Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

MZZ41-01 Room:102A Time:May 19 11:00-11:15

The beginning of the Geological Survey of Japan

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The Geological Survey of Japan was founded in 1880 as the Imperial Geological Survey of Japan after some trial of affiliation. The Imperial Geological Survey of Japan had some differences from Recent Geological Survey. The Imperial Geological Survey of Japan had three sections, Geological, Geographical and Aglonomical Section. In 1890, two publications were published from the Imperial Geological Survey of Japan. The first publication is "Die japanischen Inseln. Eine topographische-geologische Ubersicht (The Japanese Islands. A topographical-geological overview)" written by Toyokitsi Harada who was the vice-director of the above survey. The second publication is"Beitrage zur Kenntniss der japanischen Landwirthschaft, I, Allgemeiner Teil (Contributions to the knowledge of Japanese agriculture, I. general part)" written by M.Fesca who was the chief of the agronomic section of the above survey. This paper also performed a role of explanatory text of "Atlas of the Agricultural Production of the Japanese Empire" edited by Fesca in 1889.

Keywords: Geological Survay, Edmund Naumann, Toyokichi Harada, M. Fesca

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MZZ41-02 Room:102A Time:May 19 11:15-11:30

The Seismological Society of Japan was established on March 11th 1880

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[1]ERI

According to usual histories of seismology, the Seismological Society of Japan was established on April 26th 1880. But I found some articles writing clearly that the society was established on March 11th 1880. These articles appear in Transactions of the Seismological Society of Japan, Vol.6, p.40 , The Japan Gazette of March 12th 1880 and so on.

Keywords: The Seismological Society of Japan, histories of seismology

Japan Geoscience Union Meeting 2013
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MZZ41-03 Room:102A Time:May 19 11:30-11:45

Misao Hirayama's achievement as a pioneer in magnetotellurics

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Magnetotellurics is a field of geomagnetism in which conductivity of the earth's interior is estimated from combined analysis of magnetic and electric field variations. It has been accepted that L. Cagniard(1953) paved the way for the study of this kind. Recently, M.S. Zhdanov(2010) pointed out that M. Hirayama followed this line of approach as early as 1934. Hirayama finished the technician training course of the Central Meteorological Observatory in 1932 and he started in service at the Toyohara Magnetic Observatory. Japan actively participated in the Second Polar Year(1932-1933). The Toyohara Observatory, located in Sakhalin, was established as a part of this project. At Toyohara, telluric current observations were also conducted. Study of electrical properties of the earth's interior based on temporal variations of magnetic field was first made by H. Lamb(1883). However, an approach applying analysis of variations both in magnetic and electric fields was not taken until Hirayama's work. Hirayama noted the relationship between variations in these two kinds of fields. He supposed that externally applied magnetic disturbances would induce electric field variations within the conducting earth. He used a plane earth model. He set up Maxwell's equations in a rectangular coordinate system with its origin on the earth's surface. The x-axis is taken northwards, the y-axis eastwards, and the z-axis vertically downwards. The expression of Maxwell's equations in this coordinate system was employed by T. Terada(1917). Terada made an analysis of magentic field variations recorded at the Aburatsubo observation site which was under the Imperial Earthquake Investigation Committee. Terada was interested in short period magnetic variations, which were considered to be attributed to the magnetic effects of electric currents flowing in the ionosphere. Terada investigated the behaviour of this supposed overhead current on the basis of a model satisying Maxwell's equations. Hirayama followed Terada's way of setting up the equations, still he treated them in accordance with his own interest. He obtained the follwing formula expressing the ratio of the amplitude of electric field variation E(y) to that of magnetic field variation H{x}.

