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Comparison of fragment technique with MAT 253 ULTRA and O_2-CO_2 exchange method for measuring triple isotope composition of CO_2

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Anomaly in oxygen isotopes in CO_2, also called ^{17}O-excess is an important tracer to study CO_2 exchange between atmosphere and biosphere. With Isotope ratio mass spectrometers (IRMS) it is impossible to measure δ^{17}O of CO_2 directly due to interference from mass 45. With the newly developed high-resolution mass spectrometer, it is possible to measure δ^{17}O in O_2 fragments formed from CO_2 inside the mass spectrometer ion source. The fragment measurement is only possible with a mass resolution better than $\sim$4700 which is achievable with modern high resolution stable isotope ratio mass spectrometer such as MAT 253 ULTRA.

Here we compared CO_2-O_2 isotope exchange method with a newly developed fragment technique using MAT 253 ULTRA for triple oxygen isotope measurement of CO_2. CO_2-O_2 exchange method enables to obtain the δ^{17}O of CO_2 by measuring on O_2 while the fragment method allows to measure δ^{17}O of CO_2 directly from the CO_2 fragment. Enriched CO_2 and normal CO_2 samples are used to compare the two methods. The two techniques require pure CO_2.

The exchange method is more precise and requires small amount of sample relative to the fragment technique. The main advantage of fragment method is that it is simple and does not require any additional steps and/or chemicals to measure the δ^{17}O value of CO_2 unlike CO_2-O_2 exchange and fluorination technique. However, the mas signals for isotopes of fragments are relatively small and needs long measurements for a better statistical analysis.