**Japan Geoscience Union Meeting 2011**
(May 22-27 2011 at Makuhari, Chiba, Japan)


GHE024-01 Room:301A Time:May 22 14:15-14:30

# Earth Science and Science and Technology Communication

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The science and technology communication is more important as the society has become more dependent on science and technology. However, it is often said that researchers are not engaged in the communication activities. If so, it will be useful to demonstrate that science and technology communication is not a burden at all but an essential part of research activities.

In the author's view, earth science is a discipline which adds information on science and technology communication. The author introduces some examples how earth science researchers communicate with general public.

Keywords: STS, Science and Technology Communication

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# History and present of the serpentinite quarries in Chichibu area

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History and present of the serpentinite quarries in Minano (Saitama-prefecture, east Japan) were investigated.

Minano had produced one of the most beautiful serpentinite building stones in the world (so it is said). "Kijamon" is the well-known name of the building stone. It has been used in the National Diet Building. Unfortunately it is not any more available in the building stones market and even the exact location of the quarry is half forgotten. It is very important to know what our lands have produced for us, and the knowledge will help us conserve our historic constructions.

This study unravels and records the historic quarry in Minano that produced Kijamon. The present state of the serpentinite quarries industry in Minano area is also investigated and several important factors that controled the industrial state of the quarries will be discussed.

Keywords: building stone, quarry, Kijamon, serpentine, Chichibu

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# Early instruments of the Japanese Imperial land survey

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The former Japanese geographical agency began triangular survey in the middle of 1870s using instruments introduced from Britain. Besides, the Japanese army imported instruments made in France and produced color maps in French style. Afterward the nationwide survey in Japan was unified to the Imperial land survey in the army, where the German surveying system was adopted. Almost all the rest instruments were put on the shelf, scattered and lost. The National museum of nature and science preserves the some early surveying instruments imported by the general staff office of the army around 1880. Among those, French, US and German theodolites could have been treated as the memorial objects in the Imperial land survey. On the other hand, notes attached to the German theodolite and the French level state these were used until 1920s, however, this description seems questionable. The course of utilize in the surveying instruments of 1870s and 1880s of Japan are not necessarily elucidated due to lack of documents partly because of frequent changing in organization of Japanese government in the early Meiji era.

Keywords: theodolite, level, Japanese Imperial land survey

GHE024-04 Room:301A Time:May 22 15:00-15:15

# Early women earth-scientists in Japan

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In 1907, the English birth control pioneer, Marie Stopes (1880-1958) came to Japan to study plant fossils. In 1910 she wrote on Cretaceous plants in Hokkaido. In 1928, a botanist Kono Yasui (1880-1971) got a doctoral degree in science, the first one in Japan given to a woman, by studying lignite and coal in Hokkaido. It was 1943 when the first woman gologist Tami Inoue attended at the Geological Society of Japan.

Keywords: women earth-scientists, Marie Stope, Kono Yasui, Tami Inoue

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# The histories of Japanese Seismology and Mode Theory

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[1]ERI

I would like to say that the histories of Japanese seismology do not accord with Mode Theory by Michael Gibbons.

Keywords: Michael Gibbons, Mode Theory, Japanese seismology, history of science

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# Akiho Miyashiro and his long term blueprint for promoting geological sciences.

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The late Akiho Miyashiro made a substantial contribution to the long-term planning of promoting the geological sciences in Japan, which were seriously exhausted during the World War II. He played an important role at the Planning Committee in the Geological Society of Japan (GSJ) as a chairman to propose a new and potential vision. The purpose of this paper is to trace the movement of democratization and internationalization in the science after the World War II, and to extract any useful information for the interdisciplinary interaction and research activity nowadays.

Since 1953, the Science Council of Japan (SCJ) requested each of branch committees to prepare their long-term planning to activate the basic research in each disciplines. GSJ organized the committee in 1963 consisting of 81 scientists chaired by Miyashiro, who arranged a report for the society within a year. The report released in 1965 was remarkable in claiming the democratization of academic community and also in promoting the inter-disciplinary interactions together with the cooperative use of research facilities by the scientists and students belonging to different schools. The report proposed further an installation of large cooperative research institute named 'Kotai Tikyukagaku Kenkyujyo' (Kotai-tiken in short, say Solid State Geoscience Institute). The original plan was so ambitious that the first division of the institute was realize the technology of super high pressure facilities generating 100GPa per cubic centimeters., for example).

