Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)


G01-01 Room:202 Time:May 20 09:00-09:15

# Changes in building stone industry after the second world war in Japan

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Building stone industry in Japan first occurred following the introduction of western style buildings and houses to Japan. This study explored into the official statistical data to find evidence about the change in the structure of the building stone industry in Japan. The used data are mainly the import and export of stones and stone products, and the data concerning the numbers of quarries or relevant factories in Japan. It was clear that the Japan's official data are not enough to display the long-term industrial changes, so some books and articles concerning several building stone firms were also explored to reconstruct the full image of the Japanese stone industry in the old days.

Keywords: building stone, tomb stone, import, official data

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G01-02 Room:202 Time:May 20 09:15-09:30

# Disk-recording seismographs developed by J. A. Ewing

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James Alfred Ewing (1855-1935) made various improvements to the horizontal seismograph developed in 1880 by him. He also designed a vertical seismograph of which idea had been given by Thomas Gray (1850-1908), however, did not complete the instrument until his leave from Japan in 1883. The disk-recording seismographs were used at the Tokyo (Imperial) University in two decades probably because of an advantage in rigid recording surface, although handling of the disk was troublesome and arc-like records were complex. Nevertheless these instruments were not quite constructed by sophisticated technology at that time, reproduction of the instruments is not so easy at present. In Japan of 1880s who did manufactured the seismographs?; what components of the instruments were available domestically? Curiously, seismographs in the 1880s and the1990s were not installed dampers, although some scientists claimed damping mechanism should be attached to such instruments. The early worker might have though the seismic wave did not include long period components and use of pendulums of appropriate period was sufficient for observation of earthquakes.

Keywords: J.A.Ewing, early seismographs

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G01-03 Room:202 Time:May 20 09:30-09:45

# A few remarks on Alfred Wegener (1880-1930)and Edmund Naumann(1854-1927)

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This year 2012 is the 100th anniversary of the Continental Drift Theory proposed by Alfred Wagener (1880-1930). In the book of 'die Entestehung der Kontinente und Ozeane', there is description of Japanese Island Arc and Fossa Magna proposed by Edmund Naumann (1854-1927).

As Naumann was the first professor of Geology of the University of Tokyo, many historians made research on the biography of Naumann. But many things such as the site of Dresden Polytechnic in the time of Naumann attended, the name of first wife of Naumann, and so on were left as unknown. A few remarks on biography of Naumann at present will be delivered

Keywords: Naumann, Wegener, Fossa Magna

Japan Geoscience Union Meeting 2012
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G01-04 Room:202 Time:May 20 09:45-10:00

# Why was the view that faulting causes earthquakes rejected inJapan

TOMARI, Jiro[1*]

[1]ERI

Nowadays most earth scientists believe that most earthquakes are the result of faulting. But until the early nineteen-sixties, a controversy lasted over the question whether faulting was the cause of earthquake or faulting was the result of the earthquake in Japan. Although the theory that a double couple force causes a fault had been presented in the early nineteen-thirties and the theory could explain observation data satisfactorily, the view that earth block movements or subterranean magma movements causes earthquakes were more popular.

The reason why the view that faulting causes earthquakes had not been accepted would be thought that a double couple theory did not explain the origin of a double couple force bringing about faulting. The advent of the seafloor spreading hypothesis changed the situation, because the hypothesis could explain the origin of a double couple force. It owes to the seafloor spreading hypothesis that the double couple theory had been accepted in Japan.

Keywords: faulting, block movement, magma, double couple, seafloor spreading

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G01-05 Room:202 Time:May 20 10:00-10:15

# Collecting Materials for the Study of Contemporary History of Earth Science in Japan

YAMADA, Toshihiro[1*], Shinjiro Mizutani[2], Shigeyuki Aoki[3]

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More than sixty years having passed since the end of World War II, it is noteworthy that the study of history of geoscience has increasingly attracted scientists and historians these days (Editorial Committee of History of Geosciences in Japan 2008-2010, One Hundred Years of the Researches of Geophysics in Kyoto University 2010-2011, Working Group of Japanese INHIGEO Members 2011). Unfortunately, however, we have much concern about the lack of systematic attempts to collect and store the memories and records for historical researches, which otherwise in many cases may be scattered or seriously damaged.

