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KAGOSHIMA UNIVERSITY RESEARCH CENTER

FOR THE SOUTH PACIFIC

Villagers gathering for a pleasant party in Morobe Province, Papua New Guinea.
(Photographed by Kazutaka NAKANO)

## CONTENTS



**Front** : A scene of a village party in Morobe Province, Papua New Guinea.
(Photographed by Kazutaka NAKANO)

# The Future of the Research Center for the South Pacific

Akio INOUE

Director, Kagoshima University Research Center for the South Pacific

Kagoshima University Research Center for the South Pacific has aimed at interdisciplinary regional studies on "People and the Environment" in Oceania and its surrounding areas, and coordinated a wide variety of activities including cooperative scientific surveys and research, education of graduate and foreign students, and the collection of scientific information.

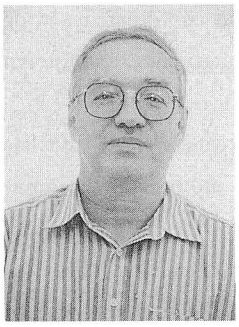
The inter-faculty research center started as a time-limited institution for 10 years in 1988 and has promoted interdisciplinary, regional studies both in social and natural sciences. On the basis of accumulated results of the center a new research center to be called "The Research Center for the Pacific Islands" is scheduled to be established in April of 1998 for another 10 years, and continues exhaustive efforts as before on various natural and cultural aspects of islands in the same area including the southern part of Kyushu, Japan. The South Pacific is characterized by comparatively small islands and island countries. Generally speaking, an island is a half-closed sphere that is isolated by ocean and has various different features from continents in natural systems such as habitats of plants and animals and weather, and modes of industry, agriculture and livelihood. The people inhabiting this region are obliged to live on limited natural resources and experience disadvantages of remoteness from neighboring countries or from world economic and political centers. They also share bitter experiences in common in that they have been devastated either through frequent wars fought among advanced countries or through environmental deterioration induced by industrial activities at highly developed regions.

The purposes of the new research center, the Research Center for the Pacific Islands, are 1) to disseminate common features of islands, 2) to pick out their peculiar features, 3) to elucidate their cultural, natural, political and economic relation with other islands, island groups and the nearest continents, 4) to consider how to recover and maintain the former natural and cultural environments by the inclusive results attained, and finally 5) to incubate them to the development of the regions. To fulfill these purposes, the new research center will have two research divisions on island studies. The Environmental Island Studies Group (Division I) includes two research projects as 1) Studies of People-Nature Interactions in Islands Group, and 2) Physical Geography of Island Groups. The Social Dynamics of Island Groups (Division II) includes 1) The Social and Cultural Changes of Islands Group, 2) The Medical Approaches to Human Ecology in Islands Group and 3) Studies of Island Nations in International Communities. The organization and management of the Research Center for the South Pacific will be fundamentally continued in the new institution whose objectives are to be fulfilled by the close cooperation of five full-time staff including one foreign guest researcher, on-campus researchers and off-campus researchers. Without the collaboration of these researchers these objectives of the embarking center cannot be achieved. I here sincerely trust that we shall be able to realize the fruits of satisfactory research before the term of years the new center concludes, in March of 2008.

# Unicellular Organisms with Calcareous Shells in the Subtropical and Tropical NW-Pacific

Johann HOHENEGGER

Visiting Professor, Kagoshima University Research Center for the South Pacific



Being a professor at the Institute of Paleontology, University of Vienna, Austria, I have enjoyed the opportunity to be a visiting professor at the Kagoshima University Research Center for the South Pacific for more than six months, from September 3rd, 1997, until March 13th, 1998.

Coral reefs of the subtropical and tropical seas are inhabited by a group of single celled organisms related to amoebas, the Foraminifera. Similar to snails, Foraminifera with sizes normally less than 2mm protect their bodies by calcareous tests, but demonstrate more diverse shell forms than the much larger snails. Some tropical representatives of Foraminifera living in the shallow water surrounding coral reefs achieve sizes up to 13cm and become the largest single celled organisms living today. Their test walls are transparent and these organisms act as microscopic greenhouses hosting microalgae. Therefore, these Foraminifera are independent of food resources to a high degree. Nearshore areas of the tropical and subtropical NW-Pacific are characterized by a special group of larger Foraminifera with star-shaped tests growing up to 3mm. They are extremely abundant in some coastal areas, where the bottom of the reef is densely inhabited by living organisms, the so-called *hoshisuna*. Settlement can be so intensive that these areas seem to be covered with 'living sand'.

Developing calcareous test that can be preserved in the sediment after death or reproduction, larger Foraminifera can be found as fossils in various shallow marine sediments through earth history. Interpretation of ancient environments by larger foraminifers can only be done, when the ecology of living forms is fully understood. Therefore, mainly paleontologists are interested in the biology of these organisms. I started my studies on living larger Foraminifera at Sesoko Island, Okinawa in 1986. Population dynamic studies on *hoshisuna* were performed in 1992/93. Participation in the 1995 trip of the Kagoshima University Research Center for the South Pacific to Belau demonstrated the geographical differences between the tropical and subtropical larger foraminifers.

The purpose of my stay in Kagoshima is the investigation of the geographical distribution of larger foraminifers in the NW-Pacific. Since the warm Kuroshio current shifts the distribution boundaries to the North in different degrees, investigations of samples from the coastal areas of Kyushu are necessary to detect the exact distribution limits. Kagoshima Prefecture with the larger islands Tanegashima and Yakushima is the best region for these boundaries' studies, and the Kagoshima University Research Center for the South Pacific seems to be the optimal place to perform this work.

