

International Symposium to commemorate the German year in Japan

*History of Academic Exchange between Germany and Japan
- Results of the Faunal Research in Sagami Bay -*

Program and Abstracts

Date: January 11, 2006

Time: 14:00 – 17:00

Venue: Hokkaido University Museum, *chi-no-kouryuu* corner
N10 W8, Kita-ku, Sapporo

Hokkaido University



Neo-Science of Natural History

CONVENOR

Shunsuke F. MAWATARI
(COE Program Sub-Leader and Professor)
Division of Biological Sciences, Graduate School of Science,
Hokkaido University

Host

21st Century Center of Excellence (COE) for the "Neo-Science of Natural History,
Hokkaido University, Sapporo, Japan

Supported by

Deutscher Akademischer Austauschdienst (DAAD)
Senckenberg Institution, Frankfurt a. M., Germany
The National Science Museum, Tokyo, Japan
The Hokkaido University Museum, Sapporo, Japan

The 21st Century Center of Excellence (COE) for the "Neo-Science of Natural History - Origin and Evolution of Natural Diversity", Graduate School of Science, Hokkaido University, Sapporo, Japan. The 21st Century COE Program is an initiative and grant by the Japanese Ministry of Education, Culture, Science and Technology (MEXT) to further strengthen educational research throughout Japan.

Preface

The 21st Century Center of Excellence (COE) program entitled "The Neo-Science of Natural History - Origin and Evolution of Natural Diversity" (Program Leader: H. Okada) is one of the twelve COE projects currently running at Hokkaido University under the sponsorship of the Japanese Ministry of Education, Culture, Sports, Science and Technology. This COE program has been actively engaged in establishing a research and education center dedicated to modern approaches to exploring nature by studying the long- and short-term interactions between the Earth and life, as well as material cycles on the Earth and phenomena of climate change.

As a part of the COE program, we aim at significantly contributing to some biodiversity research projects, such as the Global Biodiversity Information Facilities (GBIF), Global Taxonomy Initiative (GTI) and GaiaList 21 Project. Marine biodiversity is one of the important targets of our research within the COE framework. Besides the efforts on elucidation of the marine diversity as a whole, we propose to focus on comparison of the fauna between Japan and other countries in Asia and Europe. Understanding biodiversity has been recognized as one of the major scientific objectives of the GaiaList 21 Project research program outlined by the Zoological Society of Japan and then authorized by the Science Council of Japan.

The purpose of this symposium is to review the history of biodiversity research of Sagami Bay, and gain new insights through the academic exchanges between the scientists from Germany and Japan. Attention will be paid to the ways for organization and comparison of all valuable data on taxonomy, ecology and biogeography, accumulated from widely differing areas over Japan. Of the five oral presentations planned, four keynote lectures on different groups of marine fauna will be given by invited speakers from Germany. These presentations will cover the biodiversity of sponges, hydrozoans, decapod crustaceans and bryozoans from Sagami Bay. We will be discussing also about the faunal changes in Sagami Bay during the last hundred years period and also about future collaboration in studying biodiversity all over the world.

Shunsuke F. Mawatari

Program

January 11 (Wednesday), 2006

14:00-14:30 **Bernhard Ruthensteiner**

Scientific Expeditions to Japan one Century ago and the Origins of Marine Collections at the Zoologische Staatssammlung München

14:30-15:00 **Joachim Scholz, Shunsuke F. Mawatari, and Bernhard Ruthensteiner**

Sagami Bay 1905-2005: New Studies of a Historical Bryozoan Collection in the Bavarian State Collection of Zoology (Munich, Germany)

15:00-15:30 **Dorte Janussen and Carsten Eckert**

Hexactinellida (Glass Sponges) of the Sagami Bay Compared with Sponge Faunas in other Seas - History and Present Status of Research

15:30-15:40 Break

15:40-16:10 **Hiroshi Namikawa**

The 120-year history of the faunal survey of Sagami Bay originated with Döderlein

16:10-16:40 **Michael Türkay**

Taxonomy and Collections, Basis of Comparability in Biological Sciences

16:40-17:00 Discussion

Scientific Expeditions to Japan one Century ago and the Origins of Marine Collections at the Zoologische Staatssammlung München

