

# Online Simultaneous Determination of $\delta D$ and $\delta^{18}O$ in Water from Fluid Inclusion of Fluorite Mineral



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Citation: Jin et al., 2019. Online Simultaneous Determination of  $\delta D$  and  $\delta^{18}O$  in Water from Fluid Inclusion of Fluorite Mineral. *Acta Geologica Sinica* (English Edition), 93(supp.2): 396.

**Abstract:** Fluid inclusion provides important geological information. The stable isotopes of fluid inclusion can be used to trace the source, evolution and mechanism of ore-forming fluids. Water is usually extracted from fluid inclusion either by offline method or by online method. Offline method can be divided into mechanical vacuum crushing technique and thermal decrepitation, which requires a special vacuum extraction device and a large amount of sample, besides, it is time-consuming and laborious. The online method can be used to measure  $\delta D$  and  $\delta^{18}O$  simultaneously, but if the fluorine which is decomposed by fluorite is not absolutely removed, it may corrode the capillary and the isotope mass spectrometer, and the accuracy of fluorite with low water content is poor. A new online extraction device was invented to improve the accuracy of online and avoid the shortage of offline. The extraction device is connected with the EA/HT-IRMS system, which uses high pure helium as carrier gas to extract water from fluorite mineral inclusion online. The heater belts are twined around the pipeline to keep the temperature above 150°C so that the extracted gas could pass through the pipeline and the adsorption of water can be avoided. The mixture of alcohol and drikold is used to collect water, but CO<sub>2</sub> will not be frozen. The mixture of alcohol and drikold would be removed quickly after enriching water, and the electric heating system is switched on immediately. The temperature of collection pipeline for water is heated up rapidly to more than 200°C under electric current. The frozen water is quickly sublimated into gas, and passes through the heated pipeline to the reactor of EA/HT in pure helium. H<sub>2</sub> and CO are generated by chemical reaction of water with carbon in the reactor, which are separated by a chromatographic column, then go through Conflo IV into MAT253 to measure  $\delta D$  and  $\delta^{18}O$ . In addition, the liquid automatic sampler AS3000 is connected to EA/HT, which becomes a complete system with the fluorite fluid inclusion extraction device to solve the problem that there is no isotope standard for mineral inclusion. The determination of hydrogen and oxygen isotope composition of water in fluorite can be achieved by using the liquid water standard materials.

**Keywords:** fluorite, fluid inclusion, online measurement, hydrogen and oxygen isotope composition of water

**Acknowledgements:** Thanks are due to the reviewers and editors for their very useful comments. This study was financially supported by National key R&D Program of China (No. 2017YFC0602600).

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