# Symposium

## Foraminifera as Indicators of Marine Environments in the Present and Past

A symposium under the title indicated above was held at Inamori Auditorium in the Kagoshima University campus on February 28, 1998. The significance of holding it is briefed as follows:

The present environment exists in connection with the past. The Foraminifera, which are distributed in every sea area, can be a good indicator of environment and paleoenvironment. The symposium discussed the following things: useful indicators for modern and ancient marine environments; larger Foraminifera which indicate shallow water in the tropical and subtropical environments in the present and past; the distribution and daily migration of planktic Foraminifera in the west Pacific; that fluctuation of productivity depended on the difference of the season and the latitude; the paleoenvironment of Kagoshima-*shi* based on the fossil Foraminifera; and Cenozoic environment changes of the earth.

The discussions during the symposium were very extensive and intense. The abstracts of the main talks for those are as follows:

### Why Does Foraminifera Act as Useful Proxies for Modern and Ancient Marine Environments?

Hiroshi KITAZATO
Faculty of Science, Shizuoka University

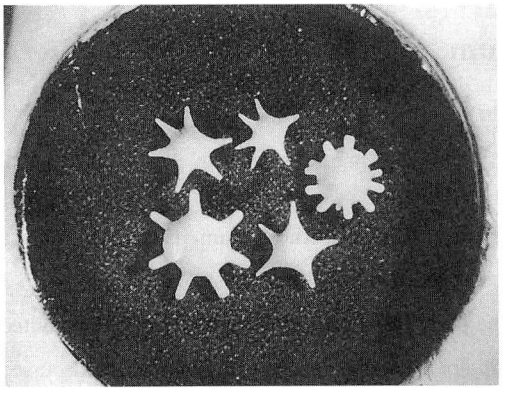
Foraminifera is the organism often used as indicators of present or past marine environments. What feature of Foraminifera is interrelated to the environment? Does species distribution correspond to specific environmental factors? Are morphological features correlated to special environmental conditions and are those available for the reconstruction of the paleoenvironment? When we investigate such interrelationships between Foraminifera and environment, constructing experiments under controlled conditions is a useful approach to such researches.

At our laboratory, to understand the significance of the morphology of foraminiferal tests, we treated experiments in which environmental factors such as temperature, salinity, dissolved oxygen, the quantity of food materials, and light intensity are controlled. The experiments have clarified that some characters of the foraminiferal tests show variations which are in response to these environmental factors mentioned above. This is the main reason why the Foraminifera can be used as indicators of the marine environment in the present or past.

### Larger Foraminifera — Microscopical Greenhouses Indicating Shallow Water Tropical and Subtropical Environments in the Present and Past

Johann HOHENEGGER
Kagoshima University Research Center for the South Pacific (Universität Wien, Österreich (Austria))

Larger Foraminifera with test sizes from 2mm up to 13cm are characteristic organisms inhabiting shallow water subtropical and tropical environments today. They prefer clear, nutrition depleted water as can be found in the surroundings of coral reefs. Two main factors acting as single gradients regulate the distributions of



"Star sand": large Foraminifera from Yoron Island, one of the Southwestern Islands in Japan. The diameter of the circle around the Foraminifera in this photograph: 13mm.

larger foraminifers within coral reef complexes. All living larger Foraminifera house symbiotic microalgae and are thus restricted to the photic zone (down to 150m), getting independence from food resources outside the cell in various degrees. Differences in water movement, mostly correlated with substrate type, and light availability are managed in various ways. Test constructions in combination with attachment mechanisms of the protoplasm combat strong water movement, while light penetration is handled by test ultrastructure. Larger foraminifers inhabiting intertidal and extremely shallow subtidal environments block high irradiation by thicker tests or porcelaneous structures, making the walls impenetrable. In contrast, species living near the base of the photic zone facilitate light penetration by thin transparent test walls and by developing light-collecting mechanisms such as nodes and pillars. Water turbulence, often extreme in coral reef environments, is handled in different ways, but is restricted to a few paradigmatic test forms. Similar tests were developed in various phylogenetic lines at different climatic climaxes during earth history starting from the Late Paleozoic (325,000,000 years ago). These can be interpreted as analogous developments in handling the main environmental gradients of light intensity and water energy.

**Distribution and Daily Migration of Planktic Foraminifera in the West Pacific**

Akio HATTA

Faculty of Education, Kagoshima University

When we wish to estimate a paleoenvironment from fossil Foraminifera, we must get hold of information about the habitat of recent living Foraminifera. I therefore investigated the distribution of planktic Foraminifera and, depth, temperature and salinity of the habitat sea area. Foraminifera was gathered by vertical towing from the divided 4 horizons between a depth of 200m to 0m. Consequently, the geographical distribution and daily migration of respective species of planktic Foraminifera in the west Pacific were made clear, and were compared with those of another sea area. There was a distinct difference in the distribution of tropical species, *Globorotalia tumida*, *Globorotalia menardii*, *Pulleniatina obliqueroculata* and so on, and the temperate zone species, *Globigerinoides ruber* and *Globigerinoides sacculifer*, *Globigerinoides obliquus*, *Globigerinita glutinata*, *Globigerina rubescens*. Moreover, there was characteristic daily migration in the planktic Foraminifera as compared with other small animals. This is an important factor among considerations about the movement of carbon dioxide.

