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A NaI spectrometer for long-term radon measurement at the sea floor

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In the Japanese Islands, the Tokai, Tonankai and Nankai earthquakes are expected within a few decades. It is a very important scientific issue to understand the physicochemical process occurring in the earthquake occurrence belt and the mechanism of earthquakes near the oceanic trench for damage mitigation of human lives and social basis. Increases of the radon concentration in atmosphere and in groundwater before earthquake are reported in the Southern Hyogo Prefecture Earthquake in 1995. In this research, gamma rays from radon daughter radionuclides at the sea floor will be continuously measured on the Kumanonada offing, where is the epicentral area of the expected Tonankai earthquake. The correlation between micro earthquakes and radon concentrations is also investigated to contribute the fundamental research on the response of the fluid in the crust corresponding to change of the crust.

Investigation on the gamma ray at the sea floor has been made only in a certain limited duration up to several hours while the submersible stays at the site for measurement. This time, a time variation of the gamma ray for several months is planned in order to investigate correlation between earthquakes and radon concentration. A battery drive type NaI spectrometer, which will be set on sea floor and can automatically record gamma ray, was designed. In this January it is almost constructed. A preliminary measurement is scheduled in February. After improvements of software and hardware, it will be set on spring water area of the Kumanonada offing from April to September, and will measure for more than about 4.6 months.

Specification of the NaI spectrometer for long-term radon measurement at the sea floor is as follows;
Name: Low consumed power type gamma-ray spectrometer for deep sea
PMT High-voltage : programmable (+1000V max)
Amplifier: Charge sensitive Memory Capacity: 1Gbit (NOR Flash)
Connection: RS-232C 921,600 bps Current: 110mA (on), 10mA (off)
Operation:
1. After initial setting with PC, measurement starts automatically, and records gamma-ray spectra.
2. It has the intermittent mode for electric power saving.
3. Battery Power Supply 30 AA alkaline batteries, 6 series, 9V
4. When the battery power supply voltage falls to 6V or spectral data is over memory capacity, measurement is suspended automatically and the battery power supply is disconnected.
5. It can connect with PC after measurement, and transfer the recorded spectra to PC.

Keywords: Radon, sea floor, long-term measurement, NaI