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Acoustic prospecting for the seaward extension of Kurehayama faults in Toyama Bay, central Japan

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The southern Kurehayama fault-belt depicts the east margin of Imizu Hill and the central and northern parts are located on the Kurehayama hill which divides Imizu plains and Toyama plains (narrow sense). The latter hill is regarded as a tectono-morphological features by the Pleistocene fault-related fold of the Kurehayama fault (Yasuda Anticline). It is an asymmetric anticline with a low angle limb on the northwest, although the anticlinal axis and its southeast limb are eroded out by Ida-gawa and Jinzu-gawa rivers in the central belt. According to the previous data from geophysical exploration, the anticline is buried beneath the downtown Toyama city in Toyama plain. It was expected that the fault belt extends into the Iwase spur in front of Iwase and Mizuhashi towns, coastal Toyama Bay (Toyama Prefecture 1997).

The sea-bottom sounding was executed in the Toyama Bay aiming to acquire information on the grasp of an accurate position, shape and activity of the in the seaward section of the Kurehayama fault belt as part of consignment business "Active fault survey in the nearshore waters" from the Ministry of Education, Culture, Sports, Science and Technology to National Institute of Advanced Industrial Science and Technology.

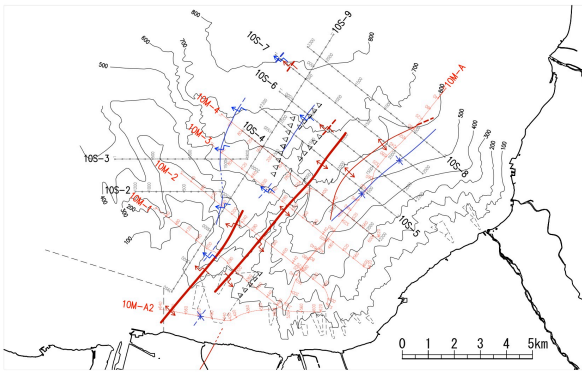
The target area is located in front sea area put from Toyama City to Uozu City, and the profiling lines were arranged in order to locate the northernmost tip of the fault and to specify the strike of the assumed extension part, that is the Hamakurosaki spur, in a parallel and an orthogonal directions. The offshore operation including the trial run conducted 8 single channeled lines and 6 multichanneled lines from July 30 to August 7, 2010, acquiring seismic profiles of about 80km in the total extension.

In the prospecting line 10M-1 along the coast, the westerly dipping high-angle reverse fault of 700m in depth is presumable and also a buried fault-scarp in the shallower depths was interpreted. In addition, an anticline exists adjacent to the fault west side in this line, and is traceable to the entire Hamakurosaki spur (From 10M-A2 to 10M-4).

Based on discontinuity of the reflectors, a reverse fault more than 45 degrees in the dip angle, parallel to the west side of the anticlinal axis, is admitted from 10M-1 to 10S-4. Such a fault is also recognized to the north of 10S-5. However it dips at 20 degrees or less, and is thought to be a surface phenomenon with no indication of the deeper fault. However, it is thought that the activity of this surface fault is new because the sea-bottom on the hanging wall to the west seems upheaved in 10S-6.

As for the seaward extension of the Kurehayama fault belt, the tectonic deformation by the fault is assumed in the area south of 10S-6, and it is pointed out that length from the coastline is about 9.5km, and the dip of the fault becomes gentle while going to the north. Since the anticlinal structure of the Neogene (layer-N) is probably unconformable with the overlying layers at the horizon of reflector-d, it is possible that fault-related folding with the Kurehayama fault has been ceased already.

The previous surveys of the reflection method of land areas reveals the shallow structures of the Kurehayama fault less than 500m in depth. Acoustic prospecting was done up to depth 1-2km in half of survey lines in this sea area, and the main Kurehayama fault was located on the just extension of the land fault trace. It can be especially said that the Kurehayama fault is characterized by accompanying asymmetric anticline structure in both regions in land and sea, and that the fault belt is a buried one whose displacement is expressed as flexures in the district from the downtown Toyama City through the coast up to the Hamakurosaki spur (south of line 10M-4).



Keywords: submarine active fault, acoustic prospecting, reflection method, Toyama Bay, Kurehayama fault, fault related fold