Quantification of oxygen isotope ratios in the Venus atmosphere by IR spectroscopy

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The oxygen isotope ratios $^{17}\text{O}/^{16}\text{O}$ and $^{18}\text{O}/^{16}\text{O}$ in the solar system are known to show a clear systematic relation. And the relation differs planet by planet. For example, the $^{17}\text{O}/^{16}\text{O}$ ratio as a function of $^{18}\text{O}/^{16}\text{O}$ ratio in Mars appears to be larger than that in the Earth-Moon system by 0.05 %. This fact indicates that the proto-Earth-Mars matter was so well mixed but with a systematic difference. In such a way, the isotope ratios may provide information about the origin and evolution of the planets. However, $^{17}\text{O}/^{16}\text{O}$ ratio in Venus has never been quantified, and may provide further information about the mixing history of the early solar system if measured.

The ratios may be quantified by ground-based CO$_2$ IR spectroscopic measurements. By assuming a use of IRTF CSHELL spectrometer with a nominal resolution of 40000, we looked for suitable wavenumber regions to quantify the $^{17}\text{O}/^{18}\text{O}$ and $^{18}\text{O}/^{16}\text{O}$ ratios. The suitable region for the former is found at 2648 cm$^{-1}$ as shown in the figure, and the latter at 4582 cm$^{-1}$. In the figure, the top two curves show the earth and solar structures disturbing the quantification, and the middle two curves show the Venus $^{17}\text{O}/^{16}\text{O}$ and $^{18}\text{O}/^{16}\text{O}$ structures indicating a feasibility to quantify the $^{17}\text{O}/^{18}\text{O}$ ratio.