**Reconstruction of Marine Environments in the Past—A Planktic Foraminiferal Approach**

Motoyoshi ODA

Faculty of Science, Kumamoto University

Many attempts applying various methods to analyse deep sea sediments are hitherto performed to reconstruct environmental conditions of the past. Various interpretations of these data have been made. Transfer functions, derivatives of factor analytical methods as introduced by IMBRIE and KIPP (1971) were based on correlations

between planktic foraminiferal assemblages and water temperature. Paleotemperatures can now be estimated using the same multivariate function values gained on today's assemblages to fossil planktic communities. This method is also proved by calcareous nanno-planktons, Radiolaria, and diatoms. Because of the differences between the larger marine areas like the Atlantic and the Pacific Oceans, however, the development of special standard functions for each marine area is necessary. Furthermore, we have to take into consideration the variations of planktic reproduction in accordance with differing latitudes and seasons. The influence of seasonal variation of planktic foraminiferal reproduction has to be studied in detail, especially regarding the relations between the flux of planktic foraminifers and the marine environment. At present, fundamental data on these relations using sediment traps are accumulated. My talk for this symposium was mainly concerned with the present situation as stated above and the reconstruction of marine paleoenvironments in the area of the Kuroshio Current after the last glacial epoch.

**Cenozoic Environmental Changes of the Earth and Fossil Foraminifera**

Ritsuo NOMURA
Faculty of Education, Shimane University

The Cenozoic, called "the Era of Mammals", is extremely important for understanding the development of present global environments. To clarify the developmental mechanisms, analyses of foraminiferal assemblages inhabiting the sea are significant, together with the information from stable oxygen and carbon isotopes recorded in their calcareous test walls. Both the assemblages and isotopic ratios in the foraminifera have changed according to the paleoceanographic changes. Major changes of the global environment are reflected in the following paleoceanographic events. (1) Extinction of some benthic Foraminifera at the end of the Paleocene, (2) Gradual changes of both planktic and benthic assemblages during the middle to the late Eocene, (3) Radiation of planktic assemblages in the early Oligocene, (4) Gradual extinction and development of both benthic and planktic assemblages toward the end of the early Miocene and beginning of the middle Miocene, (5) Development of the present-living assemblages starting in the late Miocene.

These events demonstrate complex interactions amongst the oceans, continents, and the atmosphere. Some of them are noted here: the disappearance of the Tethys Sea, the development of the Antarctic ice sheet, productivity changes in surface layers caused by the change of global deep-water circulation, changes in the distribution of continents, the uplift of the Himalayas and Tibetan Plateau, and variations in the content of green-house-effect gases, such as $CO_2$, in the atmosphere.

**Kagoshima under Cold Sea Water Told by Fossil Foraminifera**

Kimihiko ŌKI
Faculty of Science, Kagoshima University

The Late Pleistocene Shiroyama Formation is exposed in the cliff of Ryūkyūjinmatsu, Yoshino-*cho*, Kagoshima City, and the lower mud bed of the formation yields large fossil oyster (*Ostrea gigas*) forming oyster banks. *Ostrea gigas* is now living in Saroma Lake and Akkeshi Bay, Hokkaido.

This bed yields fossil pollen such as *Pinus*, *Abies*, *Tsuga*, *Picea* and *Fagus* which indicate a cool or cold condition at that time. Furthermore, *Ammonia tepida*, an index species of an inner and shallow bay, and *Buccella frigida*, an index species of cold water, occupy more than 50% of the benthic foraminiferal fauna in this bed. On the other hand, abundant molluscan fossils of a warm shallow sea type are contained in the upper mud

bed. The Shiroyama Formation was stratigraphically deposited during the period ranging from 0.3 to 0.1 Ma. From these facts it is concluded that the Shiroyama Formation is an inner-bay sediment deposited at the last stage of the Mindel or Riss glacial age.

Sea level in the last stage of a glacial age must be more than 50m below recent sea level, but the formation discussed here is distributed at a height about 50m above sea level. From this it may be inferred that the region was uplifted more than 100m.

# Research Seminars in 1997

February 3, 1997

**Distribution of Spiny Lobsters in the Sea Area to the South of Kyushu Island**

Toshio SAISHO

Faculty of Fisheries, Kagoshima University

Spiny lobsters are large-sized crustacean decapods and are favored food in many countries because of their fine flavor. They are widely distributed in the tropical and substropical coastal areas.

The spiny lobster, *Panulirus* species occurring around the islands to the south of Kyushu are as follows: *Panulirus japonicus* (VON SIEBOLD), *Panulirus longipes* (A. Milne EDWARDS), *Panulirus penicillatus* (OLIVER), *Panulirus versicolor* (LATREILE), *Panulirus ornatus* (FABRICIUS) and *Panulirus homarus* (LINNAEUS).

In central Japan, among species under the genus *Panulirus*, *P. japonicus* is the dominant species and others are rarely found. These lobsters of the genus *Panulirus* are called "spiny lobsters" because they have many pointed spines on their carapaces and antennae. The morphology, numbers and arrangements of spines are used for identification of each species. Body colors and patterns are also useful characteristics for identification when they are alive. The sea area around the islands to the south of Kyushu has a complicated biogeographic character, having a distribution of six species of spiny lobsters, much more than the northern sea area. Based on field samplings, fishery records, and oceanological data, the diverse and segregated distributions of spiny lobsters in this area seems to be effectively determined by a flowing branch of the Kuroshio Current.

February 24, 1997

**An Atypical Variant of Fabry Disease: Incidence and Genetic Analysis**

Hiromitsu TANAKA

President, Kagoshima University

Fabry disease is an X-linked recessive disease resulting from a deficiency of the lysosomal hydrolase $\alpha$-galactosidase. The clinical manifestations differ between classic and atypical forms. Fabry disease has been thought to be rare. However, we recently found seven unrelated patients with atypical variants of hemizygous Fabry disease among 230 men with left ventricular hypertrophy (3%). Thus, Fabry disease should be considered as a cause of unexplained left ventricular hypertrophy. Two patients had novel

missense mutation, and the remaining five showed decreased amount of the $\alpha$-galactosidase messenger RNA (New Engl. J. Med. 1995, 333: 288-293). The genetic and biochemical analysis in family members showed that the diagnosis could be made by measurement of plasma $\alpha$-galactosidase activity, but gene analysis should be done in female patients (heterozygote).

