

Shallow structures of the Enasan Fault, the Sanageyama North Fault, and the Sanage-Saikagawa Fault by seismic reflection survey

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Seismic reflection surveys were conducted to elucidate the shallow structure of the fault zone as part of the “Comprehensive Research Project for the Byobuyama, Enasan Fault Zone and the Sanageyama Fault Zone (Enasan-Sanageyama North Fault Zone)”. The purpose of the survey was to clarify the geometry of the multiple faults that compose the fault zone and their continuity in the subsurface. The study area is located in Toyota and Seto Cities, Aichi Prefecture, and Mizunami and Ena Cities, Gifu Prefecture. Three survey lines, each about 5-7 km long, were set across the Enasan Fault, the Sanageyama North Fault, and the Sanage-Sakaigawa Fault. The geological structure below the survey lines is thought to consist of a granite basement covered by a thin layer of topsoil, with sedimentary layers in the valley. Each fault is either a near-vertical, strike-slip fault with a reverse component or a relatively high-angle reverse fault. Based on trench surveys and other investigations, these faults are not accompanied by well-developed fault fracture zones. For these reasons, the detection of these faults by reflection surveys is not expected to be easy.

The survey was conducted in September 2021. For the reflection survey, the shot point interval was 5 m and the receiver interval was 10 m. A broadband vibrator was used, with vibration frequencies ranging from 10 to 140 or 200 Hz. In addition, in the Sanageyama North Fault section of Survey Line 1, a high-density, high-resolution survey was conducted with a shot point interval of 1 m, a receiver interval of 2 m, and a vibration frequency of 10 to 384 Hz. Refraction data for tomographic analysis were also obtained. CMP stacking and MDRS stacking were applied to the reflection data for each survey line, and after post-stack time migration, depth transformations were performed to create seismic depth sections. In Survey Line 1, neither the Sanageyama North fault section nor the Sanage-Sakaigawa Fault section showed a clear reflection structure indicating the existence of the faults. Therefore, we interpreted the faults by focusing on discontinuities or lateral changes in the reflection pattern within the pre-Tertiary basement rocks. The results of the high-density, high-resolution survey of the Sanage-Sakaigawa Fault section indicate a significant lateral change in the amplitude of the reflection from the basement, and both ends of the strong reflector correspond to the two faults recognized in the surface survey. In Survey Line 2, disturbance of the reflection structure was observed in the sedimentary layer below the surface trace location of the Sanageyama North Fault, but no clear fault structure was obtained. In Survey Line 3, east-dipping several reverse faults were identified that correspond to the surface fault traces. The Enasan Fault forms the boundary between the basin and the mountainous area, and a graben-like depression of the basement rocks is observed. They indicate the formation of a structure due to fault activity.

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