# アジア太平洋域における大学院学生の国際連携教育プログラムーダブルディグリープログラムなどの推進ー最終報告書

## 大学院学生短期研修派遣（平成23年）

### 理工学研究科 海洋環境学専攻 博士3年　矢野　優佳

推薦教員：土屋　誠

**1. 研修先および研修受け入れ責任者：**

パラオ国際サンゴ礁センター　Dr. Yimnang Golbuu

**2. 研修期間：**平成23年12月12日-22日

**3. 研究内容：**

(1)河口から沿岸にかけての有機物動態について(調査およびサンプリング)

パラオ共和国、コロールの Ngermeduu Bay、Ngiwal、及び Ngerikiilで河口から沿岸にかけてのフィールド調査を行った(図 1 - A)。上記 3 河川の河川域および沿岸域から約 10カ所ずつ調査地点を選定し、各地点から水を採取後フィルターで濾過し、水中に含まれていた有機物を採集した。また、各地点の底質および、川を流れていたリターや川岸にはえているマングローブの葉も採集した(図　1　-　B)。持ち帰ったサンプルは今後、有機炭素量及び窒素量、安定同位体などの測定を行い、 各河川における物質流動の違いについて有機物循環の視点から考察する予定である。



▲図1（A）パラオの地図。本調査を行った Ngermeduu Bay、Ngiwal、及び Ngerikiilとナマコ漁の多く見られたNgardmau。（B）Ngerikiil の川で流されるマングローブの葉

(2) パラオにおけるナマコの個体数減少とその対策について（意見交換）

パラオでは近年ナマコの個体数減少が懸念されている。ナマコの個体数を維持するため天然のナマコの漁及び輸出を禁止する法案が提出され、Koror ではナマコ漁が一時的に禁止されるなどナマコ個体数保護のための活動が行われて始めている。今回、海洋資源局局長のDavid　Orrukem氏の案内により、ナマコが多く捕獲されているという Ngardmau（図 1 – A）の沿岸域に連れて行ってもらうことが出来た。そこは、リュウキュウスガモや大型のウミショウブ、小さなウミヒルモ属が混生する海草藻場となっていて、多くの舟がナマコ漁を行っているのが見られた（図 2 - A）。その場所でシュノーケリングを行ない、藻場環境やそこに生息しているナマコを観察した（図 2 - B）。また、近隣の船着き場ではナマコの買い取りが行われており（図 2 – C）、パラオのナマコ個体数減少を危惧するDavid氏から実際の現場を目の当たりにしながらパラオにおけるナマコ漁の現状やパラオでのナマコの研究に関する話を聞くことが出来た。加えて、今回は Palau Community College で自身の研究テーマにも関する藻場域におけるナマコの役割の話を紹介し、現地学生との交流を行うこともできた。現地での調査およびサンプリングに加えて、沖縄での研究対象であるナマコについてパラオの人々との意見交換や情報交換を行うことが出来、非常に有意義なものとなった。


▲図 2 Ngardmau にて（A）沿岸域でナマコ漁を行っていた舟（B）海草の下にいたナマコ（C）買い取られるナマコ

## 大学院学生短期研修派遣（平成23年）

### 理工学研究科 海洋自然科学専攻 修士1年　Noelle Wenty Oldiais

推薦教員：土屋　誠

**1.Acceptance information:**Palau International Coral Reef Center

**2.Research term:**October 2011 to September 2013

**3.Research title, the detail and the results:**

**Purpose:** To understand the connectivity of land and coast and their nutrient dynamics by investigating the suspended solids and their organic matter at three watershed sites in Palau

**Achievements:** A research team composed of Izumi Mimura, Yuka Yano, and myself along with our advisor Makoto Tsuchiya, planned out a data collection for three watershed sites in Palau -Ngerikiil, Ngiwal, and Ngermeduu. (Figure 1).

▲ Figure 1

For each watershed sites we collected salinity, sediment samples, mangrove leave samples, and water samples. With each watershed site, we identified how many data collection sites we were going to have from within the watershed and down to the edges of the coral reefs. For Ngerikiil watershed, there were 9 sites, Ngiwal watershed had 8 sites, and Ngermeduu had 12 sites. These sample sites are shown on Figure 2.

**DATA COLLECTION**

At each data collection site, 3 sediment samples were collected. A sediment "scooper " (made of a pvcp pipe, weights, and ropes) was used and if sediment was not scooped out with this method from the boat, a local research assistant would dive in and suck the sediment with a syringe and transfer the sediment into Ziploc containers and then into a cooler of ice. Also, 3 water samples were collected at each data collection sites. From inside the boat, these samples were scooped out directly with containers of 1 and 2 litters and transferred into the cooler of ice as well. Salinity was measured at the lab for each sample sites from the water samples. In addition, several samples of mangrove leaves were collected at each watershed site.

**DATA PROCESSING**

At the lab, we first transferred the sediment samples from the coolers of ice into an oven to dry at 60℃ along with the sample leaves. Second, we measured and recorded salinity for each of the sites from the water samples using salinity refractometers. Finally, the water samples were sterile filtered through pressure systems employing syringe and vacuum filtration system. The filters were then transferred into the oven as well to dry.

**LESSONS LEARNED**

Personally, the data collection and the methods of processing were very new to me. I learned the importance of precision, accuracy, and cautiousness in handling samples to avoid any contamination.