In order to advance the study, we have started collecting the historical data such as official documents, conference reports, private notes at various meetings and lectures, written messages, manuscripts and oral histories of geoscientists. These are temporarily classified into two: the one is about the history of universities and institutions, for example the department of Earth Sciences of Nagoya University; and the other is about individual scientists such as the late professor Akiho Miyashiro (1920-2008).

Nagoya University established the Department of "Earth Sciences" in 1949, which naming was the first case in the old educational system of the national universities in Japan. Basic idea of "earth sciences" had been discussed among the professors of the School of Science during and after WWII. The educational program was entirely invented, which included not only geology but also geochemistry and geophysics. After half a century later, however, new trend of science forced the department to be changed into more advanced form of investigation and education in 1996, now called as the Department of Earth and Planetary Sciences. Thus we suppose the collecting historical materials of the department would contribute to establish the institutional history of the science in post-war Japan.

As for the history of earth science itself, we should pay attention to the works of Miyashiro, who gave the most significant influence upon Japanese geologists not only in the field of metamorphic petrology but also in the global geology covering plate tectonics. The materials we have collected include a) private letters communicated by Miyashiro in Albany with his Japanese friends, b) unpublished drafts on the history of geology in Japan, and c) books in his own library concerning philosophy of science, history of geology and so on. These are grouped as information from four stages: 1) around 1980 when he worked for editing and publishing the IWANAMI KOZA for Earth Sciences in 16 volumes, 2) 1994-96 when he wrote a series of the essays entitled "What is Geology?" in Japanese magazine for science, 3) around 1998 when he published his book KAGAKU KAKUMEI TOWA NANIKA [What is Scientific Revolutions?] and 4) the latest stage when he wrote the history of geological societies in Japan. We believe this small step would contribute to understand the life and work of the famous erudite geologist, avoiding triumphalism, in the contemporary history.

Based on these materials, we will be able to clarify the contemporary history of earth science in Japan. As is reported at the last meeting of the JpGU (Aoki and Kuramoto 2011), our research group named 'CHES (Contemporary History of Earth Science)' consisting of geologists, geochemists, geophysicists, philosophers and historians would cultivate the future programs of the science not only in its academic form but in the educational system and ultimately render some service to our society in general.

Keywords: history of earth science, Showa post-war period, Nagoya University, Akiho Miyashiro, collecting materials

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G01-06 Room:202 Time:May 20 10:15-10:30

# Archiving Historical Materials of Earth Science: A Case of the Research on Seitaro Tsuboi Materials

TOCHINAI, Fumihiko[1]*

[1]Kanazawa Institute of Technology

Today, the society has become more dependent on science and technology. It is therefore essentially necessary to study about them. History of Science (HoS) is a discipline that evaluates how science and technology work from historical viewpoint. It is needless to say that collecting and analyzing historical materials are inevitable to conduct HoS researches. However, there is a great difficulty in handling such materials of recent times, too many materials to evaluate.

The author has studied history of geology of modern Japan, and one of the main subject is a geologist Seitaro Tsuboi, who had greatly influenced geology in Japan. Shogoro Tsuboi, one of the first Japanese anthropologists, was his father, and their materials have been collected and archived by Multi-media and Socio-information Studies Archive, University of Tokyo. The author has studied the materials since 2011.The author introduces the latest findings from the study of them.

Keywords: History of Geology, Archive, Seitaro Tsuboi

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G01-07 Room:202 Time:May 20 10:45-11:00

# Observing Geodesists?: Cultural Anthropology on Geoscience

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Anthropology of science, which appears in 1970s against a background of Kuhn's theory of scientific revolution, extended the targets of anthropology into laboratories, which are highly ”modern” field ever since. The mission of this discipline is to understand the unique characteristics and anthropological meanings of scientific activities through describing them ”thickly”.

The speaker is fieldworking on a geodesy laboratory since June 2010. The central aim of my research is to answer the following question: ”why can scientific accomplishment be accumulated, though scientific researches are driven by each scientists's interest?”

In this presentation, the speaker will focus on the practice of inversion analysis, which is one of the most important practices in geodesy. The speaker divide the inversion practice into two phases. The first phase is called ”measurement”, the practice of collecting semiotic data through operating machines with operating instructions. The second phase is called ”operation”, the practice to process the data which is collected by ”measurement” and to understand the natural phenomena such as earthquake and eruption.