March 3, 1997

**Exploitation and Integration of Forest Areas in Insular Southeast Asia**

Misa MASUDA

Institute of Agriculture and Forestry, University of Tsukuba

An overview of the forest exploitation process in Insular Southeast Asia shows commercial logging during the colonial period took place mainly in monsoon forest areas with teak as a dominant species. Tropical rain forests politically formed vast vacant areas, where non-timber forest products such as gums and resins were economically more important. Since these resources had a scattered distribution with small quantity, there were no incentives to investment and local people were the only producers. It was not until the 1960's that rain forest exploitation started on a full scale according to growing demand by the plywood industry.

Types of commodities derived from a certain forest are principally determined by interaction among factors that include: natural environment of the forest, scale of the market, and available technology. In developing nations, institutional aspects like forest management systems and legal structures tend to be established following the preceding forest exploitation or urged by market circumstances.

During the colonial period, wood was mainly consumed in the domestic market. In teak forest areas of central and eastern Java, labor-intensive logging skills, with forest workers as a resultant social stratum, have been formed through a history of teak wood extraction dating back to the eighteenth century.

Deterioration of natural resources gradually became considerable, however, and the forest service was established in the middle of the nineteenth century. Forest reserves were demarcated under the colonial power, together with application of working plans. The framework of direct forest management established at the beginning of the twentieth century was taken over after the independence and has been maintained by a government forest enterprise.

In contrast, extraction of large-diameter wood from the interior required capital-intensive logging systems with heavy equipment. Owing to a lack of financial backing and of facilities in forest services, private investment including foreign capital under a concession system was commonly introduced to rain forests when the market supplying raw material to the plywood industry was formed.

The prerequisites for realizing large-scale exploitation include expropriation of forest land and application of a centralized administration system. In Indonesia, these were concurrently introduced to rain forest areas with enactment of the Basic Forestry Law in 1967. It declared all the forested areas to be national property and traditional usufructs on forest resources to be authorized so far as they do not confront development policies of the government. Consequently, customary human systems that involve actual or potential forest conservation are facing a crisis of dissolution under the pressure of logging by concessionaires.

Expansion of deforestation after the 1980's accelerated a tendency toward "first come, first served" that has led local people to elude vigilance of the forest service and throng toward the forest remnant to exploit it. Rich resources of tropical rain forests once gave rise to integration of marginal areas into a

centralized system, but in parallel with a destructive process, they now participate in an invisible sphere of disorder.

April 28, 1997

**Appropriate Environment for Growing Tropical and Subtropical Fruit Trees**

Kiyotake ISHIHATA

Faculty of Agriculture, Kagoshima University

The native habitat of a fruit tree is not necessarily the place for producing good-quality fruits, and there are many kinds of fruit trees that are economically produced in locations to which they are not native. However, the cultivation of tropical and subtropical fruit trees is greatly affected by the growing environment.

Total worldwide annual fruit production is about 330 million tons (1996). Annual fruit consumption in Japan is about 7.5 million tons (1996), with imports accounting 1.5 million tons (1996). Imports of various tropical and subtropical fruits to Japan have recently been increasing. In Japan, tropical and subtropical fruits are economically cultivated both in greenhouses and outdoors, and the main kinds include mango, pineapple, papaya, guava, litchi, star fruit, and passion fruit.

Japan's annual imports of mango are about 10,000 tons (1995). The amount of mango produced in Japan is 800 tons (1996), and both the area under cultivation and amount produced have been steadily increasing. The countries exporting mango to Japan are the Philippines, Taiwan, and Mexico.

Fruit flies present a problem with exports of mango from the Philippines and Taiwan. The mango fruits exported from those countries are subjected to steam heat treatment after harvest, resulting in increased costs. In mango imported from the Philippines in 1996, there was a problem with sponge-like internal breakdown of the flesh. This problem was attributed to the soil in which the fruit was cultivated. With mango from Taiwan, there are also problems with fruit flies and anthracnose, and fruit with internal jelly-seed-like breakdown has recently appeared, resulting in decreased exports. The main area for mango production in Japan is Okinawa Prefecture. However, the soil there is derived from coral reef, and trees and fruit with internal breakdown due to excessive calcium have occurred, so countermeasures are now being sought.

May 26, 1997

**The Reorganization of the Port-polities in the Malay Peninsula under Siam during the Early Ratanakosin Period**

Keiko KURODA

Faculty of Law, Economics and the Humanities, Kagoshima University

Ayutthaya, the capital of Siam, was functioned as an important entrépot on the East-West trade network which included many ports of China and India. Ayutthaya as a trade center was able to collect goods for trade from local ports under her jurisdiction. Ayutthaya's trade network expanded over the north valleys of Chiang Mai, the northeast districts on the basin of Chi River and the south districts including with the tributary states on the Malay Peninsula.

The main revenue of Siam was brought by foreign trade. Especially, trade income from southern

districts of the Malay Peninsula was essential for the Court of Siam.

In the southern districts of Siam, Nakhon Sii Thammarat was the first-class district which was the center of defense and trade. Nakhon Sii Thammarat had the roles of keeping the trade routes on the Malay Peninsula and of watching the Malay tributary states: Patani, Kedah, Trengganu and Kelantan.

In 1767, Ayutthaya was destroyed by Burma. Nakhon Sii Thammarat and the Malay tributary states were released from the administrative network of Ayutthaya. A Court of Siam, Thonburi, succeeded Ayutthaya, and, later, Ratanakosin were also successors of Ayutthaya. These two dynasties adopted the traditional administrative system of Ayutthaya period basically. To re-establish the traditional authority of Siam, the Court integrated Nakhon Sii Thammarat immediately and forced Patani, Kedah, Trengganu and Kelantan to pay tribute and also reorganized the Siamese trade and administrative network.

