Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MZZ45-01 Room:422 Time:April 29 14:15-14:30

Edmund Naumann (1854-1927) and Mt Fuji

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Edmund Naumann (1854-1927) and Mt Fuji
Michiko YAJIMA

Mt Fuji is the highest mountain in Japan at 3776 m. In 2013 Mt Fuji was added to the World Heritage List as a Cultural Site. Japanese people, young and old, man and woman, climb Mt Fuji for religious reason since the old age. Scientific research on Mt Fuji started at the Meiji Era by the foreigners. Before 1854 Japan closed the doors to the Westerners. Once opened the door to the Westerners, Meiji Government hired many foreign teachers.

Edmund Naumann (1854-1927) came to Japan in 1875, became the first professor of Geology in the University of Tokyo, founded the Geological Survey of Japan and made the good geological reconnaissance map of Japan. He was fascinated by the Mt Fuji just when he reached Japan. At that time many westerners came on boat, the first sight of Japan is Mt Fuji. Western scientists all made the race to climb Mt Fuji. Naumann climbed the Mt Fuji in 1883. His research work is just surrounding Mt Fuji. He made clear the history of measurement of the height of Mt Fuji. He made clear the history of eruption of Mt Fuji. His most important geologic work is proposing the Fossa Magna in the central Japan. He thought the reason of Fossa Magna may be the intrusion of Mt Fuji.

After he came back to Germany he wrote even the script of Opera “ Taketorimonogatari ” that is the old Japanese tale of beautiful lady who came from the heaven and came back to the heaven at Mt Fuji with the smoke of eruption.

Keywords: Naumann, Mt Fuji, Fossa Magna

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The Research on Seitaro Tsuboi Materials: Interpreting his Correspondence

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The author has studied a large quantity of historical materials about a geologist Seitaro Tsuboi (1893-1986) (hereinafter ”Tsuboi Materials”) since 2010, which have been collected and archived by Multi-media and Socio-information Studies Archive, University of Tokyo. Tsuboi conducted researches on igneous petrogenesis with physical and chemical methods from 1920s to 1950s, which attracted positively or negatively many geologists. Combined with his position, a professor of petrology at (Imperial) University of Tokyo, he had considerable influence on the course of Japanese geological sciences.

Prior to the study of Tsuboi Materials, the author’s understanding was that Tsuboi’s influence over Japanese geological community rapidly decreased after his retirement from the professorship in 1954. However, the analysis of contents of Tsuboi Materials, such as correspondence with publishers about his books and documents about royalties on his books, suggests that his researches did attract people’s interests even in the late 1970s. The details will be introduced in the presentation.

Keywords: History of Science, History of Geology in Japan, Seitaro Tsuboi, Archive

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The Examples of the ”puzzle-solving” in the Plate Tectonics Theory

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It is generally considered that the plate tectonics theory has become a paradigm in the field of solid earth science (for instance, Miyashiro, 1998). Indeed, when I was engaged in descriptive research on the structural geology of Boso peninsula when I was studying for the doctoral degree, I would use technical terms of the accretionary prism theory, a sub-theory of the plate tectonics theory, to interpret observed facts. Also, looking at an outcrop in front of me, I was often asking myself, ”Which part of an accretionary does this piece correspond to?” in the middle of a field survey. By doing so, I was trying to integrate new observed facts into the framework of the accretionary prism theory, which can be considered in a sense as ”puzzle-solving” in normal science as referred to by Thomas Kuhn.

Tomari (2008) describes how the Japanese earth science society accepted the plate tectonics theory, apart from the memoirs of people directly involved in this process. Tomari argued that while geophysicists and seismologist accepted the plate tectonics theory in a relatively smooth manner, it took ten more years for geologists to accept it, which he described as ”a lost decade”. He ascribes it to the following causes: the geologists were interested less in application of physics and chemistry (principle of the present) than description of the respective geographical features of each region in accordance with the orogenesis theory; also, the geologists who were the leading figures in the Association for the Geological Collaboration in Japan, which accounted for the majority of the geological society in Japan at that time, harshly criticized the plate tectonics theory. Shibasaki(2011) argued against the claim of Tomari, by noting that the Japanese geological society by no means accepted the plate tectonics theory late for the following reasons: geologists who were conducting research on biostratigraphy with the use of Radiolaria fossils from the late 1970s to the early 1980s led the geological society to accept the plate tectonics theory by, for example, successfully explaining some of the problems of areal geology with the accretionary prism theory ? in particular, the problem associated with age determination of block-in-matrices (Radiolaria revolution); as such, they were able make a contribution to a theory on global movements precisely because they were engaged in research on areal geology. She also maintained that since most of the young researchers who contributed to the Radiolaria revolution belonged to the Association for the Geological Collaboration in Japan, while it is certainly true that the researchers who were the leading figures of the association were against the plate tectonics theory, their influence was limited. She then argued that it is necessary to conduct more integrated research on science history.

