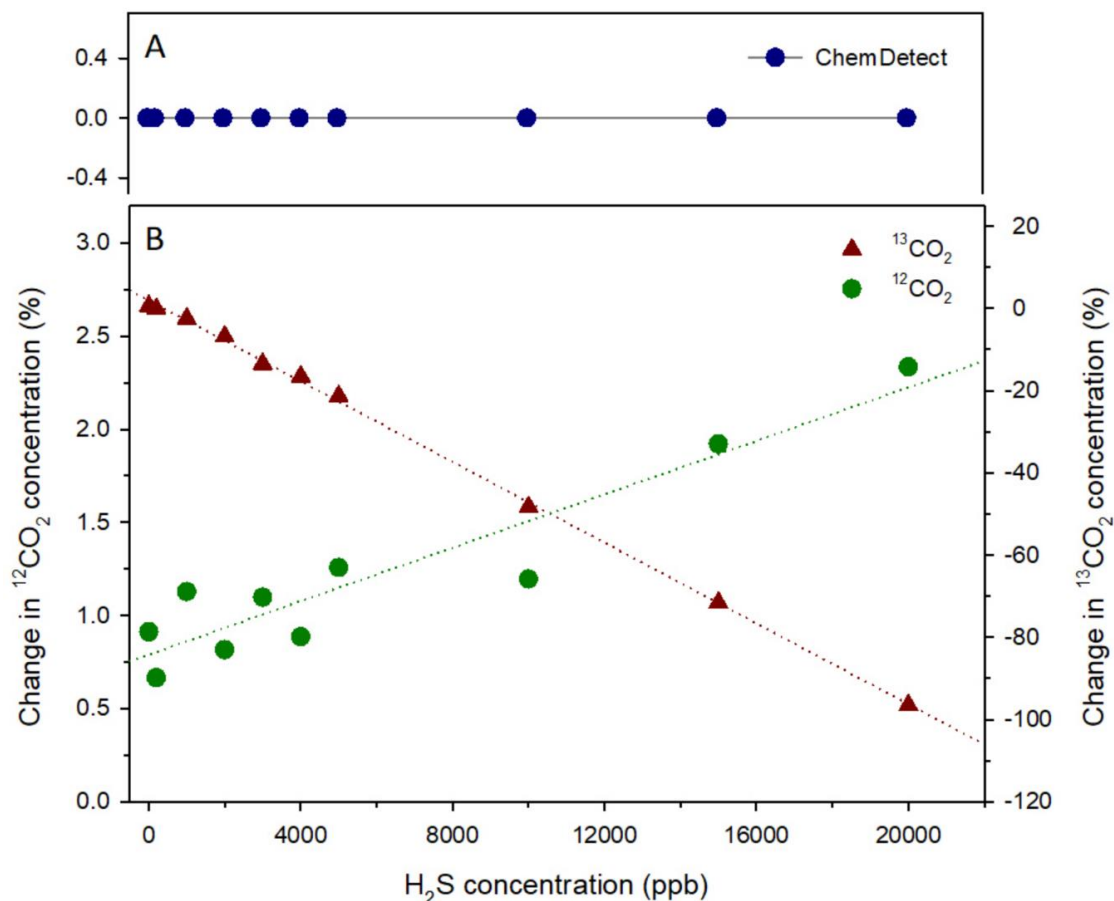
1   Supplemental Materials

3   **Figure S1. A) The feature "Chemdetect" does not show the presence of H₂S as an interference. B) Percentage**

4   **change in the ¹²CO₂ and ¹³CO₂ concentrations when increasing the H₂S concentrations. The percentage change was**

5   **calculated between the gas mixtures with H₂S and the gas mixtures without H₂S when the H₂S was scrubbed using**

6   **a copper tube.**

7   Chemdetect

8   Chemdect is a feature for newer versions of the Picarro instruments that is supposed to

9   detect the presence of interferences in the measurements. Chemdetect values of 0 mean no

