What is the ’Nigorikawa-type’ caldera?

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The structure of the Nigorikawa Caldera was described based on many geothermal drilling and compared to diatreme structure by Ando(1983). It was classified to the ’Nitorikawa-type’ by Aramaki(1983), characterized by funnel-shaped structure with small diameter at the top (groundsurface) and high aspect ratio. Other examples have been found at the Sunagohara (Mizugaki, 1993) and the Hakone (Mannen et al., 2006) volcanoes. Furthermore, internal structure and caldera-fill material of the Nigorikawa Caldera were restudied in detail by Kurozumi and Doi(2003).

There are close similarities between schematic cross sections of the Nigorikawa Caldera (Kurozumi and Doi, 2003) and a maar-diatreme volcano (e.g. Lorenz and Kurszlaukis, 2007). Both of them are characterized by long funnel/cone shape, filling of pyroclastics including fragmented wall rocks, intrusive lava bodies; their differences are size, magma type and volume.The diameter at the top end of a diatreme, i.e. the diameter of a maar, is up to 2 km (Martin et al., 2007) or 3 km (Cas and Wright, 1987), that is similar to the diameter of a ’Nigorikawa-type’ caldera. If acidic magma erupts phreatomagmatically and form a large-size diatreme through wall rock collapse, and the eruption continues to generate pyloclastic flow(s) larger than the case of a maar, it may be named a ’Nigorikawa-type’ caldera. In fact, at the Nigorikawa Caldera, accretionary lapilli have been found from deep zone of caldera fill, and its eruptive history was reconstructed to begin with phreatomagmatic eruption followed by pyloclastic flows (Nagoshi, 1994).

At the Hakone Volcano, two subsurface ’Nigorikawa-type’ calderas have been found inside topographic depression (Mannen et al., 2006). Younger activity of the Hakone Volcano, including formation of these calderas, have been predominantly monogenetic, such as lava domes and small lava flows. The ’Nigorikawa-type’ calderas seem to be members of this monogenetic volcanic field, equivalent to lava domes and flows.

At the Sunagohara Volcano, lava domes and intrusive bodies are scattered outside a buried ’Nigorikawa-type’ caldera. The largest one of lava domes, which diameter is similar to the caldera, coinsides with negative gravity anomaly (NEDO, 1985). This fact suggests that another caldera may exist below the lava dome. The Sunagohara Volcano also seems to a small monogenetic volcanic field including one or two ’Nigorikawa-type’ caldera(s).

A few other volcanic fields, the Kuttara Volcanic Group (Moriizumi, 1998), the Hijiori Volcano (Kawaguchi and Murakami, 1994), and the Katsuma-Yama Volcano (Kano et al., 2006), can be regarded as monogenetic volcanic fields consist of ’Nigorikawa-type’ calderas and other volcanic edifices.

In the vicinity of the Nigorikawa Caldera, no other volcanic center is known. The Nigorikawa Caldera is interpreted as an isolated monogenetic volcano.

In conclusion, the ’Nigorikawa-type’ caldera can be regarded as a kind of maar - diatreme voldanic system. In many cases, they form eruptive centers of monogenetic volcanic fields with other volcanic edifices. This hypothesis may suggest that the ’Nigorikawa-type’ caldera tend to be formed under tensional stress field, even it is restricted to very local.