STEPS Students Report

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At first brief explanation about research area of that whole research group is put here. Their project aims to solve the fundamental problem – the evolution of the natural environments in terms of global climate change. In the frame of the general problem our goal is to provide the fundamental solution of the specific problem: the identification of linkages between global climate changes, sea level fluctuations and condition of the Caspian Sea system.

My research topic in Tokyo University is concrete engineering. It was different from their research area. So We had to discuss our field of interest. My interest was the way of analyzing soil material. That's because I thought concrete and soil material has some analogy in terms that they are aggregate of many components and some method in soil engineering can be used for concrete engineering.

Through deep discussion, my research work had determined to be "The comparison of 4 different method to analyze soil particle size". Measuring soil particle size is most fundamental part in soil analysis. They have some methods to do this. Of course each method has advantage and disadvantage, but there was no deep comparison between these methods. Therefore I did that comparison by using one soil material gathered from Volga region. (Fig.1)

Fig.1 Soil sample from Volga region.

The detail of 4 methods I conducted is shown below.

(1-a) Cylinder method with $Na_4P_2O_7$

(1-b) Cylinder method with horizontal vibrator

Cylinder method is classical method using cylinder and pipettes. This method uses Stawks-law that the period of settlement depends on the particle size. After mixing soil

sample in cylinder, I wait for specific period in order to gather certain size of particle. (Fig.2)

Fig.2 The process of cylinder method (Mixing- Waiting for settlement- Sampling)

Before this pipette using process, we have to separate soil particle from each other. In natural situation soil particles connects each other with Ca^{2+} ion. In order to separate them, we use chemical function by $Na_4P_2O_7$ (1-a) (Fig.3) or, we use horizontal vibrator (1-b) (Fig.4).

Fig.3 Mixing with $Na_4P_2O_7$

Fig.4 Vibrating horizontally

(2-a)FRISTCH analysis with dry sample

(2-b)FRISTCH analysis with wet sample

FRISTCH is equipment which can measure particle size and shape automatically using image analysis. The optical process of Dynamic Image Analysis provides results for an extra wide measuring range of 20 µm – 20 mm, delivers multiple shape parameters and also offers a very easy and cost-effective alternative to sieving.

Via the optical analysis of the particle shape and particle size, damaged particles, contaminates, agglomerates or oversized and undersized particles are identified accurately and fast, and can be viewed as single images. The measuring time depending on the sample quantity, is under 5 minutes. And the result is available immediately. (Fig.5)

We use dry sample in (2-a) and wet sample in (2-b). It is usual to use dry sample but, We

use dry sample in (2-a) and wet sample in (2-b). It is usual to use dry sample but we need to put more sample than wet condition. We aims to compare the accuracy of analyzing wet sample with dry sample.

Fig.5 FRITSCH size analyzer

I finished whole series of experiment just 2 days before I came back to Japan, so there was no chance to discuss the result with professor. I made output after coming back and you can see the difference between the methods in below graphs.

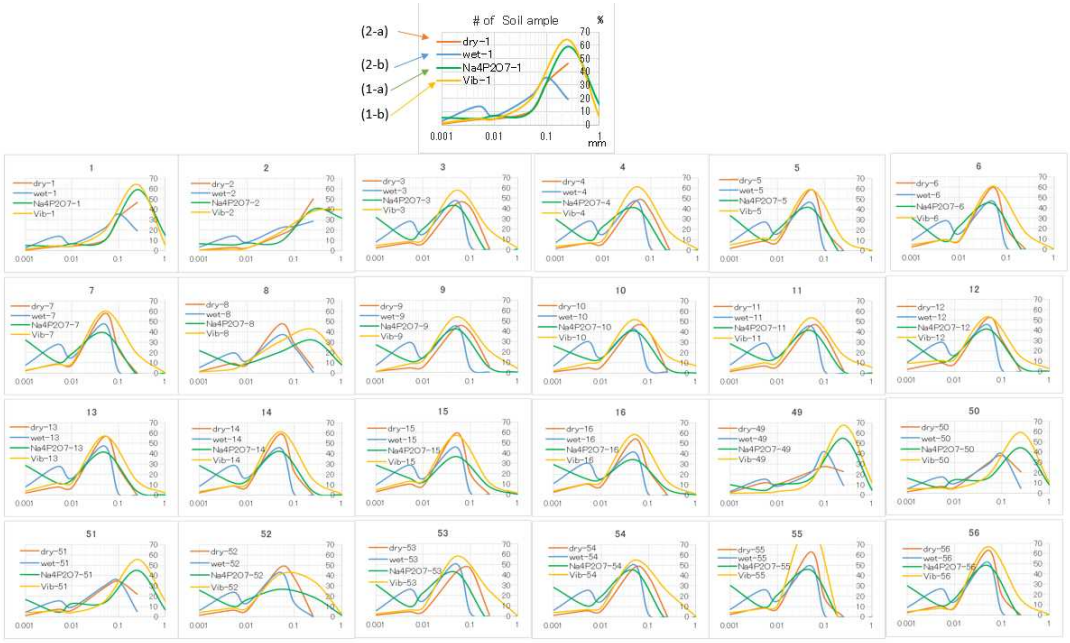

Fig.6 Results

Now I have sent this output to the professor in Russia.
He said a student in MSU will take over this research work and they will publish an academic paper regarding this work.