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Height of faceted spurs, a proxy for determining long-term throw rates on normal faults: Evidence from the North Baikal Rift System, Siberia

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We present new results on the long-term throw rates of active normal faults in the North Baikal Rift (NBR), eastern Siberia, based on a statistical analysis of triangular faceted scarps. Faceted spurs or triangular facets are morphologic features frequently observed along normal fault scarps, and result from the progressive denudation and incision of the footwall during fault activity. Fault-bounded ridges in the NBR display such typical morphologies with several contiguous facets separated by fault-perpendicular catchments. Over a range of 20 fault segments analyzed, triangular facet heights vary from $\sim$200 to >900 m. As fault scarps have been developing under similar long-term climatic conditions, we infer that the scatter in mean facet height arises from long-term differences in fault throw rate. We compare the morphology of NBR facets with results obtained in a previously published numerical model of facet growth, which predicts that the mean height of triangular facets is proportional to the fault throw rate. Using facet height as an input, model results provide estimates of the long-term fault throw rates in the NBR. These vary between 0.2 and 1.2 mm/yr. The throw rates are then compared with the cumulated throw, which has been constrained by geophysical and stratigraphic data in the basins. This provides an estimate of the age of fault and basin initiation. We show that the modern stage of basin development started circa 3 Myr ago, except for the North Baikal basin ($\sim$ 8 Ma). Our results also suggest that a proportion of the observed throw is inherited from an earlier tectonic stage.