However, since establishment of the British settlement in 1786, Penang as the local trade center by Chinese merchants had relative importance in the local network of entrépots on the Malay Peninsula. And as Chinese traders became active in the Siamese trade with China, trade income in the Siamese trade with China also increased.

Under this new situation, the Court of Siam gave Chinese merchants an important position, as the case of governor of Songkhla who was an Fukien Chinese merchant. On the other hand, the Court gradually restricted the political power of the old local district of Nakhon Sii Thammarat which had been the leading family of Ayutthaya Dynasty, because the Court of Siam needed to levy trading goods as tax more efficiently and to promote centralization of administrative power.

In consequence, both Songkhla and Nakhon Sii Thammarat became first-class districts in the Southern Region in 1791. Under this system, Chinese social and political standing also rose in the Siamese administrative system. And, also, many local ports since Ayutthaya period have been reorganized. The network of port-polities under Siamese jurisdiction was deformed and controlled by Chinese merchants who were patronized by the Court of Siam.

This caused not only the decline of some of the old local ports, but also the hostility and resistance against the Siamese control over Malay Islamic tributary states.

This situation became one of the obstacles to integrating these Malay Islamic States into Thailand as part of the nation-state in the 20th century.

July 14, 1997

**Outline of Recent Indonesian Fisheries**

Hideo ICHIKAWA

Faculty of Fisheries, Kagoshima University

Economic development in Indonesia has depended on political stability for a long time. Fisheries development has made remarkable progress in recent years. According to the Fisheries Statistics of Indonesia, the total fisheries production was one million tons in 1970, rose to 2 million tons in 1980, 3 million tons in 1989, and up to 4 million tons in 1994. According to the FAO Fisheries Statistics, it became seventh from the top in the world in 1994.

The main factors for such a remarkable fisheries development are (1) consolidation of infrastructure, such as improving of fishing ports, (2) development of fishing gear, (3) increase of domestic demand for marine products, (4) consolidation of fishing distribution system, and (5) the reorganization of fishing system.

In this way, Indonesian fisheries development has been advanced in two areas. One is the fishing development for export of marine products, to increase foreign exchange. The other is fishing development for domestic consumption of marine products to meet the increasing demand. In the former case, these products are mainly prawn, shrimp, tuna and skip-jack. Recently, the export of marine products has increased in various kinds of fish and exporting countries.

Total marine products for export in 1993 increased 65.3% as compared to 1990, and reached 529,213 tons, 13.9% of total production. In the Japanese market, the Indonesian exports are dropping while those from Thailand and Malaysia are increasing. On the other hand, Indonesian domestic consumption of sardine, mackerel and horse mackerel has increased, supported by an increase in fishing production, resulting from improving fishing boats and gears. Specifically, net-fishing such as purse seine, drift gill nets and payang, has made remarkable development.

Indonesian fishery has a lot of problems in improvement of fishing ports and fishing boats, fishing resources and environmental aspects, handling of fishing commodity, small scale fishermen problems, etc.

October 27, 1997

**African Rice, *Oryza glaberrima* STEUD.**

Tadao C. KATAYAMA

Faculty of Agriculture, Kagoshima University

African rice (*Oryza glaberrima* STEUD.) and Asian rice (*O. sativa* L.) are two cultivated species of the genus *Oryza*. About 23 species of the genus are wild species. Both cultivated species are constituted by AA genome, and interspecific hybrids between them are easily obtained, but progenies of them are seldom obtained. They showed intrafertile groups with 2 respective nearly-related-wild species, and showed intersterile groups with one another.

African rice had evolved from *O. breviligulata* CHEV. et ROEHR. about BC 2,000 in upper reaches of Niger River, and spread the distribution areas with several diversities to Senegal, Gambia, Guinea Coast, and arrived at East Africa. At present, however, the main cultivated areas are seen in West Africa, and a few strains were practically found also in East Africa. They showed wide variations as cultivated, semi-cultivated and wild types. They are growing in sympatrical and allopatrical conditions with *O. sativa*, *O. breviligulata* and *O. longistaminata* in accordance with respective ecological factors.

African rice showed different features from Asian rice in morphological, physiological and ecological characters, in which some were seen as having a wild status. These characters or features were looked upon to have connection with agronomical practices, especially hydrological conditions. African rice is important crop species in the world from now on out, owing to superior characteristics such as tolerance to injury, high potential in photosynthesis, liking by consumers, large diversification and sociological status.

# Public Lecture Series: The South Pacific

## — The Sea, the Land and the Globe —

July 26 and 27, 1997

The public lecture series of the Kagoshima University Research Center for the South Pacific entitled "The South Pacific—the Sea, the Land and the Globe—" was held at the Faculty of Science and the Information Processing Center on July 26 and 27, 1997. The public lecture series in 1997 was designed to introduce aspects of the South Pacific region to a general audience from a global point of view, drawing on the lecturer's research experience with the Center for many years. The diversity of the topics represents the extensive research fields of the Center. The Information Processing Center kindly let us use one of their new computer rooms, where the participants had a hands-on experience with the WWW on the Internet. Special thanks should go to Associate Professor NINOMIYA and Ms IJIRI, who helped this happen.

As in the previous years, at the end of the lectures an hour was allotted for an overall discussion between the lecturers and the participants to facilitate better understanding of the topics.

