Acoustic survey for the volcanogenic fault on the southwestern part of Lake Toya

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Usu Volcano erupted on 31th March, 2000. Many faults related to volcanism are situated in the flank of the volcano, and these have activated again at everytime of past eruptions. Two faults, appeared at the northern and northwestern foot of the volcano are well known. One fault is the N-S trended left-lateral strike-slip fault at the western part of Toyako Spa, northern foot of the volcano. The other is the NNE-SSW right-lateral strike-slip fault at Sobetsu Spa, northern foot of the volcano. These two faults also activated again at the 2000 eruption (Hirose et al.,2000).

Although we have data for sub-lake topography and bottom materials by the lake chart (Geographical Survey Institute,1968;1969), these are few informations about the sedimentary structure and the tectonic movement been due to the volcanism at the Lake Toya, corresponding to area of northern extension of the faults.

In order to clarify the deformation of the lake bottom and the distribution of active faults taken place by upheaval of the Usu Volcano, we carried out acoustic survey at the southwestern part of Lake Toya on September 2001. Results of previous survey on April 2001 indicated propriety of using Uniboom and watergun for sedimentary structure and side-scan sonar for bottom materials.

The survey results are briefly summarized as follows:

(1) The sub-lake topography in the part can be roughly classified into following four groups; a) steep slopes near the shore at the southern and western part of the lake, b) terrace extended from front of the Toyako Spa and the Sobetsu Spa to Nakanoshima, c) slopes in the west and east edges of the terrace respectively, d) channels on the terrace and its edge slopes.

(2) Nine layers, from layer [A] to layer [I] with ascending order are divided on the records of acoustic surveys for sedimentary structure. According to the acoustic characteristic in records and distribution, the layer [A] infers to correspond to deposits formed by recent debris flow.

(3) Depth of the terrace surface is about 70 to 80 meters under lake water surface. On the basis of the acoustic characteristic and thickness of each layer, the terrace consists of five horizontal layered (from layer [B] to layer [F]) deposits, which been supplied from south except the layer [E]. These five layers are distributed only at the terrace and the edge. On the other hand, the lower layers, layer [G] and layer [H], distribute all the survey area. The layer [I], acoustic basement corresponds to the volcanic rocks distributed around the Lake Toya.

(4) We found several displacements on surface of reflectors in acoustic records. As the result of the analysis, nine faults or fault-like structures F1-F9 are detected. Two faults of them, F3 and F4, seemed to exist in the layer [A] distributed at the front of the western part of the Toyako Spa, and strike of the faults is NNW-SSE direction. These results suggest a possibility that the two faults continue to the Tokotan fault, provisional name, on land.

(5) Though sheer displacement of the almost faults are estimated about 5 meters at most, only the F2 fault has displacement with about 10 meters on the surface of layer [D]. Thus, it is inferred that this fault was formed by tectonic movement related to volcanism.