

## ***Interactive comment on “Geomorphic signatures of the transient fluvial response to tilting” by Helen W. Beeson and Scott W. McCoy***

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Thank you for the figures and for keeping the discussion going.

*Northern Sierra Nevada canyons cannot be younger than the sediment found within them.*

We completely agree with this point. Lindgren's original maps and more recent papers from Henry et al. and Cassell et al. paint a clear and striking picture of a large former river system that in some places shared the same locations of the modern river canyons. As you have pointed out and shown nicely in this valley cross-section from the South Fork American there are late Cenozoic volcanics quite close to the modern river elevation in many of the northern Sierra rivers. We agree that the basement rocks

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must have been incised at least to that elevation before these flows arrived. We will reread the paper to ensure that we do not discount the antiquity of the canyons. That is certainly not our point. What we are suggesting in this paper is that based on our modeling and analogous disequilibrium longitudinal profile forms and patterns of incision found in the Sierra that a younger episode of incision that is still ongoing can explain what is observed in the Sierra.

Attached is an analogous figure to the one in the current paper for the South Fork American. Our guess is that valley cross-section you show comes from one of the minimum incision points around 50 or 75 straight-line kilometers from the mountain front on our plot. As we said in our previous comment, and what we are striving to convey in this paper, is that this unique nonuniform incision pattern, which repeats to first-order across the entire northern Sierra, is entirely consistent with a young transient phase of incision. Incision of just a few hundred meters above the mainstem slope-break knickpoint is consistent with this transient response. If one adds in heterogeneous lithology incision depth can become even more nonuniform. In short, we are completely on board with the canyons being older than the volcanics you describe, and we think these points of lesser incision above what we call the mainstem slope-break knickpoint make up a critical piece of the geomorphic signatures we are proposing.

### **Southern Sierra**

We will consider carefully how we present our estimate of tilt magnitude. As we said in the previous reply, we meant to frame this particular estimate as a clear maximum and known overestimate but it was in a paragraph in the discussion that wound up getting cut. We will fix this issue in the revised version. We will add in the discussion you have provided to show that indeed tilt magnitude must be less than  $2.3^\circ$  based on nice geologic evidence to try to bring that point home more clearly. In the end we might even omit the numerical value as to not distract from the more robust result of a measurable azimuth-gradient relationship in the modern stream network.

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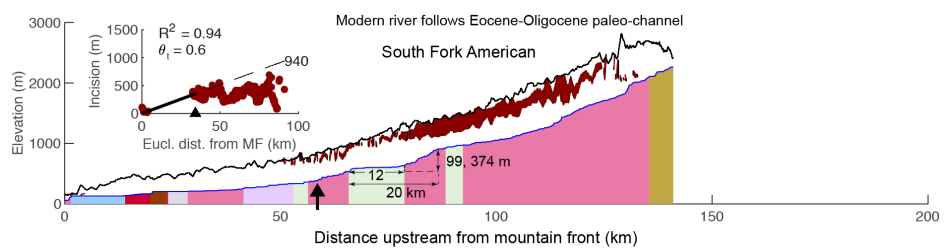


Fig. 1.

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