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A quest for the water content of the lithospheric mantle: What are the challenges and opportunities?

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2024年3月29日（金）15:00～16:00

理学部A棟6階第1セミナー室 (A604-1)

Knowledge of the water distribution in mantle lithosphere is important to model the evolution of cratons over time and the inner Earth water cycle. Attempts to estimate deep lithosphere water content from 'water' in nominally anhydrous minerals (NAM) from mantle xenoliths has been extensively used in the past. However, the ability of xenoliths to preserve water signatures from deep lithosphere has never been fully demonstrated. In the first part of the talk, I will address this question through examples from several natural case studies from the French Massif Central. The case studies will be used to demonstrate the limits of the approach, showing that water recorded does not necessarily represent mantle water content. In the second part, I will show that mantle xenoliths have not all the same infrared spectral signatures. The coexisting of different infrared spectral signatures, which have not been erased during degassing, are the true signatures preserved from depth. I will demonstrate that distinct geodynamical contexts are associated with distinct spectral signatures, and distinct signatures may exist within a single geodynamical context. It opens perspectives to use them to study water lithosphere heterogeneities.

Keywords: hydrogen, infrared spectroscopy, mantle xenoliths

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