Below are the titles and abstracts of the lectures:

### 1. Pacific Ocean and Its Tectonics

Munetomo NEDACHI

Faculty of Science, Kagoshima University

Many many islands lie widely scattered on the Pacific Ocean, and various comfortable environments and fantastic human cultures have developed on these islands. Modern geology tells us that this wonderful nature has been offered during the drastic evolution of the Earth.

The topography of the seafloor of the Pacific Ocean is unique: two types of elongated island chain (arciform chains in the western rim and chains of oceanic volcanoes in the central wide region), trenches enclosing the ocean, and a long massive rise are not observed in any continents. These features are controlled by the growth and movement of plates (great slabs of lithosphere), interpreted by the plume tectonics. Heat energy from the Earth's interior is transported through plume shaped convection in the Earth's mantle to the external space. At about 700 million years ago (Ma), the hot super-plume ascended in the center of a supercontinent, "Gondwanaland", broke it into pieces, and created the Pacific Ocean. The Pacific Ocean spread to be one large ocean on the Earth at about 400 Ma, and has subsequently decreased its area. The heat from the super-plume produced numerous oceanic volcanoes such as the Hawaiian volcanic chain, as well as trench, island arcs and back arc basins such as the Sea of Japan. During the evolution, the Pacific Ocean has also offered favorable environments for the formation of mineral resources. Numerous mineral resources are observed along the Pacific Rim region, and active hydrothermal fumaroles forming mineral resources are along the East Pacific rise and troughs in back arc basins.

However, we do not completely know the Pacific Ocean yet. Many people are trying to confirm and revise the plume tectonics theory to understand all the geological phenomena observed in the Pacific Ocean. Especially, the chemical features of oceanic volcanoes in the South Pacific region will suggest facts about the plume, and the geology of the island arc system may show why so many small plates are distributed in the western Pacific region.

## 2. Internet and Our Society

Toru AOYAMA

Kagoshima University Research Center for the South Pacific

The Internet has come of age, so to speak, since I gave a talk about the Internet in the preceding year's Public Lecture. It is not so much dazzling new technology any more, which it was for many of us, as a part of daily life which people take for granted. The change of the status of the Internet from novelty to norm has a couple of social implications. They are, in the order of negative to positive, crime, business and education.

Criminal activities in the Internet receive wide publicity in mass media, partly because the media know the story sells well. Some of the topics include obscene images on homepages, illegal copying of intellectual property, computer viruses transmitted through the Internet, hacking into databases to steal or manipulate personal information, biased political propaganda, to name a few. Legal issues concerning the Internet are further compounded by the fact that the Internet effortlessly crosses a border between one country where a case is legal and another where it is not. It must be clearly understood, however, these problems are not created because of the technology but are inherent in our own society. They simply started manifesting themselves, as the technology has become part of our social fabric.

The Internet has become a virtual land of great business opportunity. This is, whether you like it or not (we must remember the Internet started as an electronic commune where everyone contributes and shares without monetary reward), a logical consequence in a capitalist society. Some of the perceived advantages of the Internet over other information media is that it can integrate broadcasting and telecommunication into a single interactive network of information flow. When a standard method of transaction is agreed upon, the Internet will become truly an integral part of our business life.

The Internet as means of education is of great importance for our future, because we all inevitably have to learn how to cope with changes which the Internet is bringing about and how to live in the rapidly changing society. The Internet has revitalized the interactive process of inquiring and responding, which is the core of learning, in a classroom. It has enabled students even in different countries to communicate with each other to a degree that was unimaginable before. For instance, students in Japan and Spain are exchanging messages and pictures through the Internet. We hope to see the Internet will become a means of "living together, learning together, enjoying together", to paraphrase Illich's term conviviality.

Notes: WWW homepage for this lecture, which is linked to many other homepages, is found at http://bio.sci.kagoshima-u.ac.jp/kurcsp/lecture/openlec9707.html. I would like to thank Dr Koki NINOMIYA and Ms Hiroko IJIRI of the Information Processing Center for their invaluable help.

### 3. Deep Circulation of the Pacific Ocean

Masahito SAKURAI

Faculty of Engineering, Kagoshima University

About the deep water of the sea, we are more poorly informed than about the upper water. But in recent years, a large number of studies has been done since H. STOMMEL and A. B. ARONS proposed their model of a world-ocean deep circulation.

The high density water masses, which in itself by the distribution of temperature and salinity, form in only two regions in the ocean. One is near Greenland, where the sea-water is intensively cooled to less than 0℃, especially apparent in very cold winters. These dense water masses sink and flow southward along the bottom of the western side of North Atlantic basin. They continue through the equator and enter the South Atlantic.

The other source of deep cold water is the Weddel Sea in the Antarctic. The cold water sinks to the bottom of the deep sea basin and it moves northward circulating around Antarctica, mixing with near-Greenland-form water masses. These deep water masses slowly move northward as regards all three major ocean basins.

The Pacific deep water entering from around Antarctica spreads after crossing the equator and branches north-west and north-east into the North Pacific. This deep water returns to the sea-surface. Estimates of the age of the North Pacific deep water range from hundreds to thousands of years.

### 4. Benefits and Disasters due to Activities of Volcanoes

Ryosuke KITAMURA

Faculty of Engineering, Kagoshima University

In Japan there are 86 active volcanoes. This number is 10% of all of those on Earth, and Japan is, concerning the number of those, the second-largest country in the world. Kagoshima Prefecture is located in the Kirishima Volcanic zone and has many active volcanoes such as Mt. Sakurajima. The volcanic activities bring not only disasters but also benefits. This fact is different from the earthquakes which bring only disasters. Here the benefits and disasters are called the positive and negative factors due to the activities of volcanoes respectively.

The technology has been existing on the earth since the generation of human beings, for example human beings made various tools of pebbles and stones. Tools can be considered to be one of the greatest results which the technology brought. The technology has made a rapid progress in various fields since the Industrial Revolution in the 18th century and contributed to the improvement of human life since then.

