Near-vent morphology and dispersion timing of the climactic PDC in 7300 BP marine caldera formation of Kikai caldera in southern-off Kyushu Island, through seismic reflection survey

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Kikai caldera (Matsumoto, 1943) is a mostly submerged highly active caldera complex located in the southern Japan 40 km off Kyushu Island. The formation of the Kikai is believed to be responsible for dispersion of Akahoya tephra (Machida and Arai, 1978) in 7300 cal. BP (Fukusawa, 1995). The eruption is characterized by intense earthquakes (Naruo and Kobayashi, 2002), low-aspect ratio Koya-Takeshima PDC (pyroclastic density current; Maeno and Taniguchi, 2007) and tsunami (Geshi, 2009) which were taken place at the climax of the eruption.

We conducted seismic reflection observations in two survey cruises (KT-10-18 and KT-11-11) in 2010 and 2011 using a research vessel Tansei-maru of JAMSTEC (Japan Agency for Marine-Earth Science and Technology). The sound source was a 105+45 cubic inches G-I gun with 10 seconds of shot interval, and a 48-channled 1.2 km-length streamer cable was used for acquisition. Totally 24 profiles were obtained with the speed of 4 knots.

1. Possible climactic PDC deposits

Facies in Kikai area show clear distinction between caldera outskirts, caldera basin, and central rise of the caldera. At the caldera outskirts, there is a thick (around 100 m) acoustically chaotic layer named A3 in our interpretation that alike to other presumed PDC-originated deposits (e.g. Lebas et al., 2011). The layer is covered by some intensively stratified deposits except on the southern steep slopes. In contrast with outskirts however, equivalent considered layer in the caldera basin shows acoustic transparency with slight stratification within it, and the bottom terrain of it marks major unconformity. Neither of such characteristic layers was observed at the center of the caldera where large topographic rise exists.

2. Intrusive structure along the caldera-rim

Volcanic bodies are distributed along the caldera-rim. The largest one at the southeastern end has 2.5 km wide, and the rolling-up horizons beneath of it indicate it occurred just before the climactic dispersion. Presence of such bodies make difficult to evaluate caldera displacement however, it reaches 400 m in maximum at the rim of east to southeast.

3. The timing of the climactic dispersion and caldera collapses

Both caldera displacements and inner fractures seem to cut every deposit at every direction, therefore the caldera collapse should be occurred enough after the climax of the eruption. Enigmatic shortage of the talus deposits may reflect the subsidence and opening of the fractures happened gradually.