Bernhard Ruthensteiner

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The Zoologische Staatssammlung München (= Zoological State Collection Munich, ZSM) is a zoological collection and research institution owned by the German state of Bavaria. It permanently employs about 14 scientists and houses ca. 20 million specimens. The ZSM is thus among the three largest zoological collections in Germany. Most important are the entomological collections, but there are also marine orientated “sections” in the department “Evertebrata” of the institution which is located more than 500 km from the nearest marine habitat. There is a causal connection between the origin of this marine research tradition and German expeditions to Japan taking place more than a century ago. They were carried out by three persons: Franz Doflein, Karl Albert Haberer and Ludwig Döderlein.

Franz J.Th. Doflein (1873-1924) studied medicine and natural history from 1893 to 1897 in Munich and Strasbourg, and focussed on Zoology. He became employed at the ZSM in 1898 and from 1910 until his leave in 1912 he was head of the institution. His second major scientific expedition led him to East Asia (1904-1905). Most part this trip was spent in Japan, where he extensively collected zoological material, mainly marine invertebrates. After his return he intensely worked on the systematic examination of this material. He gathered a number of experts for that aim and worked himself on the decapod crustaceans. He managed to edit most of the resulting monographs in the “Beiträge zur Naturgeschichte Ostasiens” (1906-1914) consisting of four large volumes. Karl Albert Haberer (1864-1941) studied medicine and natural history in Strasbourg, Berlin und Munich until 1898. From 1899 until 1904 he made several expeditions to East Asia. Most time of this period he spent in Yokohama/Japan. He was a private scientist with a focus on anthropology. His major impact in that field was the discovery of the famous “Peking Man”. His voyages were supported by the State of Bavaria in exchange

for collected material he donated to Bavarian museums. Aside of paleontological and anthropological material, he collected enormous amounts of zoological material in Japan, primarily marine invertebrates, but also birds and mammals. Apparently he was more enthusiastic in collecting than in subsequent scientific examination of his collections. Ludwig H.P. Döderlein (1855-1936) was staying from 1879-1882 in Tokyo as lecturer for descriptive natural history at the medical faculty. He made use of this stay to extensively collect mainly marine invertebrates. After his return to Germany, perhaps not at least because of his Japanese collecting activities, he became employed at the zoological collection in Strasbourg. From 1885 until his expulsion after the world war in 1919 he was director of that institution. He was an expert on echinoderms and he could bring part of this collection along when moving to Munich. Here he found a new scientific domain at the ZSM and became head of that institution from 1923-1927. In this task he was one of the successors of his former student Doflein. Again he managed to assemble an important echinoderm collection by including material from Doflein and Haberer. At least 80 percent of this collection consists of material from Japan.

In total there are about 3000 samples at the ZSM from the Japanese expeditions led by these three men. Except for the Mollusca, this constitutes nearly one fourth of today's entire holding of marine invertebrates of the ZSM. The material predominantly has been collected in the Sagami bay. The most important taxa are echinoderms, cnidarians with emphasis on hydrozoans and decapod crustaceans. The material contains about 350 type specimens and type specimen preparations. Still a considerable amount of the Japanese expedition material is unexamined. This concerns taxa such as Porifera, Polychaeta, Bryozoa or Brachiopoda. The Japanese expeditions of Doflein, Haberer and Döderlein, therefore, marked the starting point for marine invertebrate systematics at the ZSM. Since that time this institution has a reputation in that field and nowadays scientists enlarge the collections by activities like participating in international research cruises.

Sagami Bay 1905-2005: New Studies of a Historical Bryozoan Collection in the Bavarian State Collection of Zoology (Munich, Germany)

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The Sagami Bay south of Tokyo is a world-famous area for rich marine fauna and discovery of rare and unique marine animals. Ludwig Doederlein (1855-1936) initiated the tradition of Sagami Bay research when he stayed in Japan for about two years as a “yatoi” (= foreign employee) professor of natural history in the preparatory course of the Medical Department, University of Tokyo. Most of his collections from Japan, thought to be destroyed during Second World War, have been re-discovered in good condition in the Musée Zoologique in Strasbourg by one of the authors (S.M.). Doederlein, who is considered the pioneer of marine biology in Japan, inspired his younger colleague and friend Franz Doflein (1873-1924) to continue marine biology studies in Japan.