While it seems that ”measurement” is a strictly normative activity that is controlled by operating instructions, ”operation” seems unrestricted practice though some aspects are routined. To understand the seemingly disorganized activity, the speaker will prescribe ”operation” as semiotic operational sequence which consists of

”calculation of measured value”, ”correction” and ”analysis”. And then the speaker will define the practice of ”interpretation”, which creates a brand new sequence and attach into the existing sequence.

The main focus of this presentation is to examine the characteristics of ”interpretation”. Is ”Interpretation” in geodesy, as the word implies, subjective? Or, as conventionally we thought, do scientists (geodesists) make a ”objective” knowledge of the world by the practice of ”interpretation”? In this presentation, emphasizing the importance of ”drawing” of data, the speaker will explain the process that the ”interpretation” of a geodesist takes the validity.

Through these argument, the speaker will suggest the cosmology of measurement science. It is neither the activity that tries to get the objective knowledge about the world, nor the practice that totally depends upon the scientists subjectivity. Such cosmology will contribute to understand what science is for human.

Keywords: Anthropology of Science and Technology, Geodesy, Measurement Science, Cultural Anthropology, Science, Technology and Society, Science Studies

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G01-08 Room:202 Time:May 20 11:00-11:15

# Senior High School Course ”Basic Science” for Learning Meta-science

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Senior High School Course ”Basic Science” for Learning Meta-science will be argued.

Keywords: Basic Science, History of Science, Meta-science

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G01-09 Room:202 Time:May 20 11:15-11:30

# From philosophy of science to science of science - A casestudy on earth science

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According to Turchin(2003) which advocates historical dynamics, some discpline becomes mature science when qualitative (verbal) analysis develops into quantitative (mathematical) analysis. There are some examples to testfy this: Newtonian dynamics, synthesis in evolution theory. Then, as we turn to the philosophy of earth science, each study puts forward qualitative analysis based on the results of New Philosophy of Science during 1960s to 1970s (Frankel 1988, LeGrand 1988, Stewart 1990, Inkpen 2005). After that, this field seems to have been stagnant and so we need to develop more experimental efforts.

In this presentation, we start from Laudan & Donovan (1988) (Scrutinizing Science : Empirical Studies of Scientific Change, Kluwer) and try to consider how to turn philosophical theses into mathematical models and test them against empirical findings. First problem which faces us is that, in contrast to historical dynamics, we lack statistical data in history of science. For example, in historical dynamics the data on imperial expansion/contraction are available, while such data and indexes are not yet available in history of science.

Moreoever, we have the problem on what we count as scientific growth. A representative index is the increasing number of journals and papers. However, this analysis (scientometrics) is rather external as opposed to internal examination of science, thus is different from making philosophy of science itself science. Another promissing hypothesis is, science is problem-solving acticity, and therefore its growth can be measured by the increasing number of problems. This presentation discusses what problems await us in this line of thinking.

Keywords: philosophy of science, history of science, geoscience, science of science

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# From earth science to earth and planetary science as multidisciplinary fields

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One of the most important mission of the philosophy of earth and planetary science is to understand the history on how the earth and planetary sciences have emerged from the earth sciences and its sociological background and dynamism of scientific thought. In other words, this issue may be what the earth science is and also what the earth and planetary science is. In a popular scenario (Marvin 2002), the earth and planetary science had begun to emerge through the application of the methods of earth sciences for the Moon during the great Apollo program. This scenario probably captures some truth, but there remains another question that "the earth science" here covers not the entire earth sciences but a part mainly of solid earth sciences.

Some earlier specific fields of earth and planetary science already dealt with the Moon and planets in the same way as the Earth significantly prior to the beginning of the space age. For example, Sir Jeffereys (1891-1989), famous for his pioneering work obtaining the seismic velocity structure of the Earth, had also studied on the interior of the Moon and the Saturn's rings at the early 20th century. The *Geophysical International Journal* (1922-present), in which many epoch-making classic articles on the earth's internal structure were published, were originally the supplement of a journal of Royal Astronomical Society, suggesting that many of scientists treated the Earth as a celestial body at that time. In the field of geochemistry, the idea recognizing the meteorites as a primitive materials providing crucial reference to understand the terrestrial materials was also put forward in the early 20th century (Goldschmidt, 1938). The journal *Geochimica and Cosmochimica Acta*, which treated equivalently the geochemistry and cosmochemistry, was first published in 1950 earlier than the beginning of space age. These trends may be the seeds for the modern earth and planetary sciences.

