

Interactive comment on “Carbon isotopic signature of coal-derived methane emissions to atmosphere: from coalification to alteration” by G. Zazzeri et al.

Anonymous Referee #1

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The manuscript of Zazzeri et al., aims at providing a representative estimate of the $d_{13}C$ isotopic signature of methane emissions from the coal mining sector. This is an important topic, since this signature can be used as a proxy for the contribution of the coal mining sector to the global methane emissions budget.

They determine the isotopic signature of methane emissions from coal mines in the UK, Poland and Australia, using the so-called “Keeling plot” technique on $d_{13}C$ - CH_4 measurements in air samples taken downwind of coal mines. Based on these observations, they propose a range of source signatures that is significantly more depleted (by 15 to 20 permil) than what has been used so far in global CH_4 modelling studies. This, and the fact that these findings are well supported, makes the paper very worthy

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of publication.

I have no major negative comments: the objective of the study is clearly stated and the method followed is very well suited to that problem (this may actually be quite the ideal case for using the "Keeling plot" technique). The paper is well written and concise, and the supporting figures are overall appropriate. I have a few small comments, listed below, but I think that they can all be addressed within a "technical correction", after which the paper can be published.

Minor comments:

- One useful information that I think is missing is the importance of the methane emissions from the regions studied. Some values are provided for the Silesian mines, and some estimates of the coal production is given for the Australian ones, but how much does that represent on the world's scale, and how important are the British mines? Some literature references would suffice.
- Table 2 could be extended with information on the mine type (open, deep, active, inactive since, . . . , perhaps also coordinates) and coal type.
- I don't find the map in Figure 1 very interesting: showing just the location of the mines without context information does not bring much to the paper. You could add some simplified geological map, or a map of the estimated distribution of coal mining methane emissions. Also, it is strange not to have the Australian and Silesian mines on a map!
- Are you expecting any long or short-term variability of the $d^{13}C$ signature within one coal mine? If you were to re-do the sampling at a different season, or in a few years, would you expect any different result?
- Many of the readers of this paper won't be geologists. Although Section 1.1 is helpful

and well written, it may help to provide some diagram showing the coal maturation process (when to expect which coal type), to be used as a reference when reading the following sections.

Textual comments:

- Line 26-27: what about Germany
- Line 67: ... methanogenic path: acetoclastic ... (semicolon missing)
- Line 255: the measurements are not significantly above background: is that because the mine emits less, or because the emissions are spread over a larger area in such an open mine?
- L298: why would the depth affect the $\delta^{13}C$ (other than the depth/coal-rank relation?)
- L310: There is a 20-35 permil difference between the Hunter Coalfield and the Wales mines, and you are talking of a 5-10 permil shift here ...
- L321-323: Do you have any information on the proportion of each coal/mine type in the world?

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