Study on transport behavior of cesium in the ground water via fractured rock

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Radioactive cesium released by the accident of Fukushima Daiich Nuclear Power Plant was deposited widely around Abukuma mountain region of eastern Fukushima Prefecture.
Fractured granite is widely distributed at the Abukuma Mountains. Many of the deposited Cs adsorbed on the soil of a few ~ 10cm from the surface. However, in some area, the basement fractured rocks are exposed directly on the ground, or distributed at the shallower depth from the top. In these area it can't be denied the possibility that Cs moves quickly via fracture in the basement rock. Especially, as for the Cs recharged at the mountain area, the concentration in the ground water of the spring and/or wells at the discharge area could increase with time at later time as the half-life time of the 137Cs is about 30 years. It is one of the biggest concern for residents who are already considering return to their hometown, or already use the spring and wells. However there has been seldom investigated cases of long-term behavior of the Cs released by the accident in the fractured rock.
For this reason, we have carried out the investigation of ground water analysis, dating of ground water and measurement of Cs concentration to predict the future exposure dose at discharge area. We have conducted geological, hydrogeological and hydrochemical investigation, and ground water simulation at around Odaka-ku, Minami-soma city, Fukushima Prefecture, where Cretaceous granite of Abukuma Mountain area at west part and Neogene sedimentary formation is distributed at the eastern lowland. Thus the general trend ground water flow is from west to east. The Futaba fault is situated between the Abukuma granite and Neogene sedimentary formation.
From the results of the geological investigation, Futaba fault has mylonite fabric which suggests the flow barrier function to ground water flow initially, though, brittle fracture of later stage is observed in the mylonite. And small amount of ground water flow from the fracture. This suggests Futaba fault doesn't have the flow barrier function. Regarding the hydrochemical analysis, the ground water sampled from the Futaba fault and artesian well indicate relatively longer residence time. Estimated ground water age is 25 to 30 years from the result of the tritium analysis etc. Moreover, Cs concentration in the ground water from the artesian well is below the detection limit. From the result of the ground water flow simulation which is modeled granite, Futaba fault and sedimentary formation with assigned hydraulic conductivity from data base, the hydraulic head distribution varies with the assigned hydraulic conductivity (higher or lower permeability) of the Futaba fault. For the origin of the ground water at the artesian well, it is unlikely from the Abkuma Mountain, but possibly from the sedimentary formation east side of the Futaba fault.
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