The establishment of modern earth and planetary sciences may be closely related with the building consensus of the earth sciences as a multidisciplinary field. The program of International Geophysical Year (1957-58), which organized cooperative searches covering the solid earth sciences, atmosphere-ocean sciences and the space physics, played a significant role in making linkage among previously-independent research fields about the Earth. This program, originally proposed by Van Allen, had been backuped by the development of space vehicle technology, which in fact provided the first artificial satellites Sputnik 1 and Explorer 1.

During the same era, the planetary sciences came to be clearly defined as another multidisciplinary field. It is noteworthy that this was not only based on the space programs but also was dependent on the remarkable findings in the neighboring research fields such as the establishment of the theory of stellar formation and evolution, accumulation of the global knowledge of the Earth, and the construction of molecular genetics. In the preface of *Icarus*, the journal first published in 1962 by American Astronomical Society, we find the following statement in the first paragraph:"It stands, above all, as a tribute to the new interdisciplinary science of the solar system–which is emerging to claim its own identity at the cross-roads of the allied disciplines of astronomy, geology, geophysics, meteorology, geochemistry, plasma physics, and biology–and a recognition of its anticipated importance in the years to come." This put emphasis on this new scientific field to be characterized by its multidisciplinary nature. The ensuing achievements of planetary exploration programs seem to have just embodied this discipline associated with the development of the theory of planetary formation.

Keywords: philosophy of science, history of science, earth and planetary science, multidisciplinary field

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# Decrement of Night-Sky Brightness after the Tohoku Earthquake

NOMURA Shiho[1], ONOMA, Fumiki[1*], WATANABE Yoichi[2], IWAGAMI Hiroko[2], ATOBE Koichi[3], TAKAHASHI Mariko[4]

[1]Hoshizora Kodan, [2]Sumida Study Garden, [3]Executive Committee of Light-down Kofu Valley, [4]Yamanashi Prefectural Science Center

Night-sky brightness caused by artificial lights with human activities has become a serious obstacle to the ground-based astronomical observations. Undesired brightness called "Light Pollution" is known as one of the environmental hazard, and observational data of night-sky brightness have been reported by the Ministry of Environment of Japan. In the other hand, statistical observation of night-sky brightness and artificial light are desired to clarify the relationship between them.

We installed an digital camera to measure night-sky brightness in Yamanashi Prefectural Science Center located at Kofu city, and had directly compared the night-sky brightness with artificial lights from October 2009. The night-sky brightness highly correlates with artificial lights measured for two years. This result means that bright sky over cities are strongly affected by the artificial lights. Under the assumption that the correlation between night-sky brightness and artificial lights depend on size of city and population, we installed new camera in Sumida Lifelong Learning Center of Tokyo from November 2010. This camera can observe more polluted night-sky of Tokyo, and we expected to clarify the time variation of brightness over Tokyo.

We adopt commercially available digital cameras to measure the sky brightness. We use green channel of RGB bands for measurement because visibility of human eyes has peak of green. In addition, for accurate measurement, we chose RAW format of digital camera, which is not compressed and combined the Bayer pattern. We calibrate sensor response against input light intensity to achieve gamma linearity using calibrated gray scale chart. Because digital camera sensitivity is individually changing, we calibrate sensor gain by measuring standard star on the images. We adopt Johnson V magnitude as a standard star brightness because spectral characteristics of green band on consumer digital camera has similar response of Johnson V band filter. Both camera takes the images every 10 or 15 minutes from 18:00 JST to 6:00 JST for every night.

After the Tohoku earthquake at March 11, 2011, city lights in Kofu city decrease about 40% compared to the lights measured before. As the city light is reduced, the night-sky brightness in Kofu city and Tokyo decrease about 40% after the earthquake. The brightness in Tokyo on April 4, 2011 shows value of 17.1 mag/arcsec$^2$ while the brightness from November 2010 to February 2011 shows value of 16.5 mag/arcsec$^2$. Because no intended power outage was brought in operation during observation period and it was found that billboard and outdoor lightings turned off from the night view of Kofu city, only energy saving made the night sky darker. In most cases, light sources which illuminate night sky are waste of electric power. For assessment of light pollution and evaluate the efficient power usage, it is desired to measure night-sky brightness over the long term.