$E_y/H_x=\{(uq)/(4*3.14*k)\}^{1/2}$

where u is permieability, q denotes angular frequency of a specified variation, and k is subsurface electerical conductivity. The ratio E_y/H_x is obtained from observations for a particular frequency, then conductivity k is determined. M. Hirayama(1934) was the first paper in the world in which the above formula was derived. This is indeed an honorable achievement. The formula is usually called Cagniard's MT formula after Cagniard who gained eminence as a pioneer of magnetotellurics. But Hirayama was nearly twenty years ahead of Cagniard. Hirayama obtained the ratio E_y/H_x for lots of events with periods from several minutes to many tens of minutes. The result showed that the ratio was approximately proportional to the square root of the frequency. The theoretical model was supported by the observations. Contributions by anyone who pursued and developed a system of a specific field in more detail should be highly evaluated. At the same time, significance of the accomplishments which have revealed quite a new aspect of nature should not be diminished at all, even when they are only beginning to take shape. Hirayama buckled himself to the research work while he was occupied in routine observations on duty. Working conditions were disadvantageous to conducting research. Attention should also be directed toward a somewhat flexible atmosphere perhaps settled over the Central Meteorological Observatory. Though it was a technical office, there was some scope allowed for conducting purely academic research. This is of utmost importance in consideration of the recent Japanese research system which suffers from decades of bureaucracy driven by centralized structures.

Keywords: Geomagnetism, Magnetotellurics, Telluric current, Electrical conductivity, Toyohara Magnetic Observatory, Electromagnetic induction

Japan Geoscience Union Meeting 2013
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MZZ41-04 Room:102A Time:May 19 11:45-12:00

Change in buiding stone industry structure of Japan interpreted from business paper back issues and trade statistics

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Available back issues of business papers of the Japanese quarrying and stone manufacturing industries inform us of how their industrial structure changed since 1950's. Back issues of the business paper "Nihon Sekizai Kogyo Shin-bun" from 1953 to 1975 and "Sekizai sangyo nenkan" from 1991 to 1997 revealed that the stone industry in Japan most prospered around 1960 to 1970. The number of advertisements of mining equipments increased during the 1950's and started to decrease in the late 1960's. On the other hand, the number of advertisements of stone manufacturing equipments (cutting and polishing) increased in the late 1960's. It is supposed that the stone industry in Japan is devided into two fields and mining industry flourished around 1960, manufacturing around 1970. Foreign trade statistics also revealed tnat export of building stones from Japan increased in the middle of 1960's, which supports that the stone manufacturing industry in Japan prospered in the late 1960's.

Keywords: building stone, quarry, industrial structure, headstone, tombstone

Japan Geoscience Union Meeting 2013
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MZZ41-05 Room:102A Time:May 19 12:00-12:15

The history of the study on the Earth's inner core with the aid of a scientometric method

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I investigate the history of science with the aid of a scientometric method, using the study on the Earth's inner core as an example. The increase in the number of scientific papers in recent years in every field of science hampers the construction of the history by reading all relevant papers. On the other hand, the development of databases of scientific papers such as Science Citation Index has opened the possibility of using scientometric methods as an aid for constructing the history of science. I therefore make an attempt to use the number of papers as a proxy for the activity of the relevant field to construct the contemporary history of the study of the inner core

I use Web of Science to examine the time variation of the number of papers for various fields of inner core studies. The number of papers on the inner core increased in 1990s, and its time variation parallels that of the number of papers related to the inner core seismic anisotropy. This showss that the main topic of the studies of the inner core is its seismic anisotropy. I suggest that the development of digital computing and network were responsible for the increase of the number of papers in 1990s. In seismology, the development of computers and network allowed everyone to analyze a vast amount of data from worldwide seismic network. This led to the discovery of the anisotropy. On the other hand, the discovery of seismic anisotropy motivates theoretical calculations of physical properties of iron under high pressures. The development of computers enabled ab initio calculations of material properties at the same time, activating the theoretical calculations after 2000s. The differential rotation of the inner core was alleged to be discovered in 1996, which led to the studies of checking the result in around 2000. The differential rotation also activated the studies of dynamo calculations, which were made possible in late 1990s due to the increase of the calculation ability of numerical computers.