Miyashiro, on the other hand, published an article entitled 'History and Present Status of Earth Science' serially in the monthly magazine, 'Shizen' from September 1965 to November 1966. This article had casted a strong stimulation to many scientists outside the traditional geology, in particular. Writing the article, Miyashiro analysed a number of small academic communities isolated each other and aimed to promote the organization of 'Earth Science' relating to the science of our Earth.

The geological committee of SCJ organized the ad-hoc subcommittee chaired by Hisashi Kuno in order to proposed Kotai-tiken. It was supposed to be a large research institution consisting of 13 divisions accommodating 159 staffs mainly for experimental approaches. Takeo Watanabe succeeded Kuno in 1968. Unfortunately the proposal was not adopeted from some reason or another. However, this challenging vision would have lead Japan as a leading country in experimental petrology and related disciplines.

A., Miyashiro, (1965), J. Geol. Soc. Japan, 71. 83-91.
A., Miyashiro (1965 - 66), 'Shizen'. Chuokoron Inc.
Science Council of Japan, (1965), 6-45, 130 - 135.
T., Watanabe (1969), 'Chikyu Kagaku', 23, 224 ? 226

Keywords: Akiho Miyashiro, Long Term Blueprint, Solid Geoscience Laborartoy, Contemporary History of Earth Science

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GHE024-07 Room:301A Time:May 22 15:45-16:00

# How to Describe the History of Geoscience: MIYASHIRO Akiho's Essays in the 1960s

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[1]Makuhari Sogo High School

The distinguished Japanese geologist MIYASHIRO Akiho (1920-2008) wrote a series of essays on the history and philosophy of earth sciences in 1965-1966 (SHIZEN [Nature], Vol. 20, No. 9 - Vol. 21. No.11), which was posthumously published in 2009. In these critical reviews, Miyashiro expressed his insightful opinions about the characteristics of the science and the usage of the history. I would summarize and reorganize them from the point of historiographical ideas as follows:

(1) physical aspect of geoscience
-disciplinary history of geophysics
-'intrusion history' of physics into geology and geochemistry
(2) historical aspect of geoscience
-German school of historism
-Lyellian uniformitarianism
-Marxism background and 'historicist movement'
(3) geographical aspect of geoscience
-geographical character of geoscientific objects
-criticism to 'provincialism' or regionalism of geoscientific researches
-geopolitical dimension of the history of science in developing countries.

We should especially pay attention to the third aspect, which have been underestimated or neglected, and to its role for historiography of geoscience.

We also acknowledge Miyashiro's recognition of the necessity of learning from scientific classics and reviewing scientific conceptions, which would imply humanistic literacy in science education.

Keywords: science study, contemporary history, physical sceince, historical science, geographical science, Miyashiro Akiho

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GHE024-08 Room:301A Time:May 22 16:00-16:15

# The Lost Decade of Acceptance of Plate Tectonics and Geological Revolution in Japan

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It is often said that Plate tectonics was not accepted by Japanese Geological Society in 1970's, for the opposite theory, called "The Lost Decade". However, many geologists consider that acceptance of Plate tectonics was not delayed though the stormy controversy. I think that the difference of historical views should explain as follows. First, the research technology of the geology progressed greatly in the 1970's. For instance, the new biostratigraphic research on radiolaria progress rapidly from 1969 in Japan. As a result ,these researches become popular explosively after 1979, known by "Radiolaria Revolution" . These cases has obviously received the influence from Plate Tectonics theory. However, the Acceptance of Plate Tectonics was "invisible", because these technical improvements were attended by many extremely special arguments. Second, for these researches, many geological periods had been fundamentally reviewed for Japanese complex accretionary prism were distributed. Therefore, we can say that it is relatively postponed to observe a tectonic revolution of Japanese Islands.

Meanwhile, the criticism from the viewpoint of the seismology can be understood as follows. The confidence and the mistake are included in "Plate words" taken up by Matsuda (1992) and Tomari (2008) , if these words see in Social Satistical Science. It is regarded that the structure of criticisms of Society as the difference of "Science Capital" of geology and the seismology in Japan ,by the concept of "champ/field" in Bourdieu's theory of"Sociology of Science". The possibility exists that it is a matter of positioning at Earth Science,the "High-champ/field". In addition, as can be seen from concept, since many opponents disputed rather outside than inside , the argument results in "visible" for the outside.

