

## Topographies of hazardous events on the bottom of Caldera Lake Kussharo, Hokkaido, Japan

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There are a lot of large caldera lakes in volcanic arcs such as Japan. Caldera lakes and their surroundings have good sceneries and hot springs; a lot of resorts located in their lakesides. However, the existence of abundant water in high elevation may provide the risk of the residences around the caldera lakes. The reasons are as follows: volcanic activities exist on the bottom of caldera lakes in many cases, and the inside of caldera rim is steep slope with large difference in elevation, their rims consist of lava and pyroclast which is preferred geology for catastrophic landslides. Volcanic activities and catastrophic landslides may cause overflow of lake water or tsunami. Their risk should be analyzed.

We are trying that analysis for Lake Kussharo in Hokkaido. Lake Kussharo is located in Kussharo Caldera which is the largest caldera in Japan. The lake has 79.3 km<sup>2</sup> in areas. The elevation of water surface is 121 m a. s. l. Only one river, Kushiro River flows from the lake to the downstream to Kushiro city. The resort area, Kawayu hot spring resort town is developed along lakeside. Volcanic activities are still active in this area. Mt. Atosanupuri erupted during the last few thousand years. The caldera rim has steep slopes and the highest part is 1000 m a. s. l. There are a lot of topographies of huge landslide masses and huge horseshoe shaped cliffs on the slope of rim. The terraces of old lake bottom lie on the wide area from the lakeside to the level of 150 m a. s. l. In addition, we found old terraces at the level of ca. 105-110 m a. s. l. and 95-90 m a. s. l. by our sonic survey. These terraces suggest that the level of water surface has repeatedly fluctuated.

We surveyed topography and geology of the ground surface and the bottom of lake using the sonic survey. In this presentation, we will mention about characteristic topographies related to past hazardous events. In particular, we found the mound-like hills in two areas. One area is ca 1 km in width from north to south and ca 1.5 km in length from east to west. This area has many small mounds, and their maximum size is ca 400 m in width and 20 m in height. Another area is ca 1.2km in width from north to south and ca 0.7 km in length from east to west. This area has also many small mounds, and their maximum size is ca 50 m in width and 20 m in height. These two areas are close to Nakajima Island which is the central cone of caldera. So, we deduce that both mound-like hills were flowed from Nakajima Is. by huge collapses. Also we found other topographies related to past hazardous events: landslide debris extended ca 2.5 km in width and ca 0.5 km in length near lakeside; a landslide involving bedded sediment; small eruptions with lava having width of ca 100 m; and topographies of depression associated with volcanic activities.

There are a lot of landslide masses and horseshoe shaped cliffs on the slope of rim. However, we could not find remains on their feet. Thus, most of their topographies on the rim do not concern recent hazardous events. The topographies we found are clear, so they probably formed after the formation of lake. Hazardous events formed their topographies could cause flood or tsunami, and then further events may occur around caldera lakes. Their risks should be considered for disaster prevention.

Keywords: Caldera lake, Landslide, Natural hazard, Lake Kussharo, Sonic survey