Trenching of a low-activity fault (Komachi-Odani lineament) on the western flank of Mt. Daisen, Tottori Prefecture, Japan

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The 2000 western Tottori earthquake (Mj 7.3, Mw 6.6) was produced by rupture of an NW-SE-trending left-lateral strike-slip fault system without clear topographic expressions. Since this earthquake we have conducted study on lineaments and shear zones in and around the aftershock area of the 2000 western Tottori earthquake. This study aims to develop new technique for detecting active faults that lack clear topographic expressions, but have a possibility to cause around M 7 earthquakes.

Last year we studied the Komachi-Odani lineament running parallel, about 9 km northeast, to the aftershock area of the 2000 earthquake. The 12-km-long lineament is subdivided by a 1-km-wide left-handed step-over into 6-km-long northern Komachi lineament and 7-km-long southern Odani lineament. The Komachi lineament is situated mainly on early Pleistocene basalt lava flows, and composed of many short (several hundred meters long) left-stepping lineaments. The Odani lineament, on the other hand, is developed in granite area and consists basically of two parallel continuous lineaments.

We trenched the two lineaments and identified a shear zone 20 to 50 cm wide for the Odani lineament, and a 1-m-spaced dual shear zone, 6 to 10 cm wide each, with flower structures for the Komachi lineament. The trench on the Komachi lineament identified two rupture events: the most recent event at least after the fall of K-Tz tephra (ca. 95 ka), and a previous one between 230 ka and 130 ka. The excavation survey also revealed that the last rupture event on the Odani lineament occurred after the fall of Sambe-Unnan tephra (50-90 ka) and before the AT tephra (ca. 30 ka).

The four-year study on lineaments and shear zones in and around the 2000 western Tottori earthquake area is summarized as follows. Distribution pattern of lineaments (e.g., many, short, en echelon or stepping traces, or single/dual, long, continuous traces) correlates with width of the corresponding shear zones. Both are usable complementarily as a topographic and a geologic criterion for maturity of fault systems, respectively. Rank of lineaments (e.g., Inoue et al., 2002), i.e., inferred possibility that a given lineament is a tectonic landform produced by faulting, on the other hand, primarily has relationship with fault activity (slip per event x frequency) in the Quaternary period. When a given fault system is low in maturity and a considerable coseismic slip is accommodated by very small slips on many short (sub-)parallel fault traces, it is very difficult to detect such fault traces as lineaments, even though the fault system itself has high activity.

Our preliminary study on fault gouge suggests that color or oxidation-reduction condition of fault gouges correlates with fault activity, and may be a criterion of fault activity independently of topographic information. We will start a full research on color of fault gouge from the 2005 fiscal year to develop and standardize a new geological criterion for fault activity.