Fault and basement structure around the southern Kyoto Basin and the Yawata Hill revealed by seismic reflection surveys

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1.INTRODUCTION

The Kyoto basin, particularly northern part of the basin, is surrounded by many active faults that can be traced clearly. Geomorphological feature around southern end of the basin also suggests exsistence of an active fault. There is, however, no certain evidence for it. To elucidate existence of such active fault, its activity if it exists, and the detailed structure of the pre-Neogene basement and the overlying plio-pleistocene Osaka group, we have conducted deep and shallow seismic reflection surveys, gravity survey, and collection of boring data in the southern Kyoto basin. In this lecture, we would like to summarize our research.

2.SURVEY DATA

We conducted four deep seismic surveys using a P-wave vibrator, which were designed to explore down to about 1km deep. These are Yawata-1(3.7km long), Yawata-2(2.8km), Kizugawa(7.5km) and Kumiyama-Yawata(7.0km) profiles. We also conducted five high-resolution shallow seismic surveys of land-streamer type using both SH-wave and P-wave sources, which were designed to explore down to about 50m and 100m, respectvely. These are Uchisato-NS(0.8km long, SH-wave type), Uchisato-EW(0.4km, SH-wave type), Uchisato-NS(1.4km, P-wave type), Keihan(2.1km, P-wave type) and Tanabe(1.1km, P-wave type) profiles. We newly acquired gravity data at more than 400 points, which were analysed with the pre-existent data of more than 2300 points.

3.DATA PROCESSING RESULTS

Deep seismic surveys revealed overall structure of sediments and basement in the southern Kyoto basin, combined with gravity data analysis. The pre-Neogene basement lies at about 700-800m in depth at the basin side, becomes rapidly shallow toward the Yawata hill, and lies at about 200-500m in the hill side. The Osaka group is nearly horizontal in the basin side, but shows clear flexural pattern in the hill side. There is a fault between the basin and the hill, which we tentatively call as the Uchisato fault. Shallow seismic surveys revealed much more detailed structures: several gently dipping reflectors toward the basin side that is concordant with the surface dip, fault-like structures with a few meters of displacement, and so on.

4.DISCUSSION

Comparing the deep seismic sections with deep boring data, we can identify many horizons of precisely dated marine clay beds in the Osaka group, such as Ma3(about 0.9Ma in age), Ma4(about 0.8Ma), Ma5(about 0.7Ma), Ma6(about 0.6Ma), and Ma9(about 0.4Ma). Using the buried depths of the marine clay beds, we can estimate the vertical slip rate of the Uchisato fault. Before sedimentation of Ma3, strata have nearly same thickness between the hanging-wall side and footwall side of the fault, indicating the fault became active around 0.9Ma. Displacement of these marine beds between the both side indicates the vertical slip rate of about 0.1m/ky during 0.4 to 0.9Ma. Shallow reflection data and shallow boring data suggest that the fault migrates toward the basin and causes displacement of a few meters at the Holocene (but undated) gravel layer, indicating that the fault may be still active and may have a few times larger activity than during 0.4-0.9Ma.

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