The engineering, which is a branch of the learning field for the technology, also exists in contact points of human life and volcanic activities. In this lecture such a engineering is defined as the volcanic engineering. In 1991 pyroclastic flows followed by debris flows due to heavy rain occurred at Mt. Unzen and brought a serious disasters to human lives, social capitals, and private houses. At present the volcanic activity comes down and several projects for countermeasure for disasters are proceeded by using the results of engineering. Mt. Sakurajima has continued to be active for more than forty years. Falling ash followed by eruptions brought some disasters such as debris flow, traffic troubles, health hazards and so on. A new road sweeper and house are developed to overcome the disaster due to

falling ash. The research work is also going on to analyze the occurrence, flow and sedimentation mechanism of debris flow. On the other hand the geothermal electric power stations were constructed at Yamagawa and Makizono Towns, Kagoshima Prefecture. The hot spring resorts for recreation have also been developed. The engineering contributed to construct these facilities which are regarded as the positive factors of active volcanoes.

In this lecture the research projects and their necessity in the volcanic engineering were discussed by combining and summarizing the results of various engineering fields.

## 5. Great Favors of Tidal Flats Filled with Marine Life

Masanori SATO

Faculty of Science, Kagoshima University

Tidal flats usually develop around an estuary at a river mouth. River water transports high amounts of particulate organic matter (detritus) and nutrients (nitrate and phosphate), originating from terrestrial organisms, into tidal flats. Therefore, tidal flats become ecologically important places possessing high bioproductivity and high biodiversity in the sea. Tidal flats are valuable for an ecosystem in the following instances. 1) Tidal flats serve a water-purifying function, which suppresses organic pollution and eutrophication in coastal areas, by the cooperation of various organisms inhabiting there. 2) Tidal flats are spawning and nursery grounds for many fishes, crustaceans and cephalopods. 3) Tidal flats are natural places for our recreation, i.e., swimming, fishing, taking walks, bird-watching, and are foraging places for migratory birds. The functions of tidal flats (especially 1 and 2) are important for maintaining coastal fisheries.

The values of tidal flats have been underestimated because perhaps major organisms inhabiting there, i.e., polychates, bivalves, crustaceans, are not colorful and are inconspicuous. Many tidal flats have been heavily damaged by human impact such as pollution and reclamation. In Japan, about half the area of tidal flats has already disappeared because of previous artificial reclamations. And, even now, further planning of huge reclamations continues.

The Ariake Sea (area: 1700km$^2$) in southwest Japan is an unusual bay, as characterized by the greatest tidal height (about 6m in maximum) and largest extent of tidal flats (about 260km$^2$). About 20 indigenous species, endemic to the Ariake Sea or inhabiting only the Chinese coast (except for the Ariake Sea), are known: fishes, crustaceans, gastropods or brachiopods. Many of these indigenous species inhabit Isahaya Bay, which is the only bay inside the Ariake Sea. Now, the muddy tidal flats of Isahaya Bay in the Ariake Sea face a crisis of reclamation on the largest scale (about 35.5km$^2$). This interference will result in long-term serious problems in the environment and the fishery in the whole of the Ariake Sea. Conservation of the natural environment of the tidal flats is the first duty for protecting the lives of further generations.

## 6. A Historicel View on Wooden Floor and Unfloored Space in Europe and Asia

Mitsuyoshi TSUCHIDA

Faculty of Engineering, Kagoshima University

Recently we have become used to sitting down on a chair and cannot go on our knees on the floor for thirty minutes. We sat down on the

floor in order to take a meal every day thirty years ago. Our life style has changed gradually from the floor life to the chair life because we sit down in a chair in order to read a book, to take dinner with the family and to watch television. Recently we not only sleep in a *futon* on the *tatami* but also sleep in a bed on the floor.

In the modern Japanese house, much furniture is present under the influence of European life styles, and therefore we must live with less free space. I think that it is better to build a warehouse than to build another room to create more living space, because then too much furniture is put in the warehouse and the room becomes greater. Having lots of funiture is better on a wooden floor than on *tatami*.

But *tatami* need not be lost in the modern house. At least one room will be used as a *tatami* room for a long time. On the other hand, the unfloored space has been forgotten recently. But I want to praise the comfortable goodness of the unfloored space. In Japan this sort of space was very cosiderable in the old days. It became gradually smaller and at last it has become used only at the entrance in the modern house. Therefore, I have researched the unfloored space and compared it with the wooden floors in Europe, Korea, China and Micronesia.

It is important whether people take off shoes or do not take off shoes in a room. The Japanese life style now includes the use of a wooden floor. I think that we must use both wooden floor and unfloored space, so we do not have to take off shoes and can freely progress into the house. It is important that the unfloored space be made a little larger in the future. At the last, the unfloored space should not be separated from other types of floor space, but be combined with it in order to allow us to sit down in either kind of space.

## 7. Foods Made from Transgenic Plants

Takeomi ETOH

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Tropical and subtropical areas, including the South Pacific, have a great variety of plant species, which involve a huge amount of useful genes. However, most of those genes are not effectively utilized by human beings yet.

Recently, genetic engineering has made rapid and great progress, and now we can introduce a gene from an organism to a different crop plant when the gene is identified and extracted from the organism. At the molecular level, a single gene consists of a length of DNA, and there was a brilliant discovery about the enzymes related to DNA; the discovery of restriction endonucleases and DNA ligases. Restriction endonucleases are also known as restriction enzymes, and they correctly cut DNA at a particular sequence of DNA, in other words, a restricted point of DNA. With restriction enzymes, we can cut the DNA and extract a particular gene. And then, we can insert the gene into the DNA length of another organism, using DNA ligase which joins two DNAs.