Today, the importance of the Doederlein legacy has been well established thanks to the Monbusho grant “Taxonomic and historical Studies on Prof. Ludwig Doederlein’s collection of Japanese animals” (1997-2003). In contrast, the true relevance of the Franz Doflein collection is poorly known. We still do not know how much of the types and specimens have been destroyed during the disastrous bomb raids of the Second World War on Freiburg and Munich, where Doflein had once been working. Accordingly, types need to be validated, and lectotypes to be chosen for the lost ones.

In the month of July 2005, a Japanese-German team visited the Bavarian State Collection of Zoology in Munich, a journey funded by the COE Center of Excellence of the Hokkaido University, to borrow specimens for an exhibition in Japan, and to initiate studies on the marine invertebrates and fishes kept there.

We were very lucky to find a rich collection of bryozoans (and other organisms) by Haberer (1903/1904) and Doflein (1904/1905) from the Sagami Bay, and from other localities in Japan. The samples have been examined by Buchner about two decades later. He selected certain species of Phidoloporidae to write his important contribution "Anatomische und systematische Untersuchungen an japanischen Reteporiden" (Zoologische Jahrbuecher 48, 1924). Few additional samples have been identified by Borg, and in total, we found 60 labelled samples (in alcohol) from Doflein/Haberer, and two additional samples (dried material) from the earlier journey of Doederlein in 1880/81. Whereas the identified specimens have been included in the catalogue of the Bavarian State Collection, about 70 samples do not have species labels and thus have not been inventarised. Aside from that, many of the larger, erect or multilaminar specimens show smaller, secondary encrusting bryozoan species. Finally, we expect to find some bryozoans in nearly 40 sample containers of sponges, some of them large, from the Sagami Bay, which have likewise been re-discovered among the collections made by Doflein some hundred years ago.

Why are these bryozoans so important? In the decades that followed the times of Doederlein and Doflein, his Majesty the Showa Emperor started a long-time regional research and collection activity (The Biological Laboratory, Imperial Household, Tokyo (BLIH), ca. 1928-1988). His Majesty the Showa Emperor was a hydrozoan taxonomist, a subject not too far away from bryozoology, and he considered bryozoans in his collection activities.



Fig. 1 The collections of Japanese bryozoans mainly from 1903 to 1905, kept in the Bavarian State Collection of Zoology (Munich). Shown below are some historical contributions on Japanese bryozoan: Ortmann 1900 (right), who studied the Doederlein collection, and Buchner 1924 (left), working on Phidoloporidae of the DOFLEIN/HABERER Collection.

Nowadays, the Sagami Bay research is continued by the Showa Mémorial Institute of the National Science Museum, Tokyo, in collaboration with other national institutes, and international researchers. The Sagami Bay belongs to one of the few regions in the Western Pacific with a continued history of collection for more than 100 years. Re-discovering historical collections in museums offers us rich opportunities to reconstruct the environmental state of this part of the world some 100 years ago, a region that is today close to one of the largest coastal urban and industrial concentrations in the world. At the end of the study, we will know which bryozoan species became regionally extinct, and which species possibly invaded the area as marine fouling organisms. The same applies for sponges, crustaceans, fishes and other organisms represented in Munich, and elsewhere.

Hexactinellida (Glass Sponges) of the Sagami Bay Compared with Sponge Faunas in Other Seas - History and Present Status of Research