More general science history research is necessary because the complex structure is included in the rejection and acceptance of Plate tectonics in Japan.

Keywords: plate tectonics, Radiolaria Revolution, science history, Earth Science

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GHE024-09 Room:301A Time:May 22 16:30-16:45

# The plate boundaries vicinity of Japan; the recogition of experts and non-experts.

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This study is to compare the perception of the expert community on the plate boundary locations around Japan with how it has been handled by the media for non-experts, to report cases of the process of the spread of expertise, and to consider the role of semi-experts intermediating in the process of the spread of expertise.

Three theories have been advocated since 1972 about the boundary between the North American Plate and the Eurasian Plate in the vicinity of Japan which have been gaining consensus in the expert community. Sugimura (1972) put forward the theory of the central axial zone of Hokkaido (Theory A). In 1983, Kobayashi and Nakamura presented in succession the theory of the eastern margin of Japan Sea (Theory B)). Since this theory was consistent with the Nihonkai-Chubu earthquake which occurred at nearly the same time as its announcement, it quickly gained attention. Extensive discussion took place since then about the theory of the eastern margin of Japan Sea, and various modifications were proposed. In 2000 Sagiya proposed the tectonic zone theory (Theory C)). which holds that the plate boundary in this vicinity is not a single tectonic line, but that it is in the form of a belt-shaped area with a width on the order of one hundred kilometers in which strain are converged. Since then discussion on this issue has waned, and there have been fewer occasions for the question of where is the plate boundary? to be asked. It is considered that there are the following two reasons for this. One is the decisiveness of GPS data. Another is that there is hesitation on the part of researchers to use the terminology of the plate boundary because the tectonic zone is a quite different concept from the conventional plate boundary.

As to how high school earth science textbooks have handled the boundary between the North American and Eurasian plates, the first thing that draws attention is that the descriptions of all publishers are not consistent with one another. The current situation is that the theory A and the theory B are found intermingled, and Theory C has not been adopted by any textbook. This situation can be summarized in three points.

1. The time when the textbooks adopted PT Theory. The textbooks that adopted it in 1983 or earlier naturally adopted Theory A at that point.
2. Some textbooks responded to the appearance of Theory B, and others did not.
3. No textbook has responded to Theory C even to this day.

Firstly, the first point is associated with the time when the researchers accepted PT Theory who took charge of the solid earth part of each textbook. The second point is that while there are cases of them not adopting it even if they know a new theory as an expert, there are also cases of it being positively adopted by those who are to be called semi-experts that are solid earth scientists but not experts in the regional tectonics around Japan. Now, the third point is that the appearance of Theory C in the media for the general public is considerably restrained in comparison with Theory B. The reason why Theory C does not often appear in the media for the general public can be explained as follows.

1. Discussions on the definition of a plate boundary are taking place within the expert community. Therefore, experts have stopped using the term plate boundary for a tectonic zone.
2. As a result, there appears to be no expert who asserts that a tectonic zone is a plate boundary from the viewpoint of other than experts joining the discussions. Thus, it does not appear to semi-experts that Theory C has gained consensus in the expert community.

It is considered that as a result the current situation has occurred that there are few opportunities for Theory C to appear in the media for the general public, whether written by experts or semi-experts.

Keywords: plate tectonics, plete boundaries, experts, non-experts, earth science textbook

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# Different views on warming and cooling phases appearing in the secular trend of global mean atmospheric temperature

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Callendar, G.S. (1938) first compiled a temperature curve representative of the globe from 1881 to 1935 on the basis of 150 stations records. He obtained a global warming of 0.5 degrees centigrade per 100yr. The title of the paper was 'The artificial production of carbon dioxide and its influence on temperature'. It is noteworthy that researchers in those days were focusing their thoughts on the anthropogenic influence on climate. From the beginning of the twentieth century to around 1940, the global average air temperature had shown an apparent, near linear with time, increasing trend. The rise in temperature was up to 0.6 degrees centigrade, which seemed to be interpreted in terms of anthropogenic effects. The following description quoted from Ellsaesser H.W. et al.(1986) could help provide a better understanding of the situation in those days, 'The collection and archiving of worldwide weather records began in 1881, near the apparent temperature minimum of 1883. If the present temperature curves extending back to 1850 or beyond had always been available, it is unlikely that there would now be the present degree of concern over the climatic effect of CO2'.