▲Figure 2

## インドネシア／ボゴール農業大学 水産学部 修士1年　Aliati Iswantari

受入教員：土屋　誠

**1.Research term:**

The research was conducted for three months from July 14h 2011 until August 27th 2011.

**2.Research title, the detail and the results:**

**Title:** Diurnal Nutrient Dynamic in Manko Estuary, Okinawa, Japan

**The Detail of Research:**

Surface water samples in Manko estuary were collected from the bridge at 4 sites (Figure 1). Those were river mouth area, near mangrove area, Kokuba River, and Noha River, respectively (Figure 2). Water was collected from the bridge because there is no boat can enter the estuary. Samples were collected using bucket at each station during 24 hours with 3 hours time intervals started from 10.00 am to 10.00 am. Water sample shortly analyzed for pH, salinity, temperature directly in the field (Figure 3). Water samples for nutrient analysis were analyzed in the laboratory using nutrients auto analyzer .

**The Results**

Nutrient concentration for $NO_3$-N, $NO_2$-N, $NH_4$-N, and $PO_4$-N in Manko estuary was very high and fluctuated in a day Tides influenced the nutrients concentration pattern. For several sites, nutrient concentrations for $NO_3$-N, $NO_2$-N, $NH_4$-N increased when low tide after high tide. This may occurred because high tide drifted sediment especially from mangrove area that has high organic matter content towards sea and river. Generally, both when high and low tide; river has higher nutrient concentration than river mouth and the most nutrient form found in river towards river mouth was $NO_C$-N.

In comparison with other nutrients study in a tropical estuary, Cisadane river mouth, Indonesia, the results showed that nutrients concentration in this study was much higher in low and high tides . This may be happened because the different characteristic within those sites. Cisadane river mouth does not directly influenced by tidal flat and mangrove area. Another difference is the dominant nutrient species when low and high tides between both places is inversely.

In comparison with other nutrients study in Manko estuary (Shilla 2009), the results showed that nutrients concentration for $NO_2$-N, $NO_2$-N, $NH_4$-N in this study was much higher especially when low tide. However, similar pattern was still found that river has higher nutrients concentration than river mouth.

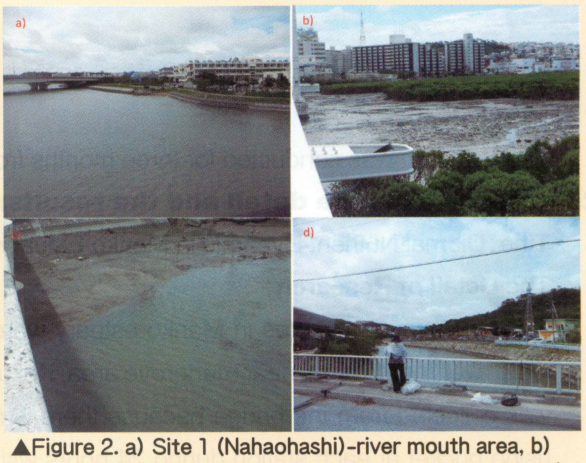
**3.Achievements:**

I was very glad and felt lucky about this opportunity joined this research program. This was a collaboration research between University of the Ryukyus students and I. In this research, I learned how to conduct a good research and be creative in research. Interacting with lecturer and students also gave me valuable experience.

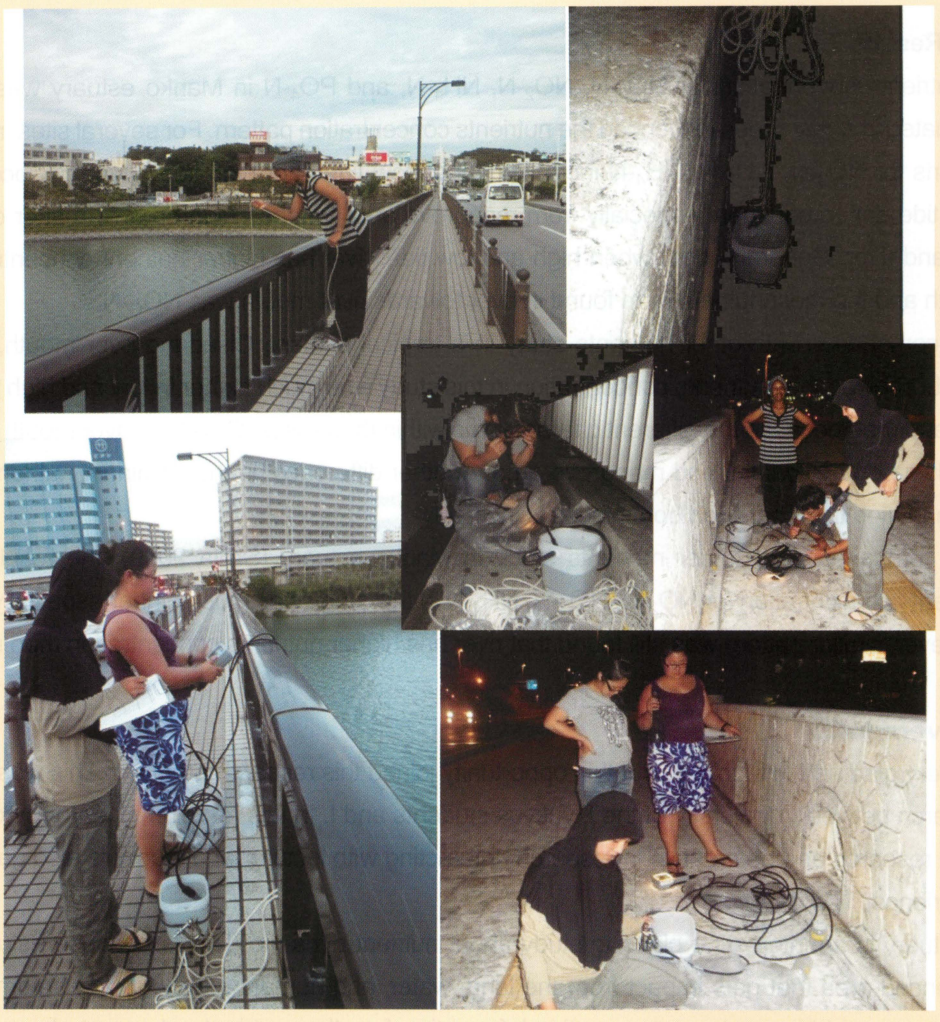
Estuary is an interesting place to study about nutrient dynamic. This is because estuary is the most influenced area that gets impact from the land, water, and human activity upside. Information from this research could be used as comparative information for other nutrient estuary study and also as basic information in managing Manko estuary.

