Field and Microscopic Observations of a Pyroclastic Dike at Miyataki, Central Kii Peninsula, SW Japan

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A pyroclastic dike is exposed at Miyataki, central Kii Peninsula. This presentation describes field and microscopic observations of the Miyataki pyroclastic dike.

(1) Field Observations

The dike is ca. 150 m long and ca. 3m wide at the outcrop.The dip and strike are N74W and 88N, respectively. Dike width increases to ca. 10 m at the central part of the outcrop, where a large block (15 m long and 0.75 m wide) of the host rock is included. The host rock is alternation of sandstone and mudstone, belonging to the Makio Formation of Shimanto terrane (Yamato Omine Research Group, 1994; Takeuchi, 1996).

Three facies are described in the dike: juvenile clast facies (I), matrix-supported facies (II), and clast-supported facies (III). All of facies I, II and III contacts with one another, and directly all facies contacts with host rock. Contacts between three facies are unclear and gradually changed. Facies I constitutes matrices in the facies II and III. Characteristics for each facies are described as follows:

I: Juvenile clast facies

This consists of one large vesiculated juvenile clast (40 m long and 2 m wide). In this clast white and black parts are observed:

[White part] This part dominates the greater part of the clast, with few accidental clasts. Vesicle sizes in the clast's center are larger than those of the margin, where coherent. Based on vesicle arrangements in the marginal zone of the clast, westward ascent of the clast or pyroclastics in the dike is inferred. Phenocrysts included are plagioclase, quartz, biotite, augite and opaque. Based on modal composition, it is regarded as dacite.

[Black part] This shows fresh and massive textures with no vesiculation. While this has same phenocryst assemblage, modal analysis results in andesite.

II. Matrix-supported facies

This facies consists of both juvenile (up to ca. 40 cm in size) and accidental (up to ca. 50 cm in size) clasts, supported by matrix with many pumices. Mostly juvenile clasts are amoeboidal in shape with flow structure. Accidental clasts (sandstone, mudstone, schist and granitic rock) are angular to well-rounded in shape and poorly sorted. In the exposure, this facies dominates in the east of the widest part of the dike mentioned above.

III. Clast-supported facies

In this facies, juvenile (up to 10 cm in size) and accidental (up to 50 cm in size) clasts contact directly with each other. There is little matrix but the amount of it becomes increasing apart from the widest part. Although the shape and composition of accidental clasts are similar to facies II, juvenile clasts are irregular in shape without flow structure.

(2) Microscopic Observations

Juvenile materials in the dike are divided into four textures based on glass/mineral ratio, mafic/felsic mineral ratio, and degree of devitrification in groundmass:

a) glass-poor and devitrified groundmass with 20-40 vol.% plagioclase;
b) glass-rich groundmass with 0.3-0.5 vol.% plagioclase;
c) glass-rich groundmass with 20-40 vol.% plagioclase; and
d) glass-rich groundmass with 20 vol.% plagioclase and mafic minerals.

In this classification, texture d) is observed only in the black part of facies I. Remainders are seen in facies I, II and III. Microscopically, the texture where a) includes b) or c) is observed in facies I. In facies II, a) is included in b), and a) contacts directly with c). Facies III shows the textures b) and c). Since all of these juvenile materials have the same phenocryst assemblage, they may be originated from one magma. During its emplacement, these variations of groundmass texture might be formed.

(3) Implications

While shapes of accidental clasts indicate fracturing in a brittle manner, those of juveniles show ductile fracturing and deformation associated with the flow structure. These evidences support the idea that after hot magma contacted with cold host rocks, fragmentation occurred to form pyroclastic materials forming the dike.