A lot of crops are being bred by means of genetic engineering. Some of the crops bred by genetic engineering are already utilized as food. Those plants into which genes from another species have been deliberately introduced by genetic engineering are known as transgenic plants. In Japan, 15 transgenic cultivars of cultivated plants are approved as food crops by the government. They are soybean, corn and canolas with herbicide-tolerant genes, and potatoes, corn, and cotton with pest-resistant genes.

Now those transgenic plants are made by means of gene transfer such as (1) through infection by a plant pathogen bacterium, *Agro-*

*bacterium tumefaciens*, which carries the gene in its plasmids, (2) electroporation which introduces the gene into protoplasts, naked plant cells, in the solution under the influence of a strong electric field, (3) use of a particle gun through which small particles covered by the genes are shot to the plant. The *Agrobacterium* method is applied to dicotyledons, and the electroporation method is applied to monocotyledons. The particle gun method is applied to plants whose protoplast-culture is not obtained yet.

Only a few genes have been used for those food plants up until now. One is the gene from a bacterium, *Bacillus thuringiensis*, which produces a protein toxic only in the digestion tube of particular pest insects. This gene was introduced into several food plants mentioned above, and they are resistant to those particular pest insects. The transgenic plant with this toxic-protein gene is often the target of consumers as a food plant to evaluate more correctly for our health. The other is the gene from another bacterum, *Agrobacterium*, which produces a protein resistant to a particular herbicide. This was also introduced into those plants mentioned above.

In conclusion, genetic engineering produced an epoch-making method of plant breeding. However, we have to evaluate the safety of those food plants made by the new genetic engineering.

# Recent Publications of Kagoshima University Research Center for the South Pacific

**South Pacific Study**

Vol. 17, No. 2 (1997)

Articles:

Ding YANG, Chi-kun YANG and Akira NAGATOMI. The Rhagionidae of China (Diptera).

Yoshiko KAKINUMA, Junzo TSUKAHARA and Syozo HAYASAKA. *Nautilus* Behavior in Aquaria.

Hiroshi MIYAKE, Kenji IWAO and Yoshiko KAKINUMA. Life History and Environment of *Aurelia aurita*.

Tie-Jun LI and Motoo KITANO. Oriental Kimura's Disease and Its Relation to Angiolymphoid Hyperplasia with Eosinophilia (ALHE).

Hiromitsu IWAMOTO. The Pacific War in Relation to Japanese Settlers in Papua New Guinea.

Vol. 18, No. 1 (1997)

Articles:

Nobio HIGO. Study on the Pine Reef—I: Fish Gathering Effect during Early Phase after Placement.

Motoo KITANO, Charles E. LEHNER, Yasushi TAYA, Hiroki S. OZAKI, Masami TAKENAKA and Mahito KAWASHIMA. Histopathological Study on Dysbaric Osteonecrosis (DON) in Tibiae of Sheep with a Hyperbaric Exposure.

Lamont RINDSTROM. Cultural Tourism in the Pacific.

Vol. 18, No. 2 (1998)

Articles:

Muhammad ASHFAQ, Nisar AHMAD and Amjad ALI. Effects of Optimum Dosages of Nitrogen, Postassium, Calcium and Copper on Silkworm, *Bombyx mori* L.: Development and Silk Yield.

Hideharu KUNIYOSHI, Motoo KITANO, Yasuto UCHIO, Taulealeausumai E. ENOSA, Leitua F. ALOAINA, Vaasilifiti F. ASAUA and Shin-ichi TERASHI. Seroepidemiological Survey of Anti-Human T-cell Leukemia Virus-Type I Antibodies in Western Samoa.

Tiru K. JAYARAMAN. Private Investment in Fiji: 1977-1994: Did Government Investment Have Any Crowding-out Effect?

**Occasional Papers**

No. 31 (1998)

Invitation to the South Pacific: Selected Lecture Notes from the Kagoshima University Research Center for the South Pacific. Edited by Toru AOYAMA and Junzo TSUKAHARA.

Part 1: Countries and Peoples.

Kazutaka NAKANO. Solomon Islands.

Tatsuro MATSUOKA. Papua New Guinea.

Motoo KITANO. Western Samoa.

Akio INOUE. French Polynesia.

Sueo KUWAHARA. Malaysia.

Part 2: Nature, Technology and Society.

A. Nature.

Munetomo NEDACHI. Pacific Ocean and Its Tectonics.

Masahito SAKURAI. Deep Circulation of the Pacific Ocean.

Hiroshi ICHIKAWA. The Role of the Kuroshio in the Global Climate Change.

Ryosuke KITAMURA. Benefits and Disasters due to Activities of Volcanoes.

Masanori SATO. Great Favors of Tidal Flats Filled with Marine Life.

Akio INOUE. Poisons of Fish and Shellfish.

B. Technology.

Satoru NISHIMURA. Rice Farmers in the Philippines: Increasing Overseas Workers and Consequent Change in Village Economy.

Tadahide NORO. Carrageenan Extracted from the Seaweeds Cultured in the Philippines.

Mitsuyoshi TSUCHIDA. A Historical View on Wooden Floor and Unfloored Space in Europe and Asia.

Takeomi ETOH. Foods Made from Transgenic Plants.

C. Society.

Ron CROCOMBE. Asia and the Pacific Islands.

Toru AOYAMA. The Internet and Us: Virtual Journey to the South Pacific.

# Announcement

As described in the article by Akio INOUE on the page 1 of this Newsletter, the Kagoshima University Research Center for the South Pacific is to be reorganized in April, 1998. Accordingly, the address of its WWW homepage shown below will be changed. The new address will be shown on the present homepage in the near future.

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