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Triple oxygen composition of carbon dioxide from fossil fuel combustion

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The oxygen triple isotope composition of CO_2 from different natural and anthropogenic sources is gaining in importance as possible tracer of gross carbon exchanges between major reservoirs [1]. Determination of carbon dioxide isotope composition (given as isotope anomaly relative to the rocks and minerals defined terrestrial fractionation line: $\Delta^{17}O_{TFL}$) of different provenance is crucial for enhance atmospheric modelling. The isotope anomaly of CO_2 from fossil fuel combustion is especially interesting as it is the main form of anthropogenic carbon release. Here, we report the first data on the $\Delta^{17}O$ of CO_2 from fossil fuel combustion.

$CO_2$was collected above the flame of a propane-butane stove. The collected gas mixture was dried in a P_2O_5 water trap and the CO_2 was isolated from non-condensable gases with a Russian doll type cryogenic trap at -196 ˚C [2]. The amount of CO_2 was determined in a calibrated volume. The $\Delta^{17}O_{TFL}$ value of CO_2 inferred from oxygen isotope equilibration with CeO_2 at 685˚C, and subsequent CeO_2 analysis by means of IR laser fluorination GC-CF-irmMS [3,4]. The amount of carbon dioxide was approx. 2% in the exhausted gas.

We determined a $\Delta^{17}O_{TFL}$ value of the CO_2 of –0.52 $\pm$ 0.02 ‰ (relative to a TFL with β_{TFL} = 0.525). The $\delta^{18}O_{SMOW}$ of the CO_2 was +22‰The CO_2 is carrier of a considerable negative isotope anomaly. The anomaly is larger in magnitude than the anomaly of tropospheric air O_2 –0.388 $\pm$ 0.032 ‰ [5].

Either formation of CO_2 during combustion of propane in air is accompanied by a mass-independent isotope effect or other processes affected the resultant $\Delta^{17}O$ of CO_2. Such effects could include (partial) equilibration with H_2O and/or kinetic fractionation during combustion with air O_2.

In ongoing work, we will investigate CO_2 from different combustion processes, like in diesel and petrol engines, natural gas heating systems and burning of firewood. Along with CO_2,we will also analyse the triple oxygen isotope composition of H_2O produced during combustion.

[1] Hoag K. J. et al. (2005) Geophysical Research Letters, 32, 1-5

[2] Brenninkmeijer C. A. M. and Röckmann T. (1996) Analytical Chemistry, 68, 3050-3053

[3] Hofmann M.E.G. and Pack A. (2009) EGU, Vol. 11

[4] Hofmann M. E.G. and Pack A. (2010) Analytical Chemistry, in revision

[5] Pack A. et al. (2007) Rapid Communication in Mass Spectrometry, 21, 3721-3728