Keywords: scientometrics, history of science, number of papers, inner core

Japan Geoscience Union Meeting 2013
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MZZ41-06 Room:102A Time:May 19 12:15-12:30

How to write the history of geoscience -right and wrong of Whig interpretation of history-

Shigeyuki Aoki[1*], Toshihiro Yamada[2], Michiko Yajima[3], Shigeo Yoshida[4]

[1]University of Aizu, [2]Chiba Prefectural Makuhari Sogo High School, [3]Tokyo Medical and Dental University, [4]Kyushu University

When we write the history of geoscience, it is important to consider what kind of interpratation of history we have. For example, as Brush(1995) argues that it is difficult to completely eliminate Whig interpretation, his history of planetary science (1996) picks up such topics as the studies on planetary formation, earth's inner structure, and age of the earth - which are selected from our present concerns. Thus, at least our questions on history are decided relative to our present concerns. On the other hand, anachronism or Whiggism of the excessive types - as we read our present knowledge or methodology in the past scientists, or praises Hutton's uniformitarianism above his contemporary fame - cannot be called objective description of history. So, the content of description should be coherent with the contemporary knowledge and background.

However, things get complicated when we dig into the detail. For example, Oldroyd(1985) rightly points out that such criticism of Whig interpretation is itself founded on Whiggism. As we sum up the oral history of living geoscientists (Aoki 2013), even "facts" might be influenced by Whig interpretation. Is it possible / desirable to eliminate such influence? Another problem is, the choice between various types of interpretation depends on the context (purpose), and the written works are often transcontextual (Iseda 2013). Historians of science aim to attain objective description. On the other hand, in case of the history of science for the general public or science education, one might argue that some simplification or idealization (i.e. Whig interpretation) - even "fictions" - may be better to serve the purpose. Also, the contemporary history has the aspect that it is written by scientists while reflecting on the past.

Thus, construction of the contemporary history of geoscience raises the question whether we could reconcile various positions. In this presentation such problems concerning Whig interpretation will be discussed.

Keywords: history of science, philosophy of science, history of geoscience, history of earth science, Whig interpretation of history

Japan Geoscience Union Meeting 2013
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MZZ41-07 Room:102A Time:May 19 14:15-14:30

The Emergence Process of Post-war Geoscience Education in Japan

Toshihiro Yamada[1*]

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This presentation examines the process of the emergence of post-war geoscience education in Japan, focusing the role of a journal entitled CHIKYU NO KAGAKU [EARTH SCIENCES].

Keywords: history of science education, Showa Post-war Period, history of geoscience education, popularization of geoscience, EARTH SCIENCE, Teiichi Kobayashi

Japan Geoscience Union Meeting 2013
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MZZ41-08 Room:102A Time:May 19 14:30-14:45

Shimazu's textbook in earth science for high school students, and reorganization of earth science(Chigaku)

Susumu Yamaga[1]*

[1]Azabu High School

Shimazu's textbook in earth science for high school students, and reorganization of earth science(Chigaku)

(1) Shimazu Yasuo and his philosophy "seamless earth"

The department of earth science at Nagoya University was founded in 1949. The feature of the department was coexistence of the laboratory of geology and that of geophysics and geochemistry.

Shimazu, who was 27 years old then, started his career as an assistant professor at geophysics laboratory in 1953. He came to Nagoya because of the name of the department of earth science.

He thought the earth is like a textile without any stitch (seamless earth),and he set his goal called "SMLES" and it became the guidlines for his research group.

(2) Shimazu Yasuo's textbook in earth science for high school students (Chigaku I)

Shimazu wrote the textbook in the 1970s. His textbook is based on the spirits of "SMLES."

The textbook differs not only from the traditional ones but also the ones in his days. As features, it uses many physical methods and also introduces some chemical approaches. The theory of plate tectonics (the continental drift theory), which is still new at the time, is included, and the textbook does not mention the concept of geosyncline.

(3) Earth science at Azabu High School

I graduated from the department of earth science at Nagoya University in 1973 and soon became a science teacher at Azabu High School.

As I was the first "earth science" teacher at Azabu, I could choose textboks freely. I chose Shimazu's textbook for high school students because I, as a gtraduate of Nagoya University, was familiar with it.

It seems that Shimazu's textbook was not used very much in the whole Japan. Because it got out of print in the 1980s, I came to teach without using a textbook.

