



Isotopic composition of carbon in CO₂ from fluid inclusions in minerals - continuous flow-isotope ratio mass-spectrometry method.

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The method of continuous-flow mass-spectrometry has been widely used for isotopic measurements for the last two decades. In this paper we investigate potentialities of the method of continuous-flow mass-spectrometry in order to determine the carbon isotopic composition of CO₂ from fluid inclusions in different minerals.

We have developed a special system for analyzing nanomole- and subnanomole-sized quantities of CO₂, through a combination of a special quartz extraction line and a commercially available interface (the Finnigan Gas Bench II) with Thermo Finnigan 253 mass spectrometer. The system is similar in a number of ways to those constructed by Bebout et al. (2007) for analyses of nanomole quantities of silicate nitrogen. The Gas BenchII system partially emulates dual-inlet mode in that it is possible to integrate measurement of the sample gas with multiple analyses of reference gas during an analytical run. More over, the system is capable of analyzing multiple aliquots of gas from samples. $\delta^{13}\text{C}$ values were determined from fluid inclusions in quartz, garnet and peridot samples.

The samples of quartz, garnet and peridot (30-100mg) were loaded into quartz tube (which have been pre-roasted at 1000-1100°C) and exposed to stepped heating up to 1000°C with a step of 100°C. Amount and $\delta^{13}\text{C}$ values of CO₂ were changing during heating, as the experiments showed. Thus, the amount of CO₂ released from garnet and peridot was about 0,05-0,1 $\mu\text{mole/g}$. Carbon isotopic ratios of ₂ from nclusions in garnet range from -22 to -30‰, and in peridot – from -22 to -6‰. More significant variation observed for quartz. Thus, the amount of CO₂ released from quartz inclusions of 10 $\mu\text{mole/g}$ was approximately an two orders of magnitude greater than that we determined for garnet and peridot. $\delta^{13}\text{C}$ values ranges from -15‰ (300-400°C step) to -4‰ (600-800°C step) with further decrease to -7‰ in 800-1000°C interval. Variability of $\delta^{13}\text{C}$ values depending on the temperature indicates an action of different factors that are resulted in compound isotopic composition of carbon. The most important from these factors are carbon isotopic exchange between CO₂+H₂O+CH₄+C, temperature decomposition solid-phase carbonates from inclusions [Miller et al., 1997, Potter et al., 2007]. Therefore, in order to obtain reliable $\delta^{13}\text{C}$ values it is necessary to study isotope composition of gas mixture (₄, N₂, H₂) from fluid inclusions in detail.

References

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