# 大学院学生短期研修受入（平成23年）


▲Figure 1. Map of four sampling sites in Manko Estuary area, Okinawa, Japan
(Source: Modified from Google Earth)




▲Figure 2. a) Site 1 (Nahaohashi)-river mouth area, b) Site 2 (Toyomiohashi)-near mangrove arealow tide, c) Site 3 (Madanbashi)-Kokuba River Site 4 (Ishibiy-abashi)-Noha River



▲Figure 3. Surface water sampling and in-situ water quality analysis process tide, c) Site 3 (Madanbashi)-Kokuba River Site 4 (Ishibiyabashi)-Noha River

## インドネシア／ボゴール農業大学 水産学部 修士1年　Mardiansyah

受入教員：土屋　誠

**1.Research term:**

The research was conducted for three months from July 14h 2011 until August 27th 2011.

**2.Research title, the detail and the results:**

**Title**

Food source macrobenthic of mangrove/estuary ecosystem using stable isotopes analysis, Manko, Okinawa Island, Japan

**The Detail of Research**

The research was conducted in Manko estuary mudflat to determine the source of food in macrobenthic using stable isotopes in August 2011, summer, in the area of mangrove Manko. Samples were taken at low tide (low tide) using a square 50 cm 2 (Fig 2) with 3 repetitions at random (random sampling). Each square of the sample collection performed crustacea gastropods and sediments by hand and with a depth of 1-2 cm using a spade. Samples of mangrove leaves taken using scissors at random to reduce bias (Bouillon et al. 2004). The sample is inserted into a plastic bag and then put into ice cool box and then taken to the laboratory for identification and preparation. Samples macrobenthic (crabs and snails) shells/carapas separated with body tissues (except Onchididae), then rinsed drop by drop with 1.2 N HCl to remove $CaCO_3$, whereas sediment soaked for 24 hours, then rinsed with Millie-Q water. Washing with HCl does not affect the value of $\delta^{13}C$ and $\delta^{15}N$ (Ng et al. 2007) and then washed with Millie-Q water because it does not affect the value of isotopes $\delta^{13}C$ and no significant effect on the isotope values $\delta^{15}N$ (Carabel et al. 2006; Ng et al. 2007; Jaschinski et al. 2008). After washing, all samples in the freeze dry (24 hours) and ground to powder, then put into tin capsules (5x9 mm) with a repetition of three times. The carbon and nitrogen isotope ratios of the samples were the resource persons measure with a Delta V Advantage mass spectrometer, IRMS directly connected to an elemental analyzer (NA-2500, CE Instruments) with the percentage correction 0.15‰. All the isotopic data are reported in the conventional δ notation as follows:

$$\delta^{13}C \text{ or } \delta^{15}N = (R_{sample}/R_{standard} - 1)\ 1000\ (‰)$$

Where R is the $^{13}C/^{12}C$ or $^{15}N/^{14}N$ ratio for $\delta^{13}C$ and $\delta^{15}N$, respectively. Pee Dee Belemnite (PDB) was used as the $\delta^{13}C$ standard and nitrogen gas as the $\delta^{15}N$ standard. To calculate the assimilation of food resources in animals (ratio $\delta^{13}C$ or $\delta^{15}N$), use the formula (DeNiro and Epstein 1978, 1981):

$$\Delta \text{Animal-Diet}$$

Where is the value of $\delta^{13}C$ or $\delta^{15}N$. Ratios δVC are assimilated by the consumer have a value of 0-1 ‰, while in aquatic systems are richer and $\delta^{V}C$ values vary between -2.1 and +2.8‰ (Bouillon et al. 2008). Fractionation ratio for $\delta^{15}N$ a high value is 2.7 (Bouillon et al. 2008) up to 3.4 ‰ between food sources by the body tissues (Minagawa and Wada 1984). However, the average full value of $\delta^{15}N$ is between -0.7 and +9.2 ‰ (Bouillon et al. 2008).