This rapid increase in temperature was followed by a phase of gradual cooling at around 1940. Though they were addressing themselves to problems of climate change caused by human activity, researchers admitted the observations. Mitchell(1975) stated 'It appears that the cooling trend which first set in during the 1940s has continued essentially up to the present time, and that the net temperature drop in the last quarter-century has now accumulated to almost 0.3 degrees centigrade. To date, then, roughly half of the warming that occurred during earlier decades of the century has been erased by subsequent cooling. One cannot say offhand whether or how long this cooling will continue in the future'.

For the cause of variations of this nature, the upward swing in air temperature due to the increase in anthropogenic carbon dioxide can not be the solution. Various external forcings such as volcanic eruptions and changes in solar radiation were considered. It is special importance to note that E. Lorenz(1968, 1970, 1976) and others developed the theory of internal causation of climate change.

At around 1970, a transition from the cooling phase to the phase of remarkable warming occurred. Discussions had tended to focus on overall rise in global mean temperature, with little consideration on observed phase transitions. Hansen, J. and S. Lebedeff(1987) presented a typical view. This forms the basis of IOCC's approach.

Keywords: Climate change, Global warming, Global mean atmospheric temperature, Edward Lorenz, IPCC, G.S. Callendar

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# From earth science to earth and planetary science – A preface to the philosophy of earth and planetary science

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The present literature on science studies has compiled various historical, philosophical, and sociological insights on the development of earth sciences up to the Plate Techtonics Revolution in the 1960s. However, little attention has been paid to the development of earth sciences after that revolution - i.e. the emergence of earth and planetary sciences. This talk aims to be a preface to the "philosophy of earth and planetary science" by displaying the following two aspects of earth and planetary sciences.

(a) History of earth and planetary science: the question over where the present earth and planetary science comes from is itself a big issue to be considered, but a promising view is that the development of meteoritics, along with the opening of space exploration, turned the planets and satellites in the solar system from astoronomical objects to geological ones. Clarification of this process is an important step to understand how earth science evoloved into earth and planetary science.

(b) Philosophy of earth and planetary science: T.Kuhn's paradigm theory has been frequently cited to account for the Plate Techtonics Revolution. Miyashiro Akiho, for example, pointed out in his book What is Scientific Revolution (1998) that although paradigm theory does not apply entirely in earth sciences, a sort of paradigm shift actually occurred in the Plate Techtonics Revolution. Then, the question we face now is whether this is also true of the transformation of earth science into earth and planetary science. In this talk, we will suggest that a paradigm shift didnot take place in case of that transformation, hence we need another model in philosophy of science to account for the formation of earth and planetary science.

Keywords: philosophy of science, history of science, earth and planetary science, meteoritics

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# Historical reconstruction in science

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Earth science includes reconstruction of the Earth's past as its central project. It tells us about courses of things such as the formation of the Earth, climate change, the rise and fall of dinosaurs and so on. Seemingly, these narratives merely describe what happened in the past.

On the other hand, it may be considered reasonable to say that historical reconstructions in Earth science are something more than mere descriptions, that is, they are at the same time scientific explanations. If so, the following problems would arise.

(1)How do historical reconstructions give us scientific explanations and what kind of explanations are they?

(2)What is the source of their explanatory power?

Philosophy of science has proposed several models of scientific explanation. But they would be no good with the solution of the above problems. For instance, Carl Hempels deductive-nomological model of explanation does not apply to historical reconstruction, because Earth science does not assume any single general covering law which governs all the possible histories of the Earth. Philip Kitchers unificationist view will not suffice, because the view, by itself, does not tell us anything about the totality which historical reconstruction of the Earths past should be unified into. Clearly we need some special model of scientific explanation to do justice to historical reconstructions qua explanation.

We will propose a new view of scientific explanation which, we hope, can address the two problems above. The view is based on two preceding works. The one is Kim Sterelnys distinction between an actual-sequence explanation and a robust-process explanation (see also M. G. Kleinhans et al: 2010). Take an example of explaining why the WWI happened, the former corresponds to saying that the assassination of the Austrian atheling caused the WWI, while the latter refers to the socio-political situation of Europe at the time. Robust-process explanations are deeper than actual-sequence explanations, because they include many possible courses of events which could have lead to a worldwide warfare without the assassination in Serbia. The second work we heavily depend on is Sei-ichiro Watanabes Senario-Model view of paradigms in earth science. Watanabe took Hayashi model in planet formation theory as an example and claimed that it should be regarded as a complex made of several models arranged along a rather loose description of the course of major events (i.e. senario).