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The fauna of the comparably small Sagami Bay, an area of only about 1000 km² with an average depth of 1000 m, belongs to richest marine communities of the world. This is true particularly to the Porifera (sponges), especially of the class Hexactinellida (glass sponges), which became famous in the last century mainly due to the findings in Sagami Bay. Hexactinellid sponges from Sagami Bay have been used in Japan for a very long time as part of the traditional decoration works. During the early 19th century Japanese glass sponges were widely distributed abroad, mostly due to the extensive work of the Japanese scientist Isao Ijima (1861-1921) in cooperation with the English trader Alan Owston. As a result, most natural museums today possess specimens of nicely preserved hexactinellids from Sagami Bay. The Demospongiae of Sagami Bay were studied first by Thiele (1898) and Lebewohl (1914, 1919) and later by T. Hoshino (Hirohito of Showa et al. 1989, Hoshino 1989), whereas the calcarean sponges of this area were investigated by S. Hozawa (1919, 1929, 1933). Ijima, with German biologist Franz Eilhard Schulze still the most important taxonomist on the sponge class Hexactinellida, published several monographic works on the Sagami Bay hexactinellids, partly together with his student Yaichiro Okada (Ijima 1894, 1895, 1901, 1902, 1903, 1904 und Ijima & Okada 1938, Okada 1932). Since these basic publications however, hardly any research has been done on the Sagami Bay sponges. The reason for the extraordinary high diversity of benthic animals in the Sagami Bay is on the one hand an extremely structured bottom relief, on the other hand the collision of warm and cold current systems, resulting in death of plankton and high nutrient supplies raining down to the bottom; both factors implying optimal condition for the rich and unusual benthic fauna of Sagami Bay. Sessile animals, which normally inhabit only the deep-sea, are distributed here within a limited area in high numbers and diversity. This is true especially of the Hexactinellida, which occur in depths of 700 – 1000 m in highest diversity; similarly rich occurrences are known only from deep-sea areas of the Pacific Ocean. According to our present knowledge, Sagami Bay is the only locality of the world, where all major taxa of the Hexactinellida are represented: **Amphidiscophora**, e. g. *Hyalonema*, *Pheronema*, **Hexasterophora**, e.g. *Farrea*, *Aphrocallistes*, *Heterochone*, *Eurete*, *Lefroyella*, *Pararete*, *Periphragella*, **Rossellidae** : e.g. *Calycosoma*, *Lophocalyx*, *Sympagella*, **Euplectellidae**: e.g. *Euplectella*, *Holascus*, *Regadrella*, *Malacosaccus*, *Bolosoma*, *Saccocalyx*, *Hertwigia*.

Based on the traditionally good and cooperative relationship with Japan, it was possible for scientists of Forschungsinstitut Senckenberg and Naturkundemuseum Berlin to participate in an expedition with RV "Tansei Maru", 8.-15.05.2004, to the Sagami Bay. Purpose of this JAMSTEC financed expedition was the investigation of benthos communities in Sagami Bay and at the West Pacific continental slope. The expedition was led by Prof. Suguru Ohta of the Ocean Research Institute, University of Tokyo. Based on the monographic works of the early scientists, the long-term purpose of our research is to thoroughly re-investigate the Sagami Bay sponges, especially the Hexactinellida, and their symbionts by means of modern methods, such as electron microscopy and molecular biology.

The 120-year History of Faunal Surveys in Sagami Bay Originated with Döderlein

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Sagami Bay is a world-famous locality that is abundant in unique marine animals. The pioneer who discovered the zoological value of Sagami Bay was the German naturalist L. Döderlein. In 1881, L. Döderlein actively engaged in fieldwork by dredging in the sea area off Misaki, Miura Peninsula, eastern Sagami Bay. He collected a large number of specimens of marine animals during this research. He took these specimens with him to Europe, where he deposited them in the Musée Zoologique Strasbourg and other museums for further study. Through this collection, L. Döderlein first publicized to the world that Sagami Bay has a rich endemic fauna.

Döderlein's research was continued from 1886 to ca. 1920 by the Misaki Marine Biological Station, Tokyo University (founded in 1886), and in 1904 by his student F. Doflein. Subsequently, from 1928 to 1988, the Biological Laboratory of the Imperial Household, a private institute of His Majesty the Showa Emperor, Hirohito, took over and expanded the research. Today, at the beginning of the 21st century, the National Science Museum, Tokyo succeeds the previous surveys in conducting research in modern Sagami Bay.

Sagami Bay has a rich endemic fauna that has been studied for over 120 years, from L. Döderlein to researchers at the National Science Museum, Tokyo, with a huge number of specimens collected. Such specimens represent the biodiversity of Sagami Bay during each period of collection, and provide us with useful data for studying changes in biodiversity there. Since further changes are likely, faunal studies should be continued in Sagami Bay in the future.