**The Results**

Stable carbon isotope values from animals close to the sediment compared to mangrove leaves . The values of the carbon stable isotope ratios also indicate that case . These results indicate that the source of food grade gastropods and crustaceans from sediment. Family Potamididae one source of food are epiphytic plants and mangrove leaves, because there is detritus from mangrove sediment (Penha-Lopes et al. 2009). In addition, microphytobenthic (diatom) particles are a source of food for gastropods (Pape et al. 2008). Type of Cerithidea spp. and C. mustelina food comes from organic sources dissolved in sediments and microphytobenthic (Bouillon et al. 2004). In contrast to the results shown by Bouillon et al. (2004), that kind of Ochinidium spp. source of food is mangrove roots or stems. While the type of Uca spp. has a mixture of food sources of benthic microalgae, sedimentary POM (Hsieh et al. 2002), diatoms, green algae, mangroves, and food pellets (Meziane et al. 2002). In addition, diatoms and cyanobacteria are a food source for Uca spp. in sediment (Bouillon et al. 2002; 2004). Nordhaus and Wolff (2007) found that the composition of food sources on the type of Uca spp. more is the mangrove leaf, which is around 61.2%, while 3.3% less sediment.

Stable isotope fractionation $\delta^{13}C$ of producers (K.obovata)showed that mangrove vegetation on land included in $C_3$ group and has a value of similarity of the results of research conducted on mangrove species K.obovata in Taiwan is -28.3‰(Hsieh et al. 2002). Value of K.obovata $\delta^{13}C$ stable isotope is -29.81‰ has similarities with Avicennia marina -28.8‰, -27.5‰ and Rhizophora mucronata (Penha-Lopes et al. 2009), and Avicennia marina -27.8‰ (Nerot et al. 2009). O'Leary (1981) showed the $\delta^{13}C$ carbon isotope values can be distinguished by the type of the process of photosynthesis which is divided into 3 groups such as $C_3$ plants, $C_4$, and CAM (Crassulacean Acid Metabolism). $C_4$ plants have a carbon $\delta^{13}C$ value of -15 to -9 ‰ (Hemminga and Mateo 1996), whereas C3 plants on land such as mangroves, during photosynthesis have values between -24‰ and -30‰. Carbon $\delta^{13}C$ values in land plants $C_3$, $C_4$ , and CAM may vary due to differences in types of factors, nutrient content, and geography position (Bouillon et al. 2008).

Mangrove plant species K.obovata has $\delta^{15}N$ stable isotope fractionation is 11‰ enrichment , than the types of Avicennia marina and Rhizophora mucronata and it ranged from 0 to 9 ‰ (Bouillon et al. 2002, 2004; Nerot et al. 2009; Penha-Lopes et al. 2009). This may be due to nitrogen that is living mostly from the atmosphere and then enter the primary producers in the form of $N_2$, mostly derived from the reduction by microorganisms (Marshall et al. 2007). In contrast to the epiphytic plants, which have a value of $\delta^{15}N$ -8 to -6‰ (Bouillon et al. 2004), seagrass with 3.6 to 4.1 ‰, red algae are 4.6 to 5.5‰ (Hanson et al. 2010), and phytoplankton at sea, has δ15N stable isotope ratio values between 7 and 10 ‰ (Ogawa and Ogura (1997) in Kasai et al. (2006)). The difference value of the nitrogen species of different plants vary as influenced by environmental factors such as soil conditions, organic enrichment, and plant physiology (Marshall et al. 2007).

Manko sediment in the area has a value of $\delta^{13}C$ and $\delta^{15}N$ is -24.23 ‰ and 7.2‰, respectively . Value of the existing carbon in the sediment Manko area has similarities with the sediment in Taiwan that it overgrows mangrove species, ranging from -25.3‰ to -25.5‰ (Hsieh et al. 2002). Carbon values in K. obovata is lower than the sediment , this suggests that the carbon value of mangrove leaves did not contribute greatly to the sediment. In addition, the density of the canopy of an individual can affect the contribution of mangrove carbon and nitrogen in sediment (Penha-Lopes et al. 2009). Nitrogen in sediment is higher than research Bouillon et al. (2004) is the average rating by 1.4 to 4.0‰ lower than the research and Penha-Lopes et al. (2009) is 8.7 to 15.8‰. The high value of nitrogen in the sediment may be due to cyanobacteria and lichens that are capable of nitrogen fixation (Evans 2007) or enter as organic from the local river.

**3.Achievements:**

Thanks for the greatest to the University of the Ryukyus who has allowed me to research and collaborate with the University of the Ryukyus. In the present study, I learned a lot about how to become a good researcher and how to work hard in all our work. I learned a lot from students and lecturers from the University of the Ryukyus, especially with Tsuchiya sensei. He teach me how to ask and answer in each study, and how the mindset of a researcher. Research on food resources in the mangrove ecosystem is a complex thing, because it consists of various food chains and food webs. But with a good purpose and precise method, it becomes easy to answer. Macrobentic food source comes from within and outside the mangrove ecosystem. Foods derived from sources within the mangrove ecosystem consisting of mangrove plants (roots, stems, and leaves) and sediment. This suggests that if a food source for macrobenthic not exists, then the mangrove ecosystem will be disturbed.

▲Fig 2. Quadrat 50cm×50cm

▲Fig 6. *P. verruculata*

▲Fig 7. *Graspidae* sp.

▲Fig 8. *Uca* sp.

▲Fig 9. *Cerithidea* sp.

