Elucidating the culture of human beings in the Ice Age from stone tools, products of the oldest manual technique

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Born in Shiroishi City in 1955. Graduated from the doctoral course of the Department of Anthropology, University of New Mexico. Studied archaeology and prehistoric studies. Has been researching the use of stone tools, etc., mainly in the Paleolithic Age, and comparative cultures in archaeology. Appointed as Assistant and then Assistant Professor at the Faculty of Arts and Letters, Tohoku University before assuming current position.

http://www.sal.tohoku.ac.jp/archa/home.htm

Professor Akoshima leads the use-wear mark research team of Tohoku University. They inherited a tradition of empirical studies from Professor Chosuke Serizawa who performed great work as a leader in the study of Paleolithic tools in Japan.

Two million years ago, in the Paleolithic Age, humankind had a technique for making stone tools, long before it was able to keep fire. One of Professor Akoshima's research subjects is use-wear marks on stone tools made by striking stone or taking flakes off stone, which elucidate human activities and cultures in daily lives in that era.

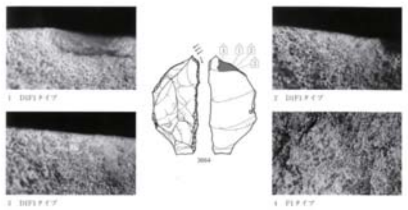
The analysis of stone tools includes observing very small traces (or use-wear marks) left on stone tools through a microscope and comparing them with those made in reproduction experiments to study how they were made. Stone tools left in the natural environment are compared with reproduced stone tools that were used to work animal bone or leather, or just flawed. The way a very small chip was made on a stone tool may be of great importance in reconstructing the ancient world. It is a wonder that there are identical use-wear marks on stone tools that have been excavated in countries that have had little historical relationship. It seems that stone tools with the same function look similar regardless of differences in age and place.

This "archaeology as anthropology" pursued by Professor Akoshima is based on the theory of Lewis Binford, the founder of processual archaeology. It is not only intended to reveal the history of the researcher's own country but emphasizes comparative studies as a part of the study of humankind. It aims to reveal how human groups in the same historical background and environment adapted to environmental changes, discover their universal experiences, and study them from a global perspective. This is the field that Tohoku University began to explore in the 1980s, earlier than any other. Use-wear analysis on stone tools is considered a way of comparing cultural remains on a global scale. A goal of this analysis is to join archaeology with anthropology for new development.

This work is like re-experiencing the memory of humankind of the far distant past. Archaeology is a long-range study that is synchronized with a remote past beyond time and space. Professor Akoshima says that hands-on and field-oriented approaches are important. They are also looking at the problem of reliably passing on archaeology to future generations in the form of theoretical anthropology.

They observe use-wear marks on stone tools through a digital microscope, a laser microscope and/or a metallurgical microscope, and compare them with reproduced stone tools. Modern archaeological means do not miss even extremely small marks such as micro flaking, linear marks and wear gloss. In the field of use-wear marks on stone tools, the laboratories of Tohoku University have led the world since the 1980s. Methods used and developed by Tohoku University are now used as standard methods not only in Japan but also in other Asian countries.

Drawers where materials for comparison from 600–700 cases are organized. Only a few academic institutions have materials for experimental comparison under set conditions. Important archaeological materials are also stored at the university.



Use-wear polish on a stone tool called a "Chokokuto (burin)" (Excavated from the Araya site in Niigata Prefecture, Upper Paleolithic Age). It has marks showing that it was used to make tools from animal bones or deer antlers, or process animal leather.

My favorite

Shale and obsidian (volcanic glass), are the main materials of excavated artifacts from ruins in the Tohoku region. Leather is a cushion material on which a stone tool is pressed in processing it. It is elastic and protective against injury. Tools for experimentally making stone tools include a flaking tool made of a deer antler, and a stone hammer, used to strike and break stone. Prof. Akoshima demonstrated how to make a reproduced stone tool.

