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Interactive comment on "Chlorine-36/beryllium-10 burial dating of alluvial fan sediments associated with the Mission Creek strand of the San Andreas Fault system, California, USA" *by* Greg Balco et al.

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General Comments

This paper by Balco et al. is a thorough investigation into the use of the 36Cl/10Be cosmogenic nuclide pair (produced in the minerals K-feldspar and quartz respectively in the same granitoid clast) in burial dating. They argue that this pair is more accurate than the commonly-applied 26Al/10Be pair for sediments/clasts in the range of 200-500 kyr due to the shorter half-life of 36Cl compared to 26Al. In the study, the authors use the technique to uncover information about the age of sediments displaced by a portion of the San Andreas fault in southern California. While their conclusions are

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complicated by low nuclide concentrations and difficulties in estimating the 36Cl/10Be production ratio for the buried clasts, I find the description of the technique and the authors' comprehensive look at multiple aspects of dating clasts with this novel method to be particularly illuminating and extremely useful to the wider cosmogenic exposure dating community. They investigate quantitatively possible explanations for the scatter in their dataset, in addition to general limits and applicability of the 36Cl/10Be burial dating pair. I additionally appreciate the authors including the detailed AMS data calculation spreadsheets in the supplement, and providing their MATLAB scripts online for all to reference.

My only general critique is that I'd like to see a more detailed discussion of the uncertainties associated with using this technique, and the impacts on the final 36Cl/10Be ratio. Should "external" errors be used (i.e., those including uncertainties in the productions rates in addition to measurement uncertainties) because you're comparing two different isotopes in two different minerals with varying production pathways? While I'm not an expert on 36Cl cosmogenic dating, I would expect that the multiple production paths for 36Cl and the 36Cl production rate dependence on the chemical makeup of the K-feldspars and bulk rock (plus the uncertainty in water content, etc.) could make the error on the 36Cl concentration (and hence the final ratio) quite large depending on what uncertainties are propagated through the calculations. It's possible that this information could be gleaned from the MATLAB scripts, but it would be nice to see a few sentences of discussion in the manuscript about this.

Overall, this is an excellent paper and I highly support it being published with only minor edits.

Specific Comments âĂć I wonder if the title could be reframed to focus more on the technique than the specific Mission Creek application, as I think the study most convincingly explores the background and limitations of the 36Cl/10Be pair as a general burial dating technique. Something like: 36Cl/10Be burial dating of granitoid clasts: a case study in the San Andreas Fault system (etc.). Or, something that would highlight

the technique/method over the application in this case.

âĂć Page 2, Eq. 3 and Lines 2-5: Eq. 3 and the variables therein are difficult to interpret at first glance due to the lack of subscripting.

âĂć Page 2 Lines 10-15: See general comment above; does the better precision for the 36Cl/10Be pair hold out if production rate/chemical composition uncertainties are taken into account?

âĂć Page 6, Lines 8-10: Do you have pictures of these samples? Perhaps include them in the supplement if not in the main text?

âĂć Page 7, Lines 11-12: Supplementary tables 1 and 2, or supplementary spreadsheets 1 and 2 (SF1, SF2)? I don't see specific supplementary table names in the files.

âĂć Page 8, Lines 2-3: How does the amount/uncertainty of Cl in the HF affect the resulting burial age uncertainty?

âĂć Page 8, Line 5: Table S3 = spreadsheet SF3?

âĂć Page 10, Lines 17-24: What are the uncertainties on these production rates?

âĂć Page 11, Lines 6-7: It would be interesting to provide a plot of either the 36Cl/10Be production ratio or just the 36Cl production rate vs. K-concentration for each sample as part of Fig. 5 or 6. (The reader could glean this from info in the Tables, but it would be nice visual).

âĂć Page 14: Line 31: "...do not show evidence of significant burial" is a little confusing because you also assert that the 36Cl/10Be ratios are due to post-burial nuclide production. Perhaps rephrase slightly?

âĂć Page 16, Lines 9-14: Are there any visual differences (weathering features, grain size, etc.) between sample MC-P7-8 and the others?

âĂć Page 16, Lines 14-15: Are these surfaces the same lithology as MC-P7-8?

âĂć Page 17: Lines 10-11: Perhaps rephrase this; e.g. “For the minority of samples in this study that have relatively high nuclide concentrations, and possible arise from relatively low-erosion-rate environments. . .”

âĂć Figure 2: Including a map here that is in between the scale of the inset regional map and the sample map would be helpful; it’s a bit difficult to understand the position of the study site.

âĂć Figure 6: Can you add sample labels to Panel A? The bold lines in this panel are difficult to discern; I assume they just all overlap?

âĂć Figure 7: Caption should read MCP-11b instead of MCP-11a.

âĂć Table 1: Are the sample thicknesses and densities listed somewhere? Also, there is a superscript missing for “g-1” under “cosmogenic 36Cl”.

âĂć Table 3: extra space before the period in the table title.

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