Keywords: night-sky brightness, photometry, digital camera, light pollution

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# How to launch the Science of Science

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[1]Nagoya University, [2]Kyushu University

We envisaged the creation of a science which deals with the seventh major event in the history of the earth, that is, the rise of science itself. We named it the Science of Science. The aim of our paper is to map out a blueprint for bringing the science of science it into shape.

Needless to say, even now there are some rudimentary attempts which could fall into the category of the science of science; cognitive psychology of scientific reasoning, sociology of science, scientometrics, anthropological study of laboratories and so on. And also we have long-established field called history of science, which describes the actual developmental process of science in detail. What we lack is something like a canvas on which we can synthesize findings of these preexisting research fields and paint a phenomenon called science with the whole history of the earth in the background.

We claim that a radically naturalized Kantian philosophical project can play a role of such kind of platform for launching the science of science. The Critique of Pure Reason can be re-interpreted as a task analysis of modern science. First, Kant posits a information processing agent which receives manifold of sense as an input and delivers scientific worldview as an output. Then, he sets about a task analysis which tries to answer the question what kind of subtasks are necessitated for this agent to complete the computation of the cognitive function described above.

Nevertheless, Kantian task analysis lacks a viewpoint of evolution which can make an issue of how such a unique information processing agent could and did emerge. In addition, Kantian analysis is too individualistic in that it models an agent doing science as a mind of an isolated individual man. However, the real science is being done by a complex made of many scientists and artifacts such as experimental instruments and institutions like a peer review system etc.

So, the challenge we are facing is to answer the question how we could build social and evolutionary viewpoints into the pioneering project of Kant.

Keywords: science of science, philosophy of science, naturalism

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# A natural view of the World in philosophy of science provided by interpretation of the Earth's evolution history

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We are proposing one of the new designs of the World view, which is not science but metaphysics, whereas it is based on the latest scientific understanding on the origin and development of life and its evolution to higher ability of sensing environments, processing of information acquired, and further feedback to itself together with environments. Anthropic view is emphasized in designing the World view, since our intellectual ability of understanding the World through science is a result of a particular evolution path with specific cultural history under the specific environmental condition for anthrop. Our intrinsic requirement is to acquire the hopeful view and strategy on the successive survival, or 'ikitsugi', which is identified with a successive continuation of intellectual working to understand the World further.

Our natural World view is designed primarily as consisted of the minimum number of essential factors in a causal space in time domain. Our idea is to choose the three; (A) past, (B) present and (C) future all in a form of question and answer. (A) is how the World has been working on the metaphysical basis, (B) is how the epistemology called science works, and (C) is how we design the future World by incorporating axiology naturalized with science and technology in the society.

(A) is given by summarizing interpretations of the latest 'historical science knowledge' acquired by (B) on the evolution of space (e.g., big bang), coevolution of life and Earth environments, our whole culture including philosophy and science as natural phenomena and also creation of the World view in (A).

(C) shall be our relevant target of 'future science' unifying all of our intellectual activities towards the survival continuation or 'ikitsugi' of intellectual agent for the World in (A) to keep working in a self-reference by feedback.

We have assigned (B) to play a central role in constituting the whole view by interpretation, and the 'ikitsugi' as our hope to be a central dogma. Therefore, the World view proposed here is metaphysical in character, whereas its foundation is placed on science concept and also on real intension of anthrop and its possible successors.

The world view above is not unique since it is based on the supposedly reasonable interpretation of science knowledge beyond its extent. Any alternative goes as a matter of course. A sound world view is expected to possess a potential of wide span including everything. We have presented only a basic framework of the world view alone without any discussion and application to specific subjects in detail in this abstract. However, this view is a result of our intensive exploitation so as to be useful for scientists, philosophers and other professionals in their respective works in detail. Further we intend to make it useful for the people in acquiring the comprehensive and systematic science literacy essential for designing our future society.

