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

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We have updated our figure to show the locations of auriferous gravel deposits as mapped on the 1:250,000 quad maps (geologic maps at the 1:125k scale are not available in digital form) and included an analogous plot from the North Fork American to help clarify some points discussed below. I was unable to locate any data on the Spring Valley/Soldier Creek auriferous gravel deposit you mention, and thus could not verify its age or elevation. I have plotted its approximate location given that you said it was 250 m below the nearest volcanic deposit. It is unclear which elevation you chose from Lindgren's data, but all of the tunnels appear to be south and east of Placerville. If they are under the volcanics, the elevation can't be much lower than the volcanics and adjacent auriferous gravels we have plotted now. Note that in the original figure, we used



a 10 km wide swath profile centered on the mainstem to pull the range of elevations of the volcanics within the swath and project these to the location of the mainstem, but in these figures we used a 15 km wide swath in order to capture the auriferous gravel deposits that you describe near Placerville.

The addition of the auriferous gravel deposits does not change our results as they are most commonly found directly subjacent to the volcanics. Deposits upstream of the mainstem slope-break knickpoint that are near to river elevation and their associated low incision values do not refute the idea that incision downstream of the knickpoint reflects surface uplift in the form of a punctuated tilting event. Rather, these low deposits upstream of the knickpoint are consistent with a transient response to a punctuated tilting event, which we show can generate highly variable incision depths upstream of the slope-break knickpoint. Note that the deposits in the South Fork American River basin near Placerville that are close to river elevation plot near the top of the first knickzone in granite and that the Spring Valley deposit plots at the top of the second knickzone in granite (a knickzone that is consistent with the western metamorphic belt acting as a band of more erodible rock). Based on our model we would expect these locations to exhibit low incision values. A similar trend is observed in the North Fork American, in which low incision values occur in a reach that is just upstream of the slope-break knickpoint and just downstream of a deeply incised section that corresponds with the western metamorphic belt.

*So, my point is that the distribution of the volcanic rocks does not define a pre-incision paleosurface and, therefore, cannot provide information on incision depths.*

We agree that the auriferous gravels would be a superior pre-incision paleosurface than the Cenozoic volcanics in that they define river valleys, whereas the volcanics covered the entire landscape and thus the basal contact inherited the paleo relief of the buried landscape. Unfortunately, the auriferous gravels are sparse and thus it is difficult to establish longitudinal trends using them. As Wakabayashi (2013) and Cassell et al., (2011) have described, the gravel deposits are usually thin (order 10s of meters with the thickest deposits described by Cassell et al., (2011) approximately 140 m) and, as is clear in our plots, they are commonly directly subjacent to the volcanics. Therefore, it seems reasonable to assume that the bottom of the Cenozoic volcanic deposits approximates a pre-incision surface even where gravels do not exist. We interpret local deviations from these longitudinal trends caused by the gravels being significantly (order 100 m) below nearby volcanics as the effects of paleo relief (i.e., volcanics on a paleo interfluve would be above the gravels in a paleo valley) or due to faulting after gravel deposition, which Lindgren showed could be 10-100 m.

*Finally, my GSAB paper showing that lithology has a first order control on channel steepness is now in press. I've attached the proofs as a supplement.*

The variability in steepness that you document in your attached paper is consistent with our interpretation of the Sierra as being in a transient state in response to a punctuated tilting event, with the tilting event heavily modulated by lithology. Our interpretation is that most of the metamorphics are more erodible and have thus responded faster, resulting in more consistent and lower channel steepness. In contrast, granodiorite is less erodible and thus all knickzones related to tilt (both the mainstem slope-break knickpoint and the rock-type slope-break knickpoints) are propagating at a slower speed, resulting in the high variability in steepness in streams in granite that you document and that is shown in our profiles. This can explain why the steep reaches are not randomly distributed across all lithologies, rather than dismissing the idea of actively migrating knickpoints.

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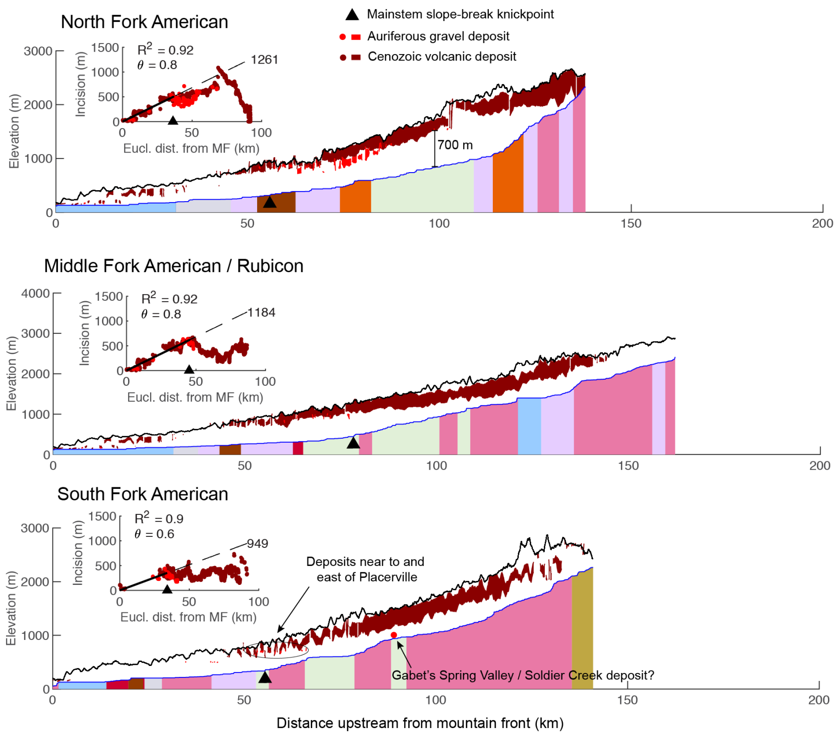


**Fig. 1.** American River longitudinal profiles with surface geology, Cenozoic volcanics and Eocene auriferous gravels. Insets show depth of canyon in basement below volcanics and gravels.