Our view put these predecessors together. The gist of it is as follows:

A historical reconstruction in earth science renders a robust-process explanation in Sterelnys sense, because the senario it includes puts the actual causal sequence of events in a space of possible causal chains.

Keywords: philosophy of science, scientific explanation, history, senario, model

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# Is the category 'historical science' appropriate?: examining the applicability of Tucker's philosophy of historical scie

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In philosophy of science, historical science used to be an unfashionable topic, but studies on this subject started to appear lately. Aviezer Tucker, a representative of this new trend, summarizes the methodology of historical science in Bayesian terms in his book Our Knowledge of the Past (2004). In this presentation, we introduce and examine the methodology Tucker proposes, and investigate the problem of whether important distinctions become less visible by categorizing several fields as 'historical science' as Tucker does.

Tucker regards historical science as a category that originates with biblical criticism and comparative linguistics, and that includes scientific historiography and evolutionary biology. According to him, the essence of historical science lies in the research method in which various pieces of evidence remaining today are used to study their common causes, and the method is supposed to have two steps: the first step is one of theoretically demonstrating that similar pieces of evidence actually preserve information of a common cause rather than are similar by coincidence, while the second being one of reconstructing intermediate stages between the common cause and the pieces of evidence and conjecturing on the features of the common cause.

Tucker proposes to see those reasoning processes in historical science as comparison of likelihoods. In the first step, likelihoods of separate-cause hypotheses are compared with common-cause hypotheses, while those of various hypotheses on intermediate stages and features of the common cause are compared in the second step.

This type of simplified analysis has its own virtue of illuminating common features among diverse fields that were not easily visible. However, our concern is that there may be other things that become less visible by simple categorization. To be more concrete, there should be some methodological difference between fields in which systematic relationships after the common cause is the focus of study and those in which the sequence of common causes themselves is the main focus. Also, there may be some qualitative, rather than quantitative, difference between fields like evolutionary biology in which a large amount of quantitative data is available and those in which the past should be reconstructed using relatively small amount of information.

Keywords: historical science, philosophy of science, Bayesianism, likelihood, common cause, evolutionary biology

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# Science as enterprise: a case study of geosciences

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Scientific research is not just a dynamic system of scientific statements. It does not only aim to accumulate journal articles. It is an actively operating system to organize research members and their abilities. Research on science, however, tends to focus on ”objective” data such as bibliometric statistics or budgetary trends although it is not necessary to be anthropology or sociology on science. Philosophy of science, thus, should be reviewed, with the following questions for example: What should philosophy of science target as its research subject? What should be called ”scientific methodology” now? It should be noticed that the notion of ”scientific methodology” here is taken wider than the traditional usage, in the sense that it includes not only justification of scientific truth and theories but also management of a research community.

The question on scientific methodology in a wider sense applies to every field of research. Each field of humanities and social sciences, as well as natural science, is also to equip with a set of methodologies which characterize the research area. In the current context of shrinking economy which tends to behave against higher education and scientific research, scientific communities should overcome difficulties such as miscommunication among professionals of different backgrounds to collaborate each other.

To capture collaborative projects among professionals, geoscience seems to provide a nice case to the analysis from the current issue of research methodology. The research community of geosciences about 30 years ago used to have tremendous diversity in (1) aims, (2) methods and (3) also backgrounds of individual researchers. while it has been established within several decades as one discipline in educational institutions, i.e. independent departments in universities and a high school subject. How can the subject work as a title of research fields, while approaches diverse?

This presentation will summarize oral histories of leading geoscientists on the following topics in the three levels (1) of individual research projects, (2) of research management at research institutes, and (3) of operation of the research community itself: decision making and scope setting, project management (long-term and short-term, in particular cases of interdisciplinary projects i.e. communities with different approaches jointly work on a single subject), personnel training and allocation, development and maintenance skills of research infrastructure (research facilities and applications/database, maintenance technicians, or even workspace), and evaluation of research outputs and outcome. In the current context of shrinking economy which tends to behave against higher education and scientific research, scientific communities should overcome difficulties such as miscommunication among professionals of different backgrounds to collaborate each other. Such studies would also provide humanities and social sciences with useful references for their coming reforming and restructuring to adapt the next age.

Keywords: philosophy of science, science communication, management of science