▲Fig 10. *C. mustelina*

## 大学院学生短期研修受入（平成23年）

### 台湾／台湾大学海洋研究所 修士1年　黄 玉馨（Huang Yu-sin）

受入教員：広瀬　裕一

**1.Research term:**

From 29th September to 12th October, 2011

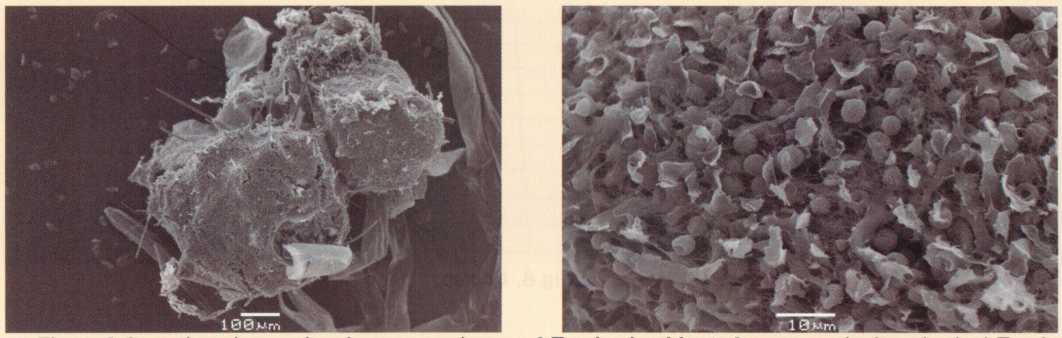
**2.Research title, the detail and the results:**

**Title:** Electronic microscope processing of a demosponge, Terpios hoshinota

My research target is to know the breeding season and reproduction cycle about a coral-threatening sponge Terpios hoshinota (Demospongia). My lab colleagues and I have collected some T. hoshinota tissue and some suspected larvae in Green Island, Taiwan in its reproduction season. I want to know the fine structure of the suspected larvae and also the position of the larvae inside the adult sponge. With the techniques of preparing samples for electronic microscope observation and using electronic microscope, I can get more detailed information of the sponge, include the body structure inside, the symbiosis cyanobacteria distribution and the structure of the suspected larvae.

Result: Because we can see the spicules obviously in the suspected sponge larvae, they may not be larvae (it is more possibly that larvae have ciliates on their surface and their spicules take a long time to develop after they settled.) They may be sponge fragments which were departure form adult sponge tissue.

It is my pleasure to learn the methods for SEM and TEM from professor Hirose and conduct electronic microscopic observation in University of Ryukyus. It is so interesting to use the electronic microscope and take amazing photos. Thanks for professor Hirose, lab members and everyone I have met in Okinawa. Thanks for University of Ryukyus for giving me this opportunity. I really have a good time in this project.




▲Figure 1 Scanning electronic microscope photos of *Terpios hoshinota* fragments. Left: spherical *Terpios hoshinota* fragments with spicules. Right: many symbiosis cyanobacteria under the surface of the spherical fragment.


▲Figure 2 Scanning electronic microscope photos of *T. hoshinota* tissue. Left: surface area of adult *T. hoshinota*, with many spicules and symbiosis cyanobacteria inside. Right: close up of spicules and symbiosis cyanobacteria.

## ベトナム／ベトナム国家大学ハノイ校 博士1年　Tran Thi Le Quyen

受入教員：須田　彰一郎

**1.Research term:**From 5th July to 2nd October, 2011.

**2.Research title, the detail and the results:**

**Title: Isolating Thraustochytrids from Okinawa coast**

Detail of the research: For this research, I was involved in sampling and isolating Thraustochytrids from samples collected in Okinawa coast. To sampling, I went to beach around Okinawa and collected seaweed, sea grass, seawater, mangrove… To isolate, I used 1/10 GPY liquid medium and micropipette method. After isolating and purifying Thraustochytrids, I kept them at -80ºC with 20% glycerol medium. By Nile red method, I also checked oil produce of few strains.

Results of the research:

-68 samples were collected from some beach in Okinawa and Ishigaki island

-From 56 of 68 samples, I isolated 543 strains, these strains were identified to Thraustochytrids base on morphological characters.

-All 543 strains were kept in deep freezer for further research

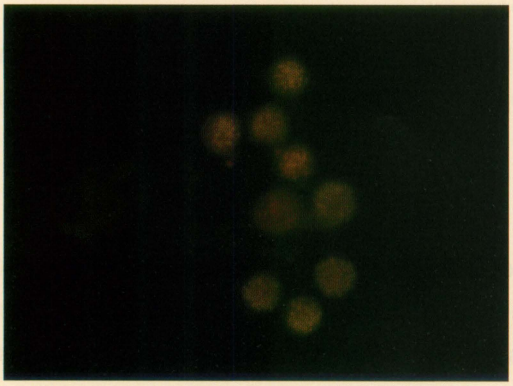
-Because I had not enough time, I only checked Nile red for oil produce of 27 strains

**3.Achievements:**

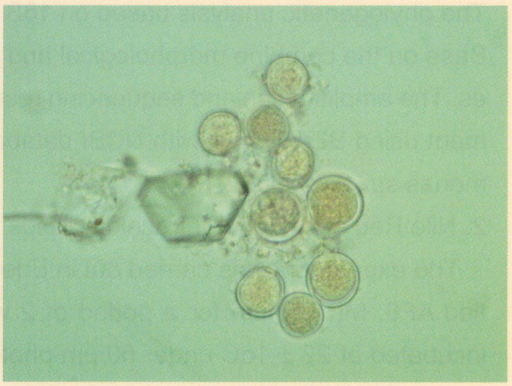
I am very happy because I have got opportunity to follow this program. This is the first time I am abroad and work with foreigner researchers on my new major. That is the best and valuable experience for me. I had a chance to learn some techniques for sampling and isolating algal. I also can learn many things from many professors in this program, especially about how to design the good scientific research to get the perfect results and satisfy. I believed that this program is very useful for my scientific development and for my life.


