

New preparation apparatus for noble gas isotope analyses to measure submarine hydrothermal fluids and renewed GVI-5400

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Hydrothermal activity is an essential phenomenon to drive geochemical differentiation on the Earth's surface, which should form polymetallic massive sulfide ores. Noble gas isotopes are regarded to be a powerful tracer even for the geochemical study on hydrothermal activity; however, there are abundant interference volatiles, e.g. halogens and hydrogen sulfide. Here, we designed a new preparation system to remove such volatiles using non-traditional gettering materials. This new preparation system consists of following components: the water preparations system, composite gettering system (halogen getter, sulfide getter and Ti-Zr getter), cryogenic pump, Saes-getter pump and charcoal trap to analyze the all noble gases. The new preparation system has compact volume, which needs small amount of seawater sample of 2-5 cc in volume. It is almost 1/20 compared to the typical requirement for He isotope measurement.

To design new noble gas measurement system in JAMSTEC, another critical problem is to be solved. One of widely used noble gas mass spectrometers, GVI-5400, is now not listed in commercial production models. Thus, all successor models of VG-5400 series have entirely finished their production support since several years ago. However, the VG-5400 series and its successor models still show satisfactory sensitivity and precision to determine noble gas isotope ratios. If we decide to use them much longer, we should maintain their control units, such as power supply, emission control or source control and so on, which requires replacement of essential electrical parts, including vacuum tube (!), regularly. At present, some of these parts are not supplied anymore and we are forced to choose between not replacing them with the new/second-hand electrical parts while they still worked, or renew their electrical circuits with currently manufactured electrical parts. By chance we had started the project to re-use old model of power supply unit. The first trial was applied to the very original VG5400 that was moved from Univ. Tokyo to Yamagata Univ. As the second case, we renewed the power supply and the emission control unit equipped for the JAMSTEC-2 noble gas mass spectrometer (GVI-5400He).

Here we report the better performance of new version of the renewed power supply unit, noiselessness and better stability, with the new noble gas preparation system.

Keywords: noble gas, getter pump, hydrothermal activity, mass spectrometer, extraction system