I have tried to teach all the fields evenly, and Shimazu's textbook has been very helpful for me. The contents of my website, and also two books which I wrote, are based on my lessons at Azabu High School.

(4) My vision for the future

Now, earth science (Chigaku) at high school is regarded as a "endangered species." I think the leading cause is that the contents and the goals of this subject have not been understood by the student and even by the teachers.

To be more popular, earth science must answer directly the universal question, "Who are we?", explain the structures of the universe, the earth, the substances and life, and elucidate the history of the universe and humankind. In addition, especially in Japan, we must think about natural disasters in the subject of earth science.

We may also have to think about changing the name of "earth science" and training teachers of "the subject." It will lead us to reconsider not only the goals of earth science but also those of natural science and secondary education.

References:
SMLES charter
http://www.selis.hyarc.nagoya-u.ac.jp/21coe-selis/limit/dvd/pdf/2007/15_open_symposium_resume_Kumazawa.pdf

Changes of the science educational system after the Second World War
http://homepage3.nifty.com/kkam12/khennsenn.pdf
http://www.osaka-c.ed.jp/kak/karikenweb/webpdf/webcur/wc10rika/wc1007.pdf

Keywords: chigaku, Shimadu Yasuo, highschool, earth science, text book, reorganization

MZZ41-09 Room:102A Time:May 19 14:45-15:00

Collaboration of Elementary Science Education with Earth and Planetary Sciences

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In order to improve serious situation in earth science education in Japan, close collaboration between people in science education and earth planetary sciences is needed. On the basis of understanding on children's, teacher's and academic worlds, specialists in earth and planetary sciences should participate in development of teaching materials and curriculums from standpoints of students. In this presentation, the author propose some approaches based on practices in publication of text books, delivery science classes in elementary, junior high, and high schools , and open lectures at universities, with brief descriptions on the proposed experiments on telescopic observation of Moon, imapct cratering, lava flows and ash falls, and examinations of stones with annual lamina (varves), and Jurassic ammonite fossils.

Keywords: science education, outreach, earth and planetary sciences, ESD, scientific literacy

MZZ41-10 Room:102A Time:May 19 15:00-15:15

Case study: research management in geosciences

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Research activities significantly differ by areas. Analysis of interviews with principal investigators of big projects in geosciences will give insights on practical reason during the activities. The main focus of the analysis is cast on (1) roles of technicians and other research assistants; (2) effects of background change of higher education system on training of researchers and technicians. Findings include the observation that a weaker personnel system of technicians is inevitable. Technicians were strategically trained under some project investigators before 1980s; they were scouted at very young ages, mainly in night programs of high schools to become artisans of experimental equipments. Most technicians of the age has been retired by now, and replacement has not work well because of disappearance of such career paths.

Keywords: STS, research management

MZZ41-11 Room:102A Time:May 19 15:15-15:30

Risk and the central problems of philosophy of science

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[1]Nagoya University

There is a trend toward public engagement in techno-scientific policies. And public risk management is no exception. Then, it should be our main concern how we can balance two goals of risk evaluation; to be scientific and to have democratic legitimacy.

The aim of this talk is to clarify what sort of relevance three major problems in philosophy of science can have to our concern. The three major problems are as follows;

1. The problem of realism: Do theoretical entities really exist? Or, are they only useful fictions to save the phenomena?
2. The problem of rationalism and relativism: Can we discuss the epistemic values and aims of scientific investigations? Or, are they relative to so-called "paradigms"?
3. The demarcation problem: What are the criteria to tell science from non-science?

These problems are highly relevant to our goal, that is to achieve a balance between democracy and science. Our conclusions are;

1. We cannot adopt the realist stance on the reality of risk. Distinction between "the real risk" and "laymen's biased cognition of it" should be abandoned.
2. However, risk evaluation can be scientific despite the fact that it is value-laden.
3. In order to ensure scientific rationality of risk evaluation, we can apply methodological falsificationism to it.

[reference]
S. Shrader-Frechette, Risk and Rationality, University of California Press, 1991

Keywords: philosophy of science, risk analysis, scientific policy, realism, demarcation problem, relativism

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MZZ41-12 Room:102A Time:May 19 15:30-15:45

The model of scientific activity: why science is so robust?

