Drainage system evolution associated with segment linkage within the northern Tokachi fault zone in the middle Pleistocene

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The Tokachi fault zone (Ikeda et al, 2002) is an active intraplate, north-trending thrust zone in eastern Hokkaido that extends for about 100 km, which forms a topographic and geologic boundary between the Tokachi Plain and the Osarushinai Hills to the east. Slip rates of major thrusts of the Tokachi fault zone deforming middle to late Pleistocene fluvial terraces deposits are estimated to be 0.1 to 0.3 mm/yr (Togo, 2000). Drastic shifts of river channels are reported in the northern part of Tokachi fault zone (Matsuzawa et al, 1978; Matsui et al, 1978) since the middle Pleistocene, but there is room for investigating their details. We investigated geomorphology, chronology and active tectonics of the northern Tokachi fault zone (Ikeda et al, 2002) since the middle Pleistocene to define evolution of drainage system patterns associated with active thrust fault activity, mainly based on field mapping of fluvial terraces, drainage and stream patterns by use of 1:25,000 topographical maps and detailed stereopair interpretation. Middle to late Pleistocene fluvial terraces widespread over the hangingwall and footwall of the thrust zone possibly record temporal and spatial changes of channel stream networks, fault activity, and their interaction. Distribution of well preserved higher terraces formed during the middle Pleistocene indicates that SE-trending transverse paleostreams at the age of older middle Pleistocene Kamiasahigaoka (KA) terrace drastically shifted its course to flow on the footwall syncline west of the fault zone at the age of younger Kita-Oribe (KI) terrace (i.e., paleo-Otofuke River) and that older, antecedent NW-trending channel streams had lost most of their upper drainage basins. This drastic deflection of major stream channels during the middle Pleistocene occurred at the segment boundary between two en-echelon, NNE-trending thrusts comprising the Tokachi fault zone, where the height of KA terrace on the summits on the hangingwall is lower than those of hill summits at northern and southern segments. We hypothesized that the transverse paleostream originally flowed through the topographic low between two en-echelon thrust fault segments, but it was interrupted and deflected due to fault segments linkage. In contrast to these deflected paleostream channels, a transverse stream channel incised into the adjacent, northernmost thrust segment appears to maintain its course since middle Pleistocene. This indicates that rates of rock uplift along the northernmost thrust segment have been slower than those along the southern segments. The drainage evolution in the area also shows that some of the paleostreams once beheaded in the age of KI terrace have again rejuvenated during the late Quaternary, leading to the remarkable dissection of landforms and reorganization of fluvial systems across the fault zone. We conclude, therefore, that two major changes are detected in the drainage evolution in the northern Tokachi fault zone since the Middle Pleistocene, the former of which provides a good example of temporal and spatial evolution of channel stream networks strongly affected by segment linkage within active thrust zones and its activity.