With regard to the question described above, I argue that it is meaningful to review when the kind of research that corresponds to the ”puzzle solving” of the plate tectonics theory began in each of the sub-fields of geology (structural geology, stratigraphy, volcanic petrology, metamorphic petrology and mineralogy, in addition to areal geology). It is because it is possible to determine whether the result of any given research corresponds to the ”puzzle-solving” of the plate tectonics theory from its theoretical structure; and by doing so, it is possible to show that the plate tectonics theory functions as a paradigm. In this presentation, I introduce some examples of the geological studies which are regarded as the ”puzzle-solving” in the plate tectonics theory.

Keywords: plate tectonics, puzzle-solving, history of science, geology

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A history of mining, mineralogy and geology in the German literature

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The question of organic or inorganic nature of minerals had been a subject of a debate since the ancient Greece to the Middle Ages. Thales and Pythagoreans believed that stones had souls, whereas Plato and Aristotle believed they possessed an anima. In the view of nature in the Ancient Rome, people believed that leaving mines without mining for a certain period of time would allow them to refill. In the Middle Ages, the relationship between minerals and magic was debated, and people believed stones had anima whereas jewels had magical powers. This thinking was further developed by alchemists, for whom the knowledge and understanding of minerals and jewels was essential.

The idea that minerals have supernatural power is also found in the German literature, especially that of the 18 and 19th century. A lot of novelists at the time studied mining, mineralogy and geology as they had been involved in mining business. In their writings stones have mystic powers.

However, already in the 13th century, Albertus Magnus ridiculed the idea of stones having a soul. Georg Agricola published De Re Metallica (1556) a complete and technical treatise on mining and extractive metallurgy in the 16th century, whereas Leibniz created Protogaea, an ambitious account of terrestrial history, central to the development of the earth sciences in the 17th century.

I will introduce works of romanticist (Goethe, Novalis, etc.) and philosophers (Leibniz, etc.) involved in mining business, and discuss the gap between their philosophy and reality.

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Wang Mo’s role in the history of Japanese and Chinese geography

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Wang Mo is first Chinese graduate of the department of geography at Imperial University of Tokyo, and also founder of second department of geography in China. This paper examines his role in the history of Japanese and Chinese geography.

Keywords: institutionalization of geography, diffusion of geographical thought, Chinese international students in Japan, history of geography

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MZZ45-06 Room:422 Time:April 29 15:30-15:45

Theory Change in Science - Case Study on the Solar System Formation

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Philosophy of science today has been particularized, just like particular sciences themselves. Philosophy of earth (and planetary) sciences was active in the 1980s-1990s following the Plate Tectonics Revolution in the 1960s, but seems to be inactive these days. Recent anthology on philosophy of science (Curd & Psillos 2013) discusses biology, chemistry, cognitive science, economy, psychology, social sciences, etc. while making no references to earth sciences. The above-mentioned literature on Plate Tectonics Revolution was based on preliminary historical studies on the earth sciences in the 1960s. In contrast to this, the synthetic process of earth and planetary sciences is not yet documented in detail, so philosophy of earth and planetary sciences has to start with digging up interesting historical data.

This presentation, drawing on Brush(1996), overviews the theoretical developments on the origin and evolution of the solar system in the 20th century, and then discusses which model best explains this process.

Keywords: Philosophy of Science, History of Science, Science Studies

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A rudimentary consideration on anthropogenic climate change and countermeasures to it, ”geoengineering” in particular

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The issue called ”anthropogenic climate change” (ACC) or ”global warming” is such a chain of causes and effects that human industrial activities result in increase of concentration of greenhouse gases such as carbon dioxide in the atmosphere, enhancement of the greenhouse effects, and cause changes of climate which can be characterized by increase of global mean surface tempearture. It also have such aspects as sea level rise and changes of dryness, which have impacts on human society. The impacts are given unevenly between regions and between generations.

Since 1998 when the IPCC was established, the countermeasures to ACC has been discussed in terms
of ”mitigation” and ”adaptation”. In its 5th Assessment Reports (AR5) to be published in 2013-14, another category called ”geoengineering” is added. Here I tentatively follow the categorization of AR5.

The human society has developed within the constraint of the environment, by adapting to it. Climate, including its changes, is part of of the environment, and adaptation to it is one of basic functions of the human society. There are a few notable issues, however. Since the start of agricuture, the human society has experienced the climate of Holocene which has extraordinarily small variability in the context of the whole Quaternary era. Also, in the modern world, adaptation by migration has become difficult, since clear national baoundaries and land ownership have been developed, and population has increased so much thanks to technologies which also involve utilization of fossil fuel. In addition, with recent development of global ideas of equality between nations and humanitarianism,
people tend to valuate avoiding such fates where many people die untimely.