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The aim of this presentation is to verify and examine the model about scientific activity in terms of the concept of robustness of science.

What is the purpose of science, the production of true theories or not? This problem has been examined in various contexts of the philosophy of science. Among these, scientific realists insist that we couldn't explain the success of science if science is not true. But critics of this view says that there are many scientific theories or postulates which once supposed successful but abandoned later in the history of science. That is, what is "correct" or "true" is always varied in science, the temporal acceptance of scientific theories is not justify the truth of it.

This is a epistemological problem in science: justification of scientific knowledge. Why we think or believe in or accept the productions of scientific activity? What is the reason? As an answer to this problem, it is important to focus on the practical turn in the philosophy of science: from truth to robustness of science (Wimsatt 1981and 2012; Soler 2012; Boon 2012, etc). That is, the total robustness including the development of observational technique, the modeling of data, the stability of phenomenon, etc generates the reliability of science.

On the other hand, the dual-Feedback-Loop-Operator model (dFLO) as a method of science, which Mineo Kumazawa, *et.al*. proposed, reflects the actual scientific practice and improve the folk understanding of the relation of scientific theory and natural world. This model has a two system, the observational system and the modeling (theorizing) system. These systems always have an influence on each other and produce the most promising understanding of the natural world at that time. So, scientific activity is a process of successive improvement of the two (or more?) systems. Importantly, this model indicate the dynamics of scientific activities and our understanding of nature is not static.

We indicate that the basic concept underlying dFLO is the robustness of science, and examine philosophical importance of this model.

Keywords: philosophy of science, scientific knowledge, STS, collective intelligence

Japan Geoscience Union Meeting 2013
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MZZ41-13 Room:102A Time:May 19 15:45-16:00

The evolution of behavioral modernity and the evolution of science

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It is almost a truism that as the community sizes and the number of researchers increase in a scientific field, the number of papers published and the pace of its development will also increase. Moreover, Ota (2013) suggested that although a number of experiments have been accumulated in a specific scientific community, the setting or results of the experiments have not been properly transmitted maybe because of the community size. In fact, the community has some institutions needed for accumulation of decent scientific knowledge such as a peer-reviewed journal though the community size is smaller than other fields. So it is possible that the size partially constrains the decent accumulation and improvement of the scientific knowledge.

Although this view is almost a truism as I said at the beginning, it has not often been supported by scientific approaches. This talk supported this view by referring to some researches on a historical fact of the evolution of behavioral modernity. The evolution of behavioral modernity has been one of the challenging problems in archaeology and paleoanthropology. It has been widely thought that behavioral modernity including the use of symbols suddenly evolved around 50 kya and some hypotheses developed for explaining the sudden evolution have refered to the sudden evolution of some cognitive capacities (e.g., Klein 1999; Mithen 1996; Cochrane and Harpending 2009). However, more recent researches have casted doubt on this cognitive hypothesis: Archaeological or paleoanthropological evidence suggest that (1) we find primitive forms of behavioral modernity even before 50 kya (e.g., in Middle Stone Age) (e.g., McBrearty and Brooks 2000), and that (2) in some areas, after behavioral modernity once evolved, it had disappeared for a while (e.g., Allen and O'Connell 2008). If behavioral modernity evolved because some cognitive capacities evolved, we would not expect these phenomena. Thus it is likely that the evolution of behavioral modernity cannot be explained in terms of cognitive capacities. The alternative is the population-dynamics hypothesis (Henrich 2004; Powell et al. 2009; Sterelny 2012). If the community size and the density increase to some degree, some mechanisms for retaining novel cultures and techniques such as redundancy of learning models would evolve, which makes it possible that novel cultures and skills, even if they may have been created accidentally, are retained and improved gradually, and also that behavioral modernity evolves.

If the population-dynamics hypothesis is right (at least I think so) and a certain community size is needed for behavioral modernity and novel cultures are to be retained and improved, it is suggested that also in scientific community, the size is important for novel ideas and experimental settings to be properly accumulated.

Keywords: The evolution of science, science of science, philosophy of science