

# STEPS Students Report

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The main research objective in this program is to conduct mineralogical investigations into the bentonite clay used in my master's study (Kunipia F; Kunimine industries, Japan) because both of us are interested in the collaboration by using this material. My research topic in master's course at the University of Tokyo is in the field of soil mechanics, and mainly focusing on the macroscopic bulk behavior of the expansive clay. In comparison, in MSU, various kinds of bentonite clays are studied especially from the geological and mineralogical aspects. Therefore, my clay sample was sent to Moscow and several mineralogical analyses were conducted on it.

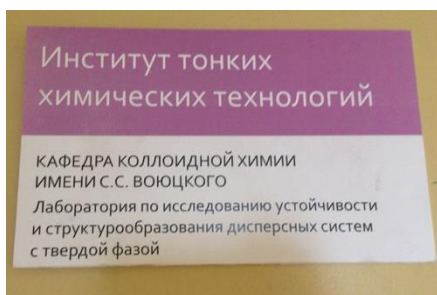
I visited two universities for the experiments. Firstly, I conducted some chemical treatments and measurements at the laboratory of colloidal chemistry in the Lomonosov Moscow State University of Fine Chemical Technologies, Moscow Technological University (MITHT). In this laboratory, with the great help of Dr. Boris Pokidko, several parameters of clays, such as CEC, particle size distribution and iron content were measured. In addition, cationic exchange treatments by alkylammoniums and other cations ( $\text{Ca}^{2+}$ ,  $\text{Li}^{+}$ ,  $\text{NH}_4^{+}$ ) were performed to the clay sample. After completing the cationic exchange treatments, samples are studied by powder X-ray diffraction (XRD) analysis in MSU to obtain the information of layer charges. Moreover, I conducted X-ray CT scanning on the clays at another laboratory in MSU Geology Department and visualized the pore distribution in the slurry samples made from distilled water and the sodium chloride solution.



(a)

Fig. 1: Institutes for chemical experiments

(a) МИТХТ (Lomonosov Moscow State University of Fine Chemical Technologies, Moscow Technological University)



(b) Colloidal Chemistry Laboratory at ИТХТ

(b)

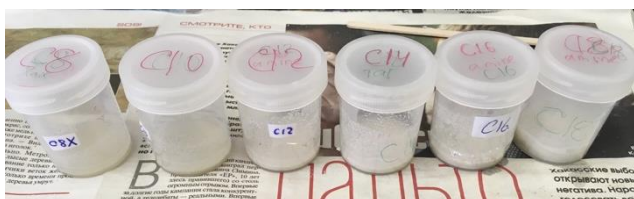
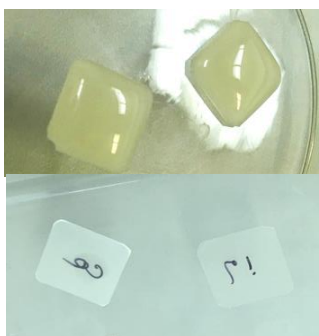
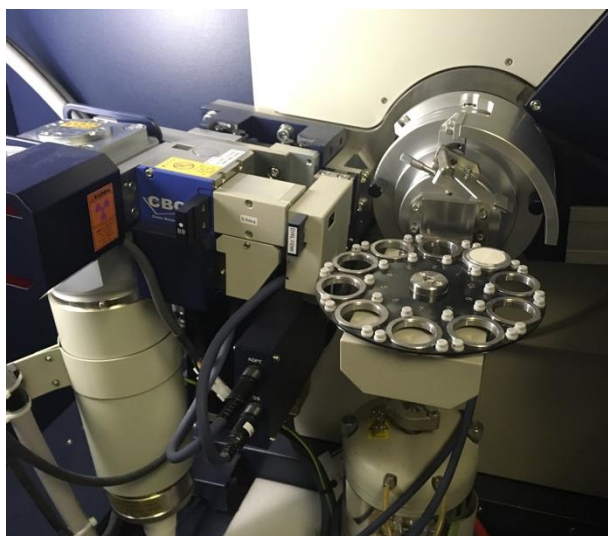


Fig.2: Alkylammonium treatment to the clay samples



(a)



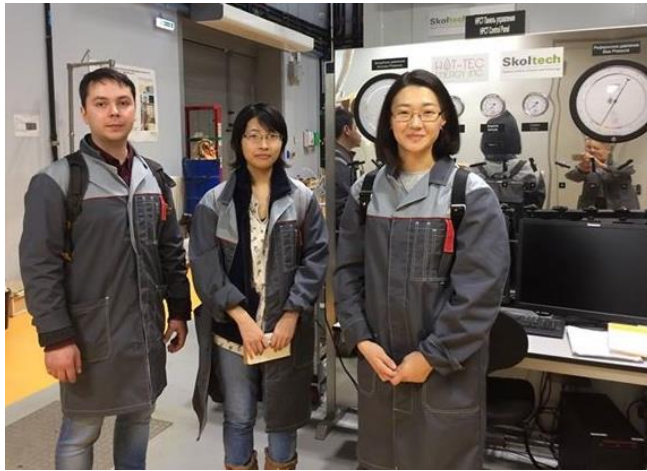
(b)

Fig.3: XRD analysis

(a) Preparation of oriented samples

(b) X-ray diffractometer, Ultima-IV (Rigaku, Japan)

On 31st January, I visited Skolkovo, the newly developed innovation centre in Moscow. Skoltech is an international university located there. I saw the laboratories in Skoltech Center for Hydrocarbon Recovery. Professor Evgeny Chuvilin conducted a laboratory tour to us. This research centre was established for mainly solving problems in the oil and gas exploitation industry in Russia. Their research areas are geomechanics, enhanced oil recovery, gas hydrates and permafrost, geophysics and petrophysics, and advanced reservoir simulations. There were various up-to-date facilities such as the universal experimental unit for thermal enhanced oil recovery.



(a)



(b)

Fig.4: Skoltech Center for Hydrocarbon Recovery

(a) Universal experimental unit for thermal enhanced oil recovery (b) Apparatus for making artificial gas hydrates

It was an excellent academic experience for me to participate in this program from two points of view. Firstly, I could acquire the skills of various methods of clay mineralogical investigation and the basic knowledge of clay mineralogy. It is noteworthy not only that this collaborating experience would be helpful and suggestive for my master's research, but also that we obtained a future possibility to collaborate for further research. Secondly, this experience widened my perspective in the way of doing research, by comparing the research environments between Russia and Japan. It was impressive to me that the bentonite clay research in Russia is conducted by the joint group from different institutes and fields, compared with the subdivided research environment in Japan. Above all, it was a great delight to share the curiosity into the interesting odd clay beyond the language barrier. In addition, I was lucky enough to meet with some kind people at the universities, enjoyed Russian food and exchanged some cultural things like movies and music with them. I liked the atmosphere in Moscow and got a closer feeling to Russia. I would like to visit Russia again someday, hopefully in summer. I am grateful to all the supports, funding and people who helped me to participate in and enjoy this STEPS program.