In the middle 20th century, it was hoped to technologically control climate
within a state favorable to human society. Development of science resulted in two pieces of understanding. One is that the climate is a complex system with large uncertainty due to nonlinarity and difficulty of observation. Another is that emission of carbon dioxide by burning of fossil fuels is an important forcing that shifts the energy balance of the climate system. Then, people tended to think a kind of ”passive intervention” by reducing the forcing that human activities already have made as the major countermeasure to the climate change. It has become customarily called ”mitigation”.

The essense of mitigation is reducing use of fossil fuels. International decision making on it has not been very successful even though 20 years have passed after the establishment of UNFCCC in 1992. It is because energy resources is fundamental to economical development.

In this context, hopes to technologically control climate, e.g. ”geoengieering” have risen again. It is still diffficult, however. The technology is not finished, and the knowledge about effects, side-effects and costs is uncertain.

Two major sub-catetories of ”geoengineering” are called ”carbon dioxide removal” (CDR) and ”solar radiation management” (SRM).

CDR is equivalent to mitigation as far as it reduces the forcing to the atmosphere, but it modifies the environment of geological formations, soil, or ocean, where the carbon dioxide is put. In addition, failure of sequestration is possible. ”How much environmental modification and possibility of accidents people can tolerate” will be a subject of social decision making. The decision making can be done within a country if the sequestration is made within its territory.

SRM can cancel the greenhouse forcing in global mean sense, but it will enhance it in some of latitude bands and seasons. Assessments of its impacts is as difficult as regional projection of ACC. The fact that this is intentional makes the issue of liability more serious. Thus, such an international governance regime that is much stronger than the current UNFCCC regime is necessary, in addition to technological feasibility, to include SRM in policy options.

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Keywords: anthropogenic climate change, global warming, geoengineering, adaptation to climate change, mitigation of climate change, solar radiation management

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Partial Commensurability: Translations between Multiple Observational Systems in Solid-Earth Physics

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The theme of incommensurability was introduced to philosophy of science by Kuhn and Feyerabend in 1960s. This theme has been discussed as problem of translations between multiple paradigms or conceptual frameworks. However, in 90s, a philosopher of science Ian Hacking extended the problematique ontologically. He argued that incommensurability is the problem of translations between multiple ”closed systems” in experimental science [Hacking 1992].

If we apply his argument to observational science, it is outlined as below. Each observational equipments forms closed systems. That is, each equipment has the particular procedure and principle of observation which correspond to the mechanical structure of it. The data are visualized in the peculiar way and analyzed with the unique methods of correction. When observational equipment is different, the methods for articulations and the results are totally different. Therefore, a result from a particular observational equipment is difficult to translate into a result of another observational equipment.

This theme suggest the problem how we can achieve the comparison between different observational systems. In this paper, the author will call such comparison ”partial commensuration” and discuss some specific examples of solid-earth physics, such as joint-inversion.

Keywords: Incommensurability, Observational Systems, Translation

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A Web-application of Dynamic Time-Scale Previewer and its Application for Historical Geoscience Studies

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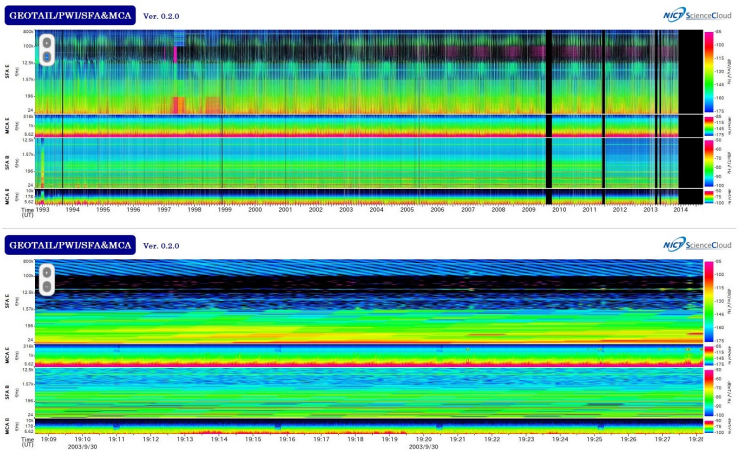
The NICT Science Cloud is one of the science clouds proposed for development of sciences. A variety of science data are collected and stored in the science cloud to be analyzed interdisciplinary. After the Internet is widely used, new concept and information technology haves shown up; semantic web and linked open data (LOD). These technologies enable information on the Internet machine readable. In many science fields, it is pointed out that the semantic web will play an important role for the interdisciplinary research works. However, there have been few ideas to be ever proposed as a methodology or roadmap to the interdisciplinary science using semantic web. Herein we present a concept of professional knowledge and academic knowledge following collective knowledge proposed as a Web 2.0. Based on the concept, we design a Web-application for interdisciplinary science. The application (named STARS touch) provides users with an environment of dynamic and light preview of any types of time-dependent data. In the demonstration, we show an example of simultaneous preview of both scientific data (satellite observation data) and social data (newspaper information).