We are now working on the description of detailed structures of this world view in each of (A), (B), (C) and their interrelations. Some of them will be presented in detail at the time of JGU meeting. We note several practical utilities of the new world view as exemplified below.

(1) The present World view is designed to provide us with a basic framework of reconstructing the philosophy of science to match with the sense prevailed in working science laboratories.

(2) It will promote a really naturalized attitude in philosophy itself to be adapted to science age. The consequence is the practical and realistic stance towards the axiology substantially naturalized to match with 'future science' for our own future 'ikitsugi'.

(3) Many philosophical concepts and terminology are interpreted or translated into the comprehensive and useful ones for scientists and others by means of this framework of World view.

Keywords: philosophy of science, world view, decoding Earth evolution program

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# Where and how did science come from? A cognitive approach.

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Scientific activities started as one of the greatest events in the history of the earth. Thus the historical question 'where and how did science come from?' can be also investigated in geoscience in so far as one of the aim of geoscience is to reveal the history of the earth (e.g., Kumazawa, Ito, and Yoshida 2002).

In fact, such origin and historical development of science has been vastly studied in the traditional metasciences such as history, philosophy, and sociology of science since the 19th century. However, these traditional metasciences have not focused on the following questions: What and how do scientists do think? When and how did humans acquire the scientific thinking in their evolutionary history? Why is it impossible for other non-human animals to engage in scientific activities? Especially, the last two questions are important to consider the history of science in terms of the geoscientific time scale.

To consider these questions, first, it is useful to look at recent developments in cognitive studies of scientific thinking (e.g., Anderson, Barkar, and Chen 2006; Carruthers, Stich, and Siegal 2002; Feist 2006; Giere 1992; Gorman 1992; Holyoak and Thagard 1995; Mithen 1996, 2002; Nersessian 2008; Simonton 2004; Thagard 2012), where the results of cognitive science and other metasciences are connected to elucidate how scientists do think in their activities. A consensus from these studies is that abstract thinking such as analogy and modeling is necessary for creative reasoning in science.

Then where did such abstract thinking come from? This is a question we would like to investigate in this talk. More specifically, first, we will outline some of the above works developing insightful arguments on the question (e.g., Holyoak and Thagard 1995; Nersessian 2008). Second, we will extend and update these arguments through examining more recent arguments in philosophy (e.g. Carruthers 2006, 2008; Dutton 2009), cognitive archaeology (e.g., Coolidge and Wynn 2009), and comparative studies of huamns and non-human animals (e.g., Haun and Call 2009; Penn, Holyoak, and Povinelli 2008).

Keywords: metascience, history of science, philosophy of science, cognitive science of science

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# Model, where earth science and the philosophy of science meets

YOSHIDA, Shigeo[1*], NAKAO, Hisashi[2], KUMAZAWA, Mineo[2], TODAYAMA, Kazuhisa[2]

[1]Kyushu University, [2]Nagoya University

We carried out a project called ”Decoding the Whole Earth History”, in which we identified the birth and development of science as the seventh big event in the Earth’s history. A natural extension will be to locate science in the Earth’s history through a more intensive investigation. On the other hand, philosophy of science is also trying to locate science in a broder perspective of human intellect. Having this aim of locating science in a broad perspective in common, we have organized a group of scientists and philosphers.

Nevertheless, we have realized difficulties in finding topics with common interest. Since modern philosophy of science originates from logical reconstruction of mathematics and the advent of quantum mechanics, the main theme of philosophy of science has been the logical reconstruction of the logic of science and the ontology of physical object. These topics are distant from the interest of earth sciences. However, with the recent turn of philosophy toward naturalization, we have found various common topics, one of which is the problem of scientific models.

In earth sciences, models play a central role in explaining various natural phenomena. On the other hand, in the philosophy of science, semantic conception of scientific theories tries to characterize models as representations of the world. However, the characterization has been found difficult due to the diversity of scientific models (Nakao, 2011). We have thus tried to classify scientific models from the viewpoints of both science and philosophy, with examples taken from earth sciences. We classify models into three categories: reality-representing type, idealization type, and hypothesis type. We further classify the reality-representing type into prediction type and causal-explanation type. With these classification, we explore the diversity of models, thereby trying to characterize explanations in earth sciences.

Keywords: model, classification, earth and planetary sciences