Mysterious plants that do not travel but stay put A world's first! Supports Darwin's hypothetical theory published in *Nature*

Professor Masao Watanabe

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Born in Ehime Prefecture in 1965. Graduated from the Department of Agronomy, Faculty of Agriculture, Tohoku University. Completed the first half of the doctoral course of the Division of Agricultural Sciences, Graduate School of Agricultural Science, Tohoku University. Acquired a Ph.D. in Agricultural Studies. Assumed positions of Assistant Professor at the Faculty of Agriculture, Tohoku University, then Associate Professor at the Faculty of Agriculture, Iwate University, then invited Professor for a 21st Century COE Program at Iwate University. Has been in current position since 2005.

http://www.ige.tohoku.ac.jp/prg/watanabe/

Brassica plants are used as research material. It is important for human beings to understand the fertilization of plants, because they eat their seeds/fruits. If climate change is drastic in the future, plants may evolve by changing their genes. The mystery posed by Darwin is still left unsolved.

Plants do not speak, nor can they travel freely. However, they have their own ways of taking in outside information. In 1876, Charles Darwin, who put forward the theory of evolution, proposed the hypothetical theory that self-fertilization, i.e. being pollinated with their own pollen, was advantageous for plants in an environment with few breeding partners. This spring, research results that support this hypothetical theory were published in *"Nature."*

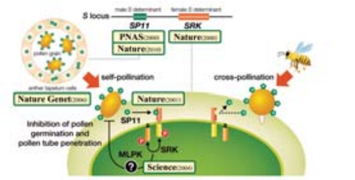
For many plants, if the stigma surface is pollinated with the plant's own pollen, this pollen is rejected, and as a result no seeds will be produced. This is because plants have the ability to distinguish their own pollen from other plants' pollen, i.e., self-incompatibility (SI). This trait is to prevent inbreeding depression, which is observed in most of animals and plants, including human being. On the other hand, there are self-compatible (self-fertilized) plants, like rice and *Brassica* plants. Why do these plants accept their own pollen? Professor Masao Watanabe and his collaborators elucidated the molecular mechanism of the evolution of SI.

Arabidopsis thaliana, known as a model plant, is self-compatible. Professor Watanabe, *et al.,* surveyed several ecotypes of *A. thaliana,* and found one ecotype (Wei-1) having functional *SRK* (female *S* determinant) and non-functional *SP11* (male *S* determinant). After modifying and repairing the non-functional *SP11*, the repaired (functional) *SP11* was introduced into Wei-1 ecotype. The transgenic *A. thaliana* showed the SI phenotype. This is the first case of success in artificial SI in *A. thaliana* using modified gene introduction in the world. Since Darwin, researchers have discovered how finely plants have adapted to various environments in wonderfully sophisticated ways. The data from Professor Watanabe's group is the first case of demonstration of the evolutionary process at the gene level.

Professor Watanabe has also done outreach activities at elementary and junior/senior high schools more than 100 times. In the future, he is looking forward to doing research with children. His ideas and ambition will be passed on to the next generation in this way. "A whole understanding of the molecular mechanism of plant activities should elucidate the problems of environments, food, and energy," says Professor Watanabe.

Members of Prof. Watanabe's laboratory. They do cross-breeding experiments of rapeseed plants at the green house. They cultivated several cruciferous plants, including cabbage, Chinese cabbage and radish (self-incompatible), and *Arabidopsis thaliana* and other wild relatives (self-compatible).

Spring is the important season for collecting the stigma (i.e., the top of the pistil) and anther (i.e., the top of the stamen) of Brassica flowers. This work requires picking up one stigma with a weight of 0.1 mg one at a time with tweezers. In one season, the members of laboratory will collect tens of thousands of stigma and/or anthers in total for several experiment.



A figure of a schematic model for the recognition mechanism of SI in cruciferous plants including turnips, cabbage, and Chinese radish. Self and non-self pollen are transferred to the stigma's surface by insects, like honey bees. If self pollen pollinates the stigma surface, SP11 (male *S* determinant) and SRK (female *S* determinant), bind, and SI reaction (rejection of self pollen) occurs. In contrast, when pollinated with non-self pollen, SP11 and SRK do not bind, and the pollen tube can penetrate into the papillar cells of the stigma surface. The scientific journals, in which our experimental results were published, are shown in the figure.

My favorite

"I still sharpen pencils by hand. So I need a knife. Tweezers are a very important tool for genetic experiments. I grind them by myself. And I always have candies for the throat, because I do a lot of lectures," says Professor Watanabe. Apart from them, on his desk there are shells of cicadas, models of a whale and seal, a miniature set of cabbages, Chinese radishes and Chinese cabbages, and so on. They are very important items to make his space comfortable and give him good ideas for experiments. There are three chestnuts in a pocket of his white coat—playing with them is helpful when he is thinking.