

Development of effective utilization method of borehole core samples in class by cooperation of teachers and museum curator

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Japan is where disasters occur frequently, such as earthquakes, tsunamis and volcanic eruptions. Geological knowledge is required to understand these kinds of disasters. However, many teachers lack the experience of learning geology in high schools or universities, and they think that teaching geology is difficult. It is necessary that researchers and engineers specializing in geology, especially geologist in museums, support teachers.

Osaka Museum of Natural History is located in The Osaka Plain. Most part of the Osaka Plain was bottom of the sea about five thousand years ago, and the thick mud layer (so called “Alluvium marine clay bed”) deposited there (Fig1, 2). This Alluvium marine clay bed contains many kinds of fossils of sea creatures, such as shells and bones of whales. Because the Alluvium marine clay is very soft and contains a lot of groundwater, the Osaka Plain shakes well and liquefaction happens in some places, when the large earthquake occurs. Geological survey by boring is necessary to make a building in such soft ground area.

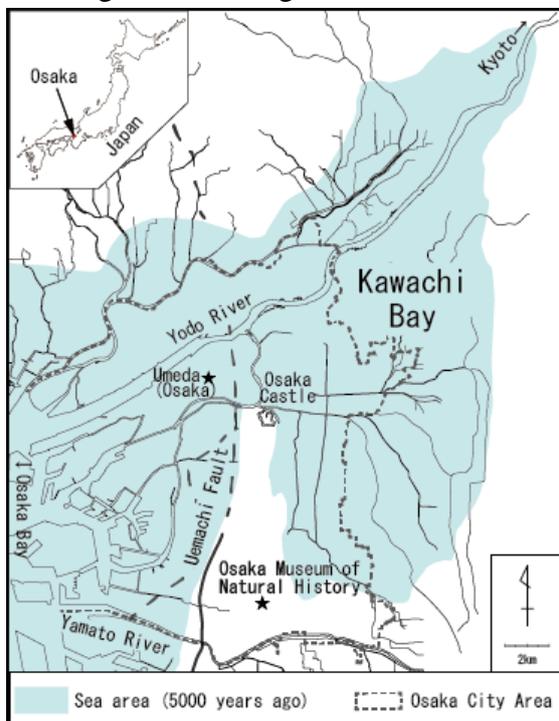


Fig.1 Map of the Osaka Plain and Sea area about 5,000 years ago. (Modified from Osaka museum of natural history; 1986)

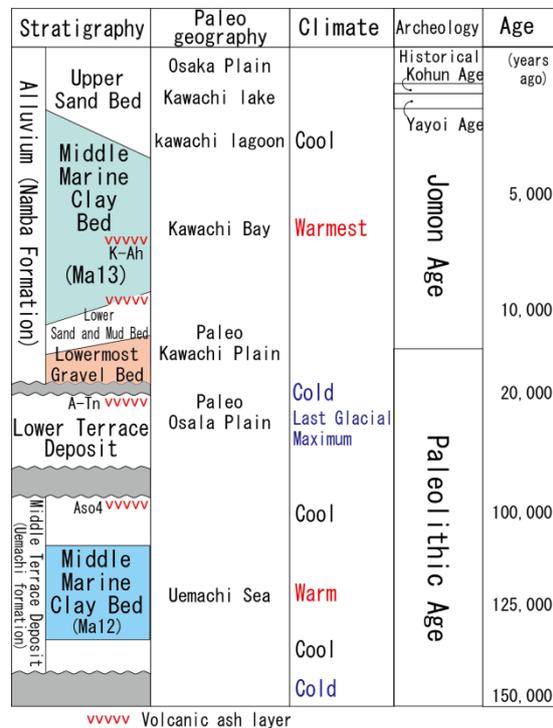


Fig.2 History of the Osaka Plain last 150,000 years (modified from Osaka museum of natural history; 1986)

The Osaka Museum of Natural History has collected borehole core samples and data that were obtained from the construction of schools and municipal housing in Osaka City area. The number of the core and data area more than 4,000. We lend these borehole core samples to the school for teachers to use in class.

The elements to lend are below. (Fig.3)

Borehole core samples (yielded from the teacher's school who wants to be support)

Geological section of 2-3km range including the school

Description of geological history and environmental changes revealed from the borehole core samples

Special exhibition commentary book on the geological history of the Osaka plain (Osaka museum of natural history; 2016).

Panel set of paleo-geographic maps and photographs of fossils (Fig.4)

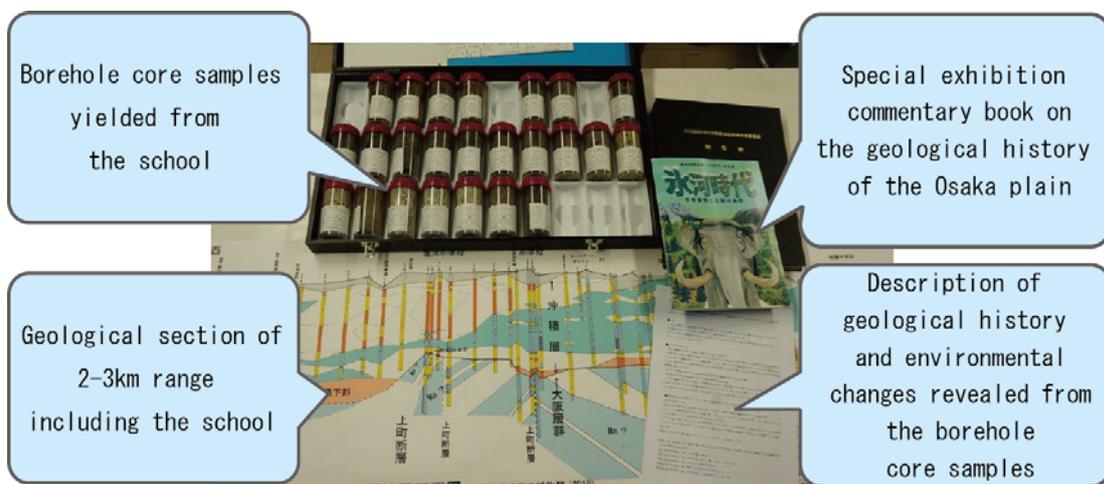


Fig.3 Elements to lend for a school.

