to Trapezoid model generally occurring a cross-castic, e.g. (A) from sodic calc-alkaline to sodic alkaline-calcic, (B) from sodic calc-alkaline to shoshonitic alkaline-calcic, (C) from sodic calc-alkaline to potassic calc-alkaline, (D) from potassic calc-alkaline to shoshonitic alkaline-calcic, (E) sodic alkaline-calcic to sodic alkaline/peralkaline, (F) shoshonitic alkaline-calcic to potassic/ultrapotassic alkaline-calcic (cross-castic in subalkaline), (G) shoshonitic/potassic alkaline-calcic to shoshonitic/potassic alkaline/peralkaline. In this study, Fossa delle Felci volcanics (Italy) shows the evolution of magma from Mg-series to Mg-series, but the evolution of alkalinity of magma reveals the cross-caste (from sodic calc-alkaline to shoshonitic alkaline-calcic). Salak volcanics (Western Jawa) shows the evolution of magma from the Mg-series to Fe-series (cross-castic), and also the cross-castic in the evolution of alkalinity from sodic calc-alkaline to alkaline-calcic. Gothara albitites (India) clearly reveal the sodic-rich alkaline, which the magma generates from the evolution of sodic alkaline-calcic to sodic alkaline without the presence of potassic. (C) IJOG - 2021.
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