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福島事故以前における表層土壌中の放射性核種塩素‐36 とヨウ素‐129 の分布
Distributions of radionuclides Cl-36 and I-129 in surface soils before Fukushima accident

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The long-lived radionuclides ^{36}Cl and ^{129}I are generated by the nuclear tests or interaction with cosmic rays. They have descended to ground or sea level surface, and they have remained ground surface afterward. We have measured amount of ^{36}Cl and ^{129}I by accelerator mass spectrometry (AMS) before nuclear accident at the Fukushima No. 1 nuclear power plant.

We have collected surface soil samples from the Sea of Japan to the Pacific Ocean at the equal-latitude cross-sectional areas (37 ^{o} 20' N - 37 ^{o} 30' N) in the south Tohoku, Japan. Inorganic chlorine in soil developed an improved leaching process that uses diluted HNO3 as an extractant, activated carbon to remove organic matters without decomposition, and H_2O_2 to remove residual organic matters. After leaching from soils, the AgCl samples for AMS-target made from the obtained solutions at ordinary treatment. Isotopic ratios of ^{36}Cl/Cl were determined by AMS at Tandem Accelerator Complex, University of Tsukuba. Preparation of Iodine-129 target was following ordinary method. Isotopic ratios of ^{129}I/I were determined by accelerator mass spectrometry (AMS) at MALT, the University of Tokyo. Moreover, we determined ^{137}Cs concentrations by gamma spectroscopy and LOI (loss on ignition used by an electric furnace) which related to the amount of the organic matter in soil.

We obtained the distributions of radionuclides ^{36}Cl and ^{129}I in surface soils. The measured ^{36}Cl/Cl ratios of 34 surface soil samples which were about 0-10 cm in depth from 6 sites at the equal-latitude cross-sectional areas were between 0.1 x 10^{-13} and 4.1 x 10^{-13}. It was shown that the ^{36}Cl/Cl ratios are lower at both sea sides. The concentrations of ^{129}I and ^{129}I/I ratios in surface soil (0-10 cm) at 28 points were determined to be 0.18 - 1.13 mBq/kg and 4.3 x 10^{-9} - 11.7 x 10^{-9}, respectively.

The depth profiles of ^{36}Cl/Cl, ^{129}I and ^{137}Cs were examined that the difference of distribution. The concentrations are higher at close surface in each nuclide. The results of ^{36}Cl/Cl profiles in soil cores up to 1 m long suggested that bomb-produced ^{36}Cl remains in uppermost sections, typically for ˜20 cm deep, in undisturbed soil layers. The observed close correlation between organic matter content and ^{36}Cl/Cl ratio implies that presence of biological activity contributes the retention of fallout ^{36}Cl in the surface zone. The concentration of ^{129}I is shown the highest in uppermost surface. It is thought that the influence of global fallout has been received until now. In both nuclides, a constant amount exists in deeper than 30 cm. The concentrations of ^{137}Cs are not detection in deeper than 40 cm. It is showed that ^{137}Cs was lower mobility in soils. Therefore, the sampling soils were not a disturbance.

キーワード: 加速器質量分析, 塩素‐３６, ヨウ素‐１２９, 土壌
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