A new method to determine both water content and hydrogen isotope composition of two forms of water in nominally anhydrous minerals

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A new continuous flow method, by combining high vacuum stepwise-heating (HVST) device with the thermal conversion elemental analyzer and gas isotope mass spectrometer (TC/EA-MS), is presented for determination of water contents and H isotope compositions for both structural hydroxyl and molecular water in garnet. By using the HVST device, molecular water and structural hydroxyl can be liberated step by step from garnet at different heating temperatures. By using the on-line quadrupole mass spectrometer in the HVST device, heating temperatures were determined for releasing the two forms of water from garnet from ultrahigh-pressure metamorphic eclogite in the Dabie orogen. Releasing temperatures of molecular water and structural hydroxyl from the garnet are 400°C and 1400°C, respectively. The garnet gives water of 228±39 ppm and a dD value of -110±10‰ for molecular water at dehydration temperature of 400°C for 1 hour, and water of 301±27 ppm and a dD value of -81±4‰ for structural OH at dehydration temperature of 1400°C for 1 hour. Therefore, the HVST-TC/EA-MS method can be used to analyze both water content and H isotope composition of the two forms of water in nominally anhydrous minerals.