Once ready for loan, the curator asks the teacher to come to the museum and explains how to observe the borehole core samples, including the characteristics of the marine clay layer and how to find fossils of shell fragment.

We introduce the teachers with some teaching plans. The teaching plan for elementary school showing



Fig.4 Panel set (paleo-geographical maps and Photographs of fossils)

below was written by the teachers who had experience to use the borehole cores in teaching class. Some teachers did open classes using this teaching plan. The flow of the class proposed in the teaching plan is as follows.

1st hour: The teacher proposes to the students to imagine and draw what the underground of the school looks like. Ask the students how to survey underground. Some students may give an opinion "digging a hole". According to that opinion, the teacher actually lets the students dig a hole in the school yard. Students will get tired before they dig 30 cm.

2nd hour: The teacher introduces the boring survey, which is a method that can survey to a depth of several tens of meters underground. Then students observe the borehole core samples. They will understand that there are layers of gravel, sand and mud. Some students may find that the mud layer contains shell fragments. The teacher explains that the layer has deposited in the sea about 5,000 years ago. Students apply colors to the geological column of the borehole core samples they have observed.

3rd hour: Students consider if there are some beds that can be correlated among several geological columns yielded from the school, using the worksheet (fig.5). Students will notice that the mud layer deposited in the sea can be correlated. Using the geological section in the 2-3 km range, that includes the school, the teacher shows that the marine clay bed is widely distributed. Then the students apply the blue color on the area where the sea had spread on the paleo-geographic map of 5,000 years ago which the school's

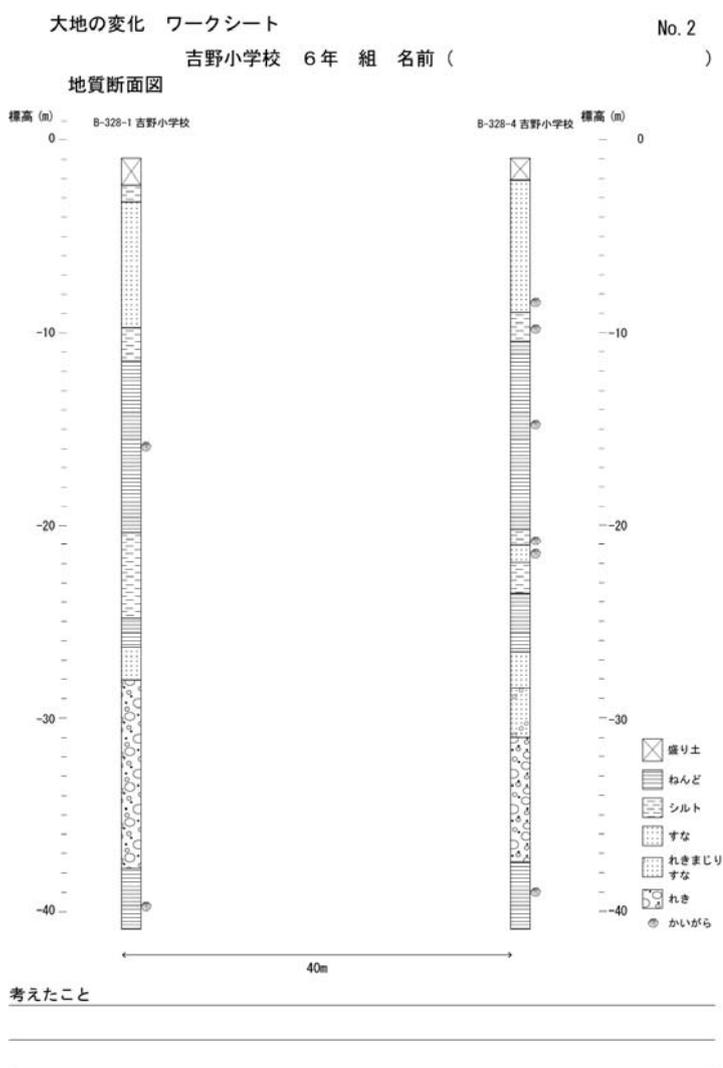


Fig.5 A sample of work sheet for the 3rd hour.

location was shown. Through this work, students can understand the situation of the Osaka Plain at that time and the environment where the school is located. The teacher tells students that the marine clay bed deposited 5,000 years ago is very soft. Students can discuss what happens when an earthquake occurs at such a place at the next class.

The lending of borehole core samples and the proposal of teaching plans are generally well received by the teachers. Some teachers said that both teachers and students had gotten interested in the geology because they had used borehole core samples yielded from their school in class. Some teacher said that using the actual borehole core samples had been also effective, too.

Through this project, students and teachers can learn the geology of their school, understand the past environment, learn about the characteristics of the ground, and gain the knowledge necessary for disaster mitigation. This project will be continued in the future.

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#### Reference

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