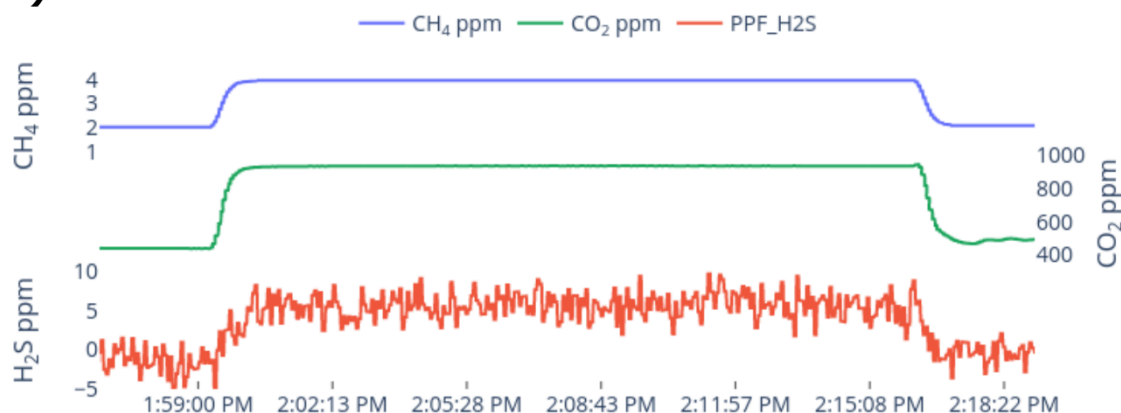
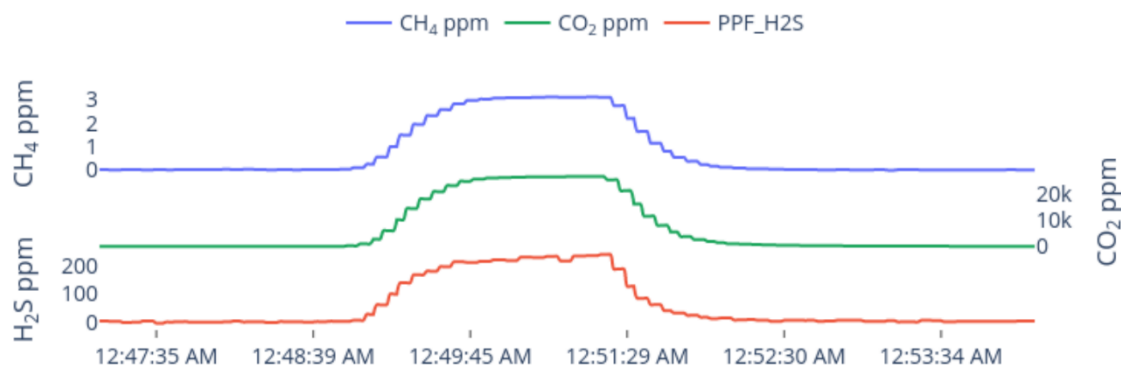
10   interferences while values of 1 indicate the presence of an interferent. During the experiments

11   conducted in this study, the Chemdetect value was always zero, meaning that there was no

12   interference detected by this feature. The results of Chemdetect are shown in Figure S1 when

13   adding H_2S to the 995 CO_2 standard. The Chemdetect results did not change even though H_2S was

14   present and was producing an effect on the other measurements. Therefore, we conclude that the

15   Chemdetect feature is not sensitive to the presence of H_2S.

16   **Figure S2. Time series of raw concentrations from the Picarro instrument data processing package. A) Time series**

17   **of a 15-minute laboratory experiment measuring a gas mixture of the 995 ppm ± 20 ppm CO_2 standard spiked with**

18   **~ 5 ppm H_2S. The 995 ppm CO_2 standard has a known CH_4 concentration of ~ 4 ppm. The PPF_H2S signal is noisy**

19   **in low concentrations B) Time series of ~ 2-minute laboratory experiments measuring the natural gas sample. Due**

20   **to the high concentrations, the experiment was ended within 2 minutes to avoid compromising the functionality of**

21   **the instrument. The response time of the three gases of interest appear identical at low and high concentrations.**

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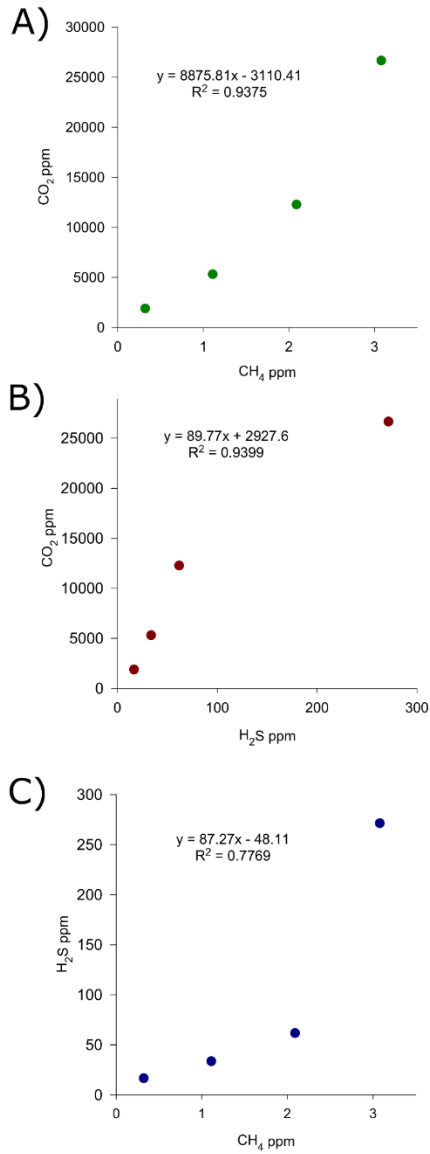
Figure S3. Gas ratios of natural samples calculated with the Picarro G2201-i. A) Correlation plot between CO_2 and CH_4. B) Correlation plot between CO_2 and H_2S. C) Correlation plot between H_2S and CH_4. The slopes and R^2 values of these trendlines are also detailed in Table 1.