▲Sampling seaweed in Nashiro-cho port at 30-August-2011

▲Sampling sea grass in Sukuji beach at 9-September-2011



▲Oil producing cell with Nile red method



▲Thraustochytrids Cell

## 大学院学生短期研修受入（平成23年）

### ベトナム／ベトナム国家大学ハノイ校 修士2年　Pham Thi Bich Dao

受入教員：須田　彰一郎

**1.Research term:**From July 5th to October 2nd, 2010

**2.Research title, the detail and the results:**

A. STUDY ON 17 VIETNAM MICROALGAE STRAINS

**Material and Methods**

Material: 17 Vietnam microalgae strains were isolated from the samples which were collected from different water bodies of Da Lat and Vinh Phuc provinces, Vietnam and cultured in AF6 medium.

▲Shoichiro Suda Lab.

**Methods**

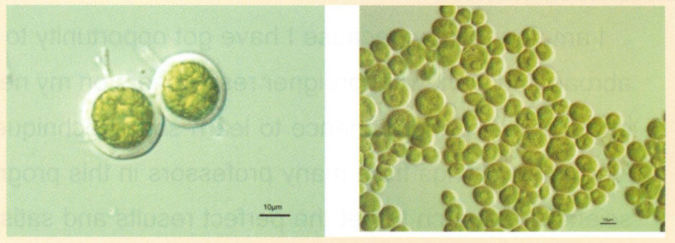
1. Taxonomy by the morphological characterization and the phylogenetic analysis based on 18S rDNA nuclear markers

2. Nile Red staining method for intracelular lipids

**Results**

1. Taxonomy by the morphological characterization and the phylogenetic analysis based on 18S rDNA nuclear markers Morphological characterization

Chlamydomonas is a single cell green alga about 8-18 μm in diameter that swims with two flagella. They are spherical, ovoid or ellipsoidal in shape. The tow flagella are equal size.



▲Fig.1. Light micrograph of ***Chlamydomonas***

They have a cell wall made of cellulose, a single large cup-shaped chloroplast, a large pyrenoid, and an eyespot that senses light (Fig.1).

The parent cell comes to rest and divides into 4 of 8 daughter protoplast. The daughter cells do not develop flagella but remain within the gelatinized parent cell wall. Progressive division colony of several hundreds of cell embedded in a gelatinous matrix. and therefore this stage is called Palmella-stage. On return of the favourable conditions, the daughter protoplasts of Palmella stage revent to the typical motile condition. So it is a temporary feature in Chlamydomonas.

Although widely distributed worldwide in soil and fresh water, Chlamydomonas is primarily used as a model organismin biology in a wide range of subfields. Chlamydomonas is also of interest in the biofuel field, as a source of hydrogen.

The phylogenetic analysis based on 18S rDNA nuclear markers

Base on the combine morphological and molecular techniques namely the 18sDNA gene sequences. The amplification and sequencing resulted in a 1691bp sequence of 18S rDNA. Sequence alignment using BLAST tool with NCBI database indicated 99% these strains similarity with Chlamydomonas sp., AY220092.1. F

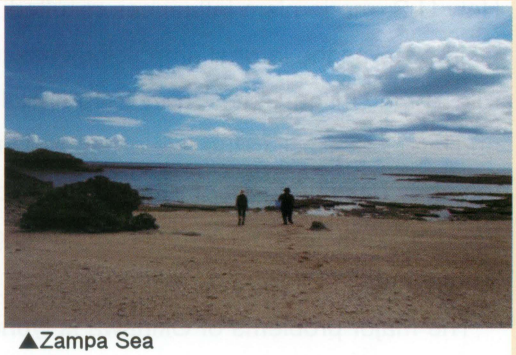
2. Nile Red staining for intracelular lipids

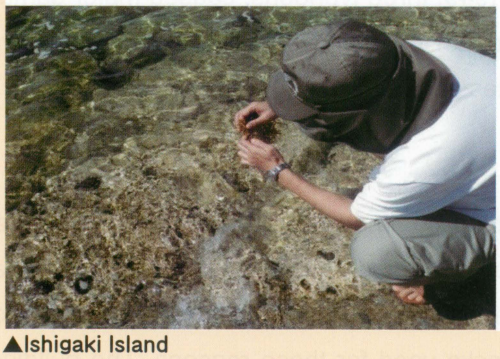
The experiment was carried out in Erlenmeyer flasks of 250 ml capacity, containing 100 ml modified AF6, MI medium for a period of 2 weeks. The culture flasks were inoculated (20% v/v) and incubated at 22 ± 1oC under 50 μm photons m-2s-1 using cool-white fluorescent lamps with 14:10 hrs light and dark cycle.

