The main goal of the research proposed is to recognize the processes of interaction between cesium (an element from the first group of periodic table) and aluminum-bearing high-charge swelling clays (i.e. finely grained layer silicates commonly occurring in soils and exhibiting swelling properties in contact with water) likely taking place in natural environments. According to available literature data and the results of the initial research into the field the following research hypotheses can be formulated: 1. Dioctahedral high-charge swelling clays likely adsorb Cs^+ selectively (i.e. they exhibit higher adsorption for Cs^+ relative to other cations) and irreversibly from water solutions. 2. The processes take place, likely commonly, in natural environments and they lead to enrichment observed for sedimentary rocks in Cs due to formation of Cs-mica. To verify the hypotheses a series of laboratory experiments using different solutions and a set of carefully selected samples of Cs-bearing micas and/or dioctahedral swelling clays are planned to be performed. A study into selective irreversible adsorption of ^{137} Cs by high-charge swelling clays likely taking place in natural environments in the Tatra Mountains is also planned to be conducted. It is known, from prvious studies, that both soils and lake sediments from the Tatra Mountains contain the artificial cesium-137 isotope produced due to nuclear weapon testings performed in the 50s and 60s and during the accidents of Chernobyl powder plant. Both the soils and the sediments are also rich in high-charge dioctahedral swelling clays. In course of planned research the natural samples and substrates and products of the experiment will be analyzed using modern instrumental mineralogical and chemical techniques (e.g X-ray diffractometry, inductively coupled plasma optical emission spectrometry, gamma spectrometry, and Mössbauer spectrometry). Obtained data will be interpreted using sophisticated computer programs. The proposed research has a chance to constitute a first systematic and comprehensive study into interaction between Cs and dioctahedral high-charge Al-bearing clays. The results of proposed research will broaden our understanding of geochemical pathway of Cs and the properties of dioctahedral high-charge swelling clays. Due to the fact that contamination of an environment with ^{137}Cs constitutes the principal long-term problem caused by nuclear reactor accidents and nuclear weapon usage, the results of proposed research will likely have a significant impact on the development of more applied geological and environmental sciences as high-charge dioctahedral clays could be used for decontamination of ^{137}Cs-contamined waters.