Answer to referee comment 3 from Amy Townsend-Small for "**Source attribution of methane emissions from the Upper Silesian Coal Basin, Poland, using isotopic signatures"**

We would like to thank Amy Townsend-Small for the suggestions to improve the manuscript. Below you find our answers to their comments. The reviewer's comments are written in normal font, our answers in italics.

A couple of major takeaways: Some coal mines have methane formed through biogenic carbonate reduction, and some coal mines can emit thermogenic methane more isotopically similar to natural gas. You could highlight your results more clearly in the abstract – it seems that your study, using both isotopes, identifies these mines as clearly emitting thermogenic methane. I believe most papers have previously only used carbon isotopes? E.g. Zazzeri et al., 2016.

We highlighted the differences between the coal mines and the advantage of using the hydrogen isotope more clearly in the abstract:

"Different layers of the USCB coal contain thermogenic methane, isotopically similar to natural gas, and methane formed through biogenic carbonate reduction. The signatures vary depending on what layer of coal is mined at the time of sampling."

"[The isotopic signature] clearly differs from the USCB regional signature in δ^2H. This makes a source attribution using δ^2H signatures possible, which would not be possible with only the $\delta^{13}C$ isotopic signatures."

Another thing that your study clearly shows is that the use of hydrogen stable isotopes is really essential for source apportionment in regions with a mix of thermogenic and biogenic sources. I was excited to see this result because I have also found similar results in Los Angeles, the Barnett Shale, and in Denver, Colorado. I see you mention this in the last sentence of your abstract – can you highlight it more? For example, I think Figure 5 also illustrates this well. In your Figure 5, for carbon isotopes, your mining samples are both above and below the isotopic composition of air. This makes it very, very difficult to use carbon isotopes as a tracer of this source in air. This has global implications because carbon isotopes are being used to track methane sources at background monitoring sites – not hydrogen! My group has found similar results with ground samples taken at natural gas methane sources – as an example see Townsend-Small et al., 2016, Geophysical Research Letters - Using stable isotopes of hydrogen to quantify biogenic and thermogenic atmospheric methane sources: A case study from the Colorado Front Range.

Thanks for this feedback. We added the reference to the interesting Townsend-Small et al., (2016) paper.

We highlighted the importance of the hydrogen isotope signatures more clearly at the end of the abstract and conclusions.

"The average signature from the ventilation shafts of -49.8 ± 5.7 ‰ in $\delta^{13}C$ and -184 ± 32 ‰ in δ^2H clearly differs from the total regional signature in the δ^2H and makes a source

apportionment between coal mine and other emissions possible. This would not be possible with only the $\delta^{13}C$-CH_4 signatures, because the coal methane signatures vary considerably in $\delta^{13}C$ and are both above and below the isotopic composition of air."

"This study confirms the importance of $\delta^{2}H$-CH_4 observations for methane source apportionment, as reported in previous recent studies (Townsend-Small et al., 2016; Fernandez et al., 2022). This is especially true in regions with a mix of thermogenic and biogenic sources and large variations in the $\delta^{13}C$ signature of one sector."

Fernandez, J. M., Maazallahi, H., France, J. L., Menoud, M., Corbu, M., Ardelean, M., Calcan, A., Townsend-Small, A., van der Veen, C., Fisher, R. E., Lowry, D., Nisbet, E. G., and Röckmann, T.: Street-level methane emissions of Bucharest, Romania and the dominance of urban wastewater, Atmospheric Environment: X, 13, 100153, 10.1016/j.aeaoa.2022.100153, 2022.

Townsend-Small, A., Botner, E. C., Jimenez, K. L., Schroeder, J. R., Blake, N. J., Meinardi, S., Blake, D. R., Sive, B. C., Bon, D., Crawford, J. H., Pfister, G., and Flocke, F. M.: Using stable isotopes of hydrogen to quantify biogenic and thermogenic atmospheric methane sources: A case study from the Colorado Front Range, Geophysical Research Letters, 43, 11,462-411,471, 10.1002/2016GL071438, 2016.