After 2 weeks old culture, observation and nile red staining by G2A filter of fluorescence micrographs to compare between nitrogen depletion (MI medium) and AF6 medium. Micrographs of cells were taken with 5-megapixel SPOT Idea digital camera connected to Nikon Eclipse 80i light microscope. Cell mass coloration 17 strains are bright green which are cultured in AF6 medium. Using MI medium for culture, cells mass coloration of 17 strains change from bright green to olive-green, yellow after 2 weeks old culture. VN10-03, VN10-08, VN10-12,VN10-17 shows lipids bodies found inside cells (yellow color in micrographs of nile red stained cells).

B. ISOLATED AND CULTIVATED HETEROTROPHIC MICROALGAE FROM NATURAL SAMPLES
Colleted samples: the leaf, seaweed, seagrass, sand, seaspong from mangrove forest and seaside in Okinawa, Japan.


▲Maeda Sea


▲Zampa Sea

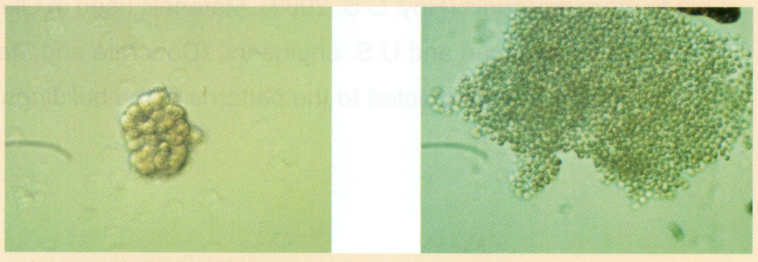

▲Ishigaki Island


▲Mangrove forest

Medium culture for heterotrophic microalgae (1/10 GPY): Glucose (0.2g/L), Pepton (0.1g/L), Yeast extract (0.05g/L), Seawater (0.9 L), Deionized water (0.1 L), Agar (18g), Chloramphenicol (0.2g/l); Chloramphenicol instead by Ampicillin (0.1g/L) and Streptomycin (0.1g/L)
Isolation using micropippete

**3.Achievements:**

In this program, I researched about taxonomy by morphology and molecular techniques. I evaluated microalgae oil production using Nile red staining under fluorescence microscopy. I also took sampling, isolated and cultivated heterotrophic microalgae from natural samples. With the knowledge and techniques gained from this program, it is very useful for my next researches.


▲Image of heterotrophic microalgae

## 大学院学生短期研修受入（平成23年）

### タイ／キングモンクット工科大学 修士2年　Boonlee Panphot

受入教員：小倉　暢之

**1.Research term:**

The research was conducted for three months from October 15th 2011 until January 7th 2012.

**2.Research title, the detail and the results:**

Title:The Characteristics of Modern Architecture in Okinawa, Japan

**The Detail of Research**

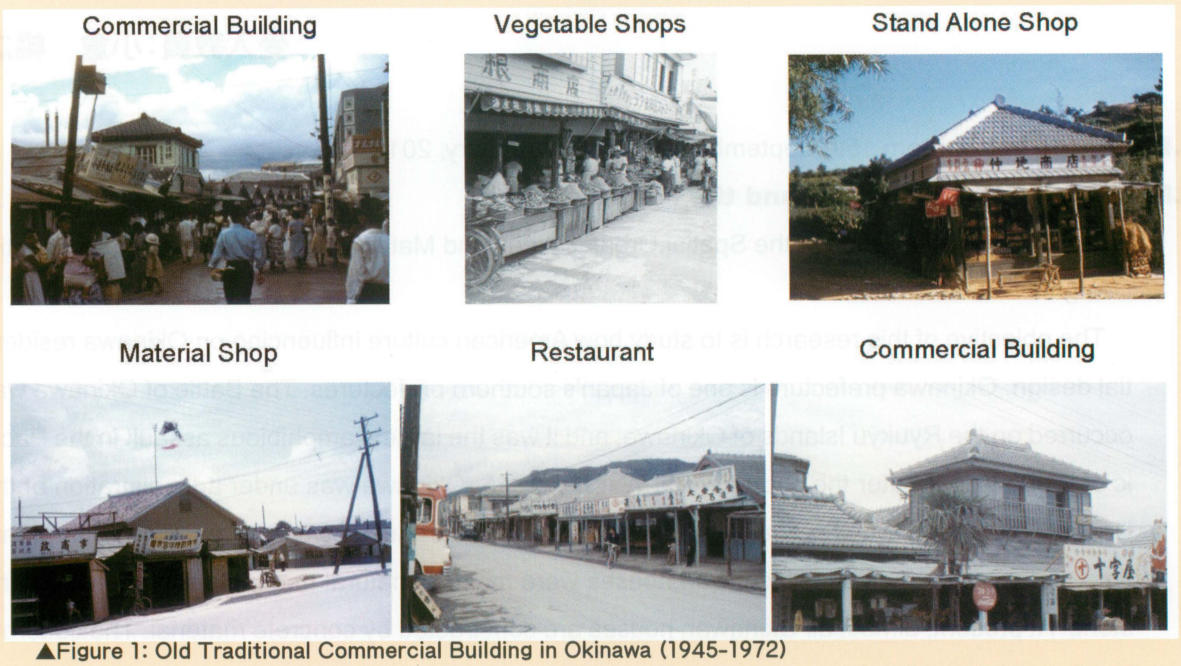
The purpose of this research is to study the Characteristics of Modern Architecture in Okinawa. How U.S. modernism influences resulted in Okinawa Commercial Buildings in Japan. In the past, Okinawa was the largest amphibious assault in the Pacific War of World War II and it was under the rule of the United States from 1945 until 1972. It has been ruled by the United States for 27 years and later sent back to the rule of Japan. During the rule of the United States, Okinawa has been built the army base and other military facilities by the engineers and using technology of the army. Later, the U.S. army has built commercial buildings to support cultures of American life style such as shopping centers, restaurants, and theaters.