Keywords: STARS touch, NICT Science Cloud, Web Application



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Science against Natural Hazard 1960-1993: Has the Natural Disaster Science Overcome the Disasters?

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The disastrous Ise-wan Typhoon of 1959 triggered the emergence of the field of Natural Disaster Science in Japan, which was proposed by the geophysicist Hasegawa Mankichi (1894-1970), President of Fukui University. The project, funded by the Ministry of Education and well organized especially by the geologist Matsuzawa Isao (1906-1990), Professor of Nagoya University, was continued until 1990s and provided many opportunities for the researches and activities of geoscientists. This article focuses this project considering the following contexts: 1) the post-war defense conversion in the field of earth sciences; 2) the interrelationship between the two major disciplines, geology and geophysics, in the sciences; and 3) the inclusion of the human and social sciences to cope effectively with such hazards and disasters.

Keywords: Natural Disaster Science, contemporary history of earth sciences, defense conversion, interdisciplinary domain, Hasegawa Mankichi, Matsuzawa Isao

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MZZ45-11 Room:422 Time:April 29 17:00-17:15

The reasons why we couldn’t avoid the Okawa Elementary School disaster

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March 11, 2011. Fifty minutes after the earthquake off the Pacific coast of Tohoku region, the big tsunami hit the Okawa Elementary School at Ishinomaki city. The victims include 74 students and 10 teachers from that school, as well as 3 students from Okawa Junior High School that had come to take children home and unknown number of Okawa district residents. Only 4 children and 1 teacher survived the catastrophe. It is considered the worst tragedy under the school administration since the establishment of the school system in Meiji Restoration.

The role of Earth Planetary Science will be examined considering the fact that the comprehension about magnitude of those involved in science education is still in the 1960’s, and the problem concerning the Okawa Elementary School accident verification committee’s investigation, which is predictable and not enough to get to the truth about the tsunami catastrophe.

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Characteristics of the modern stone industry and the regional context in each granite production areas in Japan

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Japanese stone industry has been thought to have developed to supply materials for the western architectures that were introduced in Japan in the late 19th century. It is also thought that it simply reduced because the imported stone materials became inexpensive. They are true, in a way, but the fact is more intricate, according to the interview survey carried out in several granite production areas. It is important to learn and record the complexity in the industrial history of one of the Japanese undergroung resources. Characteristic Japanese manner in the stone industry is described in this article. Difference in the industrial structure and history between several production areas are then documented.

Modern quarrying and stone manufacturing industry in Japan was established shortly after the introduction of western architecture, which used stones. Before that, stone was not popular in architectures. Therefore, stone was accepted in Japanese construction as decorating or finishing material. As the result, the standard manner of stone panelling in Japan became very elaborate, which only allowed beautifully designed stone panels with perfect colors and patterns, without any irregularities. The tradition has lead to low yield ratio (high rate of waste). Japan is also unique in its market of large granite tombstone which became popular after the world war II. Religeous monuments are also popularly produced in stones. Stone materials in Japan therefore had two different markets, one for building stones, another for tombstones and religeous craftworks.

Grain size, number density and orientation of cracks seems to determine the use of the stone, for building stone or for tombstone. Coarse grained granite with less cracks and veins yields large sized blocks, which is more favorable for architectural use. Some of those granites are used in famous hitorical buildings in Tokyo (e.g. Shodoshima stone, Kitagi stone). Fine grained granites with greyish colors are favored for tombstones in Japan (e.g. Aji stone, Oshima stone). Those quarries tend to have cracks with high number density and very low yield ratio, resulting in very expensive tombstone products.

Another factors that made difference between the granite production areas are the location of the quarry. Quarries on islands had advantage when principal transportation was seaborne. The transportation however shifted onto land and the islands lost their advantage. The relation between the quarry and the town sometimes restricted the activity of the quarry, concerning the noise or the disturbance on the landscape. Ownership of the mining area seemed to affect the sense of community in the production area.

The scheme and the unique manner of the stone industry in Japan are described. The interview survey revealed the context of each several granite production areas in Japan, and demonstrated how they corresponded to the decrease of stone production in Japan.

Keywords: building stone, tombstone, headstone, granite, quarry, modern industrial history