Method measurement of Ar isotopes in He stream (conflo) for K/Ar geochronology

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Mass-spectrometric methods of measurement of Ar isotopes for K/Ar geochronology after of some key development (Inghram *et al*., 1950, Standacher *et al*., 1978) are developed on a way of perfection low background equipments. Achievement low background conditions measurement of Ar isotopes is extremely a challenge, requires greater efforts and a lot of time. Here, we report a new laser GC-MS method that incorporates helium carrier gas and chromatography methods (conflo) that allow for rapid analyses for small samples. The Ar gas is swept into the mass spectrometer in a helium carrier gas, allowing for extremely small samples to be quantitatively transferred ($<5\cdot10^{-13}$g). The laser GC-MS technique consists of six components: the overall high vacuum extraction line, the system of input tracer ^{38}Ar, the sample chamber, the laser, the gas chromatograph, the interface to the mass spectrometer and the mass spectrometer MAT-253 (Thermo Electron, Bremen, GmbH). Three Faraday cup for simultaneous measurement of isotopes ^{36}Ar, ^{38}Ar and ^{40}Ar are installed in the ions receiver of mass-spectrometer. Electrometric amplifiers for mass 36, 38 and 40 have entrance resistance 10^{-12}, 10^{-11} and 10^{-11} Ohm accordingly. We used infrared (λ=1.064 µm, CW, 100W) Nd-YAG laser to heat samples up to 2000^0C. Samples are placed into the chamber (10 - 18 samples, depending on weight). Extracted Ar together with tracer (^{38}Ar – $0.5\cdot10^{-9}$g) passes through U-shaped a trap (T =-196) and is adsorbed onto activated coal in a loop at temperature of liquid nitrogen. He is passed through the loop (He 99.9999) and the loop is heated up to 100^0C. The Ar gas is entrained in a helium stream (1-2 mL He/min), passes through the gas chromatograph to separate the Ar from any other gas, and admitted into the mass spectrometer via a split interface (Matthews, Hayes, 1978). To separate the Ar from other gas we use the capillary chromatographic column (HP-MOLSIV). Samples are analyzed using a dynamically pumped mass spectrometer. In general, Ar extraction by laser can be made every 15-20 min. The laser GC-MS system has been used successfully to analyze samples containing $<5\cdot10^{-11}$g ^{40}Ar. Smaller samples can be analyzed with the use electron multiplier for ^{36}Ar. Laser GC-MS method may be used and for ^{40}Ar/^{39}Ar geochronology.

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On the nebular origin of water in the Earth

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Although the chondritic or cometary origin of water in the Earth has been widely accepted, we explore another possibility that the Earth acquired water from the solar nebula. Several recent theories of the final assembly of the terrestrial planets in the solar system (e.g., Kominami and Ida 2002; Nagasawa *et al*. 2005) suggest that there existed the nebular gas until the formation of the terrestrial planets was completed. When that is the case, the planets collect large amounts of hydrogen from the solar nebula.

Our simulations of the structure of the atmosphere on terrestrial planets embedded in the solar nebula (Ikoma and Genda 2006) demonstrate that the planet's surface temperature is rather insensitive to the parameters and almost always higher than the melting temperature of silicate. In that situation the atmospheric hydrogen efficiently reacts with oxides contained in the magma ocean to produce water on the planet. From the chemical equilibrium constants (Robie *et al.* 1978), we find it possible that the reaction yields water comparable in mass to hydrogen. Although the exact amount of hydrogen that the primitive Earth acquired is unable to be determined at present because of the uncertainties in the heat flux and the grain abundance in the primitive atmosphere, our simulations show that production of water comparable in mass to the Earth's current sea water is possible for wide ranges of the values of the quantities.

We have also tackled the well-known problem of the discrepancy between the D/H ratios of the Earth's current sea water and the nebular gas (e.g., Drake and Righter 2002). We have simulated the evolution of the D/H ratio of sea water in the case the Earth had a relatively massive hydrogen atmosphere, which was neglected by previous studies, and found that the D/H ratio of the sea water increases by a factor of 3 to 9, depending of the escape rate of the atmospheric hydrogen (Genda and Ikoma 2007); this is consistent with the current D/H ratio of the Earth's sea water.

In the presentation we will discuss the advantages and disadvantages of the nebular hypothesis about the origin of water in the Earth.

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