Taxonomy and Collections, Basis of Comparability in Biological Sciences

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Biological sciences deal with living beings. A characteristic quality of life is its discontinuous organisation. Reactions and properties of cells cannot be reduced to the sum of molecule properties so that this level of organisation is regarded as a distinct one above the molecular. On higher levels life is organised in specific individuals and these are grouped to species, genera and higher levels of hierarchy. Such groupings leave gaps between them and form natural entities as a result of speciation and evolution.

Taxonomy is at the base of the classification systems because species are definable units that have a genetic coherence. They do not only share common characters, but also their genepool is continuously mixed through reproduction processes. Recognising a species is a complex scientific endeavour that includes comparison, morphology studies, the explanation of functions in relation to reproductive isolation and genetic comparison. The definition of the circumscription of a species is an elaborate hypothesis about a natural grouping. It should therefore not be considered as simple registration and cataloguing.

With the definition of taxonomic units, names have to be attributed to the so defined entities. This nomenclatural procedure makes sure that formally the same name is used for an entity which is considered to be homogeneous and recognisable as such. All natural objects grouped into a taxon that bears the same name are deemed to share the taxon properties like a generally similar life cycle, behaviour, distribution, ecology etc. On this basis such entities are compared with others and common features as well as differences are drawn. Species are compared to each other in many respects and differences can be economically very important if a natural compound once discovered in a species and serving for industrial (pharmaceutical) purposes has

to be reallocated. Not only in such extremely useful respects, but also for the sake of general intercomparability a clear and reproducible taxonomic classification is essential. How could we know if a physiological or biochemical process is restricted to a certain species or a more general principle if we do not identify our laboratory animals properly? How can we prove reproducibility of experimental results without knowing that we really deal with the same natural entity (a certain species)?

Species definition and circumscription are theoretical issues. In nature we only observe individuals. Grouping them to species is identical with forming a hypothesis that all individuals that we include in that particular group by our definition can potentially interbreed and are in this respect separated from groups of individuals that we assign to other species. Notwithstanding the fact of existence of species as gene pools, the circumscription of such an entity is variable and follows the scientific progress in understanding structures and reproductive isolation. Therefore comparability to earlier results means also the comparison and re-examination of specimens on which former results were based. Collections are not repositories for animal corpses, but archives of occurrences of a given species in time and space. Their mostly overlooked function is that they are also archives of past concepts and theories. Older identifications are attached to specimens and their examination is the only way to know whether past and present results differ or not. In environmental studies for example it is critical to know if the fauna has really changed or the concepts of species circumscription have done so, before one can state that there is a faunal change. Museum collections fulfil a national and international role in preserving all this information for future generations and this must also be seen as a cultural heritage of a nation and mankind in general.

プログラム

2006年1月11日(水)

司会者：馬渡 駿介

14:00-14:30 **Bernhard Ruthensteiner**

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14:30-15:00 **Joachim Scholz, Shunsuke F. Mawatari, and Bernhard Ruthensteiner**

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Hexactinellida (Glass Sponges) of the Sagami Bay Compared with Sponge Faunas in other Seas - History and Present Status of Research

15:30-15:40 休憩

15:40-16:10 並河 洋

The 120-year history of the faunal survey of Sagami Bay originated with Döderlein

16:10-16:40 **Michael Türkay**

Taxonomy and Collections, Basis of Comparability in Biological Sciences

16:40-17:00 全体的な質疑応答

日本におけるドイツ年記念シンポジウム

*History of Academic Exchange between Germany and Japan -
Results of the Faunal Research in Sagami Bay –*

「日独学術交流史－相模湾動物相調査 の歴史と成果」

プログラム & 要旨集

日時：2006年1月11日(水) 午後2時～5時

会場：北海道大学総合博物館 知の交流コーナー
札幌市北区北10条西8丁目

主催：北海道大学大学院理学研究科 21世紀 COE プログラム
「新・自然史科学創成 - 自然界における多様性の起源と進化」

司会者：馬渡 駿介 (北海道大学)

後援：ドイツ研究交流会(DAAD)、ゼンケンベルグ研究所
国立科学博物館、北海道大学総合博物館

Hokkaido University



Neo-Science of Natural History