Flow and emplacement mechanism of Koya Ignimbrite

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Koya ignimbrite sourced from Kikai caldera 7.3 ka and traveled across the sea to reach the adjacent islands and the mainland of south Kyushu 40-90 km distant. Proximal facies of Koya ignimbrite, called Takeshima pyroclastic-flow deposit, comprise two or more flow units with a maximum thickness of 30 m, but the distal deposits collectively called Koya ignimbrite are consist of one flow unit and are exclusively very thin. Lag Breccia of Koya ignimbrite is recognized as layer 2b of 5 m thick on Takeshima and layer 1 of 2 m thick on Satsuma-Iwo Jima.

Koya ignimbrite contains essential pumices and volcanic glasses, both exhibiting a bimodal compositional distribution, e.g., ~60 and ~70 wt.% SiO_2 (Fujihara and Suzuki-Kamata, 2013). In addition to the silicic component, reflecting contribution the mafic component increases upwards from the basal to middle level of the deposit, and this vertical variation likely indicates progressive aggradation of pyroclasts. Koya ignimbrite overlies the ground layer consisting of crystal and fine pumice 1~5cm thick, and segregation pipe is commonly recognized in the ignimbrite in distributed area. The pyroclastic-surge deposit showing cross lamination overlies the ignimbrite on south of Osumi Peninsula. The surge deposit is rich in the mafic component, and suggests that the surge is formed at the late stage of ignimbrite eruption.

Koya ignimbrite distributes from the shoreline to the highland 1900m above sea level in Yakushima. Koya ignimbrite shows different lithofacies depending on altitude, which is thick and massive deposit more than severeal meters thick at lower area, and thin less than 50cm and composed of layer 1 at the base at higher altitude of 1600m above sea level. Mafic component is contained from the base of Koya ignimbrite in the north-west area on Yakushima both the lower area and the higher area, but mafic component increases upwards from the basal to middle level of the deposit in south-west area of Yakusima as same as Kyushu, Kuchinoerabujima and Tanegashima. This suggests that the earlier Koya ignimbrite climbing up the mountain area flows back due to the gravity in the north-west area and deposited thick at the lower area.

While silicic component can be recognized throughout the ignimbrite, mafic component exist only at the upper level of it at Tanegashima. The early phase products of Koya ignimbrite eruption reached to Tanegashima because this vertical variation is equal to that of the ignimbrites on proximal area, Satsuma Peninsula and Osumi Peninsula (Fujihara and Suzuki-Kamata, 2013). Lower contents of mafic component from upper most level compared with that of Osumi Peninsula suggest that the flows which contain abundant in mafic component occured at the later phase of the ignimbrite eruption cannot reach to Tanegashima. This is conformable the fact that the ignimbrites on Osumi Peninsula are thicker than that of Tanegashima. Based on above, it is estimated that Koya ignimbrite lost a great many amount of pyroclasts in the sea during traveling across the sea and the Koya ignimbrite widely lies on the sea floor around Kikai caldera. Koya ignimbrite became the low aspect ratio ignimbrite after passing the sea area, and low density pyroclastic surge was formed in the mountain area reflecting the topography.

Keywords: low-aspect ratio ignimbrite, Koya ignimbrite, Kikai caldera

