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Near-surface deformation structure delineated along Arakawa River near Kita-Akabane by Land Streamer reflection survey

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High-resolution shallow seismic reflection surveying by means of S-wave type Land Streamer clearly delineated near-surface deformation structure along a survey line set on the Arakawa River bed, near Kita-Akabane, Kita Ward, Tokyo. Dislocation as large as 1 m was interpreted to a reflection event about 5 m in depth, along with a cumulative deformation pattern. This indicates that the imaged structure was formed by recent faulting.
Conventionally, topographic investigations have been adopted to delineate the surface traces of active faults. However the technique is inadequate when applied to large urban areas where the surface topography suffered repeated artificial deformation. Dense drilling has been also the common method to clarify the near-surface deformation structure. However, we would have to note that it was still difficult to delineate the detailed faulting structure by such "pinpoint" surveying. Seismic reflection surveying has been utilized to delineate the 2-D deep structure of faulting. However it was still difficult to image near-surface structure of faulting by means of the conventional seismic reflection surveying due to its insufficient spatial resolution as a near surface investigation tool. In contrast, high-resolution shallow seismic reflection surveying is capable to provide detailed information, surpassing that of drilling. To conduct the surveying at large urban areas where surfaces are almost paved, we developed a field tool named Land Streamer (Inazaki, 1992), and utilized it to high-resolution active fault survey (Inazaki & Nakanishi, 2007). The Land Streamer is featured as a non-stretch towing member on or in which geophone units are mounted to form a multichannel geophone array similar to a marine streamer. The tool can be easily towed by hand, or by a vehicle. The geophone units are coupled to the paved surface with the metallic baseplate. Even this non-planted coupling through the baseplate, the tool can receive comparatively clean data on the pavement.
We adopted it for the delineation of near-surface structure beneath the existing levee systems at the right bank side of the Arakawa River. A 900 m long seismic line was deployed along the levee, near Kita-Akabane, Kita Ward, Tokyo to obtain an S-wave seismic profile. A CMP stacked section clearly profiled characteristic deformation structure in the near surface down to 50 m in depth. A reflection event at about 5 m in depth was cut by high angle reverse faulting accompanied with the upheaval of eastern (downstream) side as large as 1 m. In addition, a reflector about 25 m deep, which was correlated to the top of a buried channel fill gravel bed, showed about 5 m displacement between the structure. That is, the identified faulting has cumulative deformation structure in the recent deposits.

Keywords: concealed fault, Tokyo area, Land Streamer, seismic reflection surveying, Arakawa River