The major problems of Okinawa is typhoons and earthquakes. In the past Okinawan Traditional Building used Wood Construction. In 1948 and 1949, three typhoons, caused major damage to the US and Okinawa facilities including injuries and death to US and Okinawa citizens. Okinawa located in the area that affected by typhoons, earthquakes and humidity.

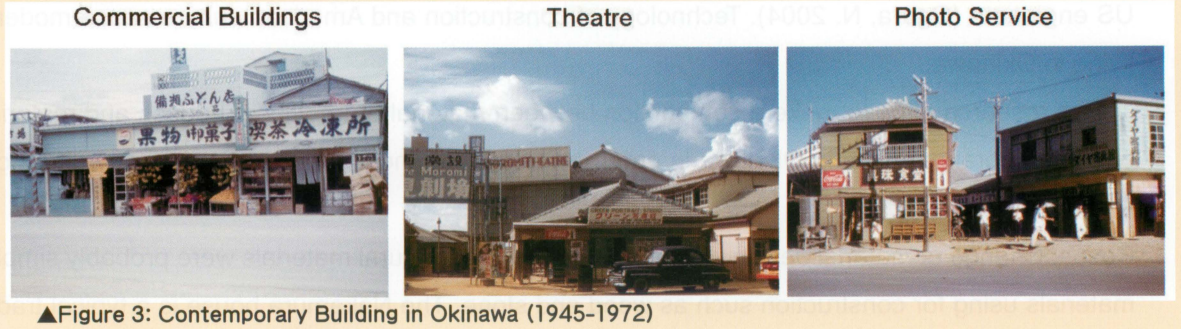
**Result**

Characteristics of Modern Architecture including commercial buildings in Okinawa have been received influences by the building patterns of U.S. modernism around the 1970s that mainly emphasize the strength, beneficial unities inside the area, quickly built by using cheap and at hand materials. Therefore, concrete and concrete blocks used for these reasons. The buildings are in square shape or like the shape of box. It's got square walls, plain roofs and square shape of the doors and the windows.

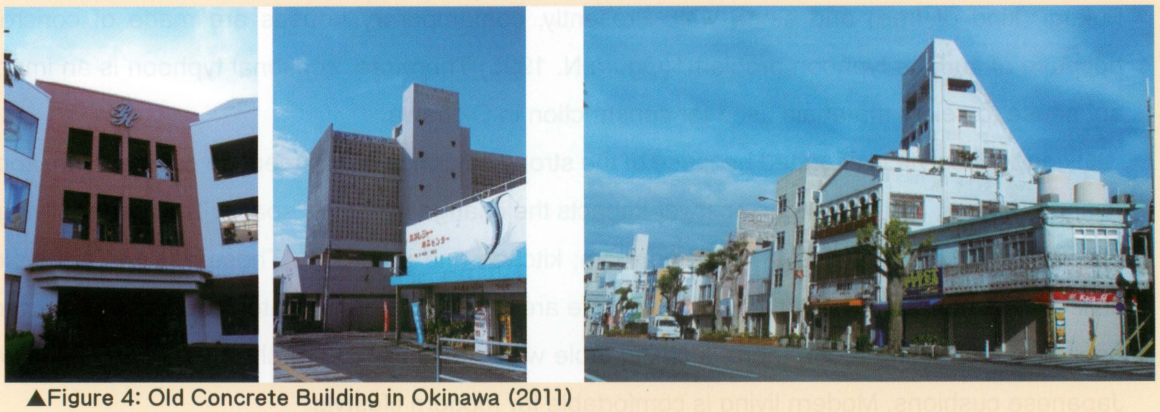
Typhoons problem as a result from, US government approved to design facilities to withstand typhoon wind of 185 miles per hour and earthquakes equal to San Francisco Building Code. In 1950, it has started to build permanent and durable concrete buildings by using concrete materials and concrete blocks which cost a little money and find easily. It is suitable for local economies comparable to other materials (Roy, C.S. 2003). Materials used in Okinawa received construction technology from Mainland Japan and U.S. engineers, (Concrete and Masonry Construction, Pre-cast Concrete Construction) These affected to the patterns of the buildings in Okinawa at present.




▲Figure 1: Old Traditional Commercial Building in Okinawa (1945-1972)




▲Figure 3: Contemporary Building in Okinawa (1945-1972)



▲Figure 4: Old Concrete Building in Okinawa (2011)

▲Figure 5: Shopping Street and Drive in Restaurant in Okinawa (2011)

## 大学院学生短期研修受入（平成23年）

### タイ／キングモンクット工科大学 修士2年　Teekawat Veerasettakul

受入教員：小倉　暢之

**1.Research term:**From 15th September 2011 to 7th January, 2012

**2.Research title, the detail and the results:**

**Title:** The Transformation of the Spatial Organizations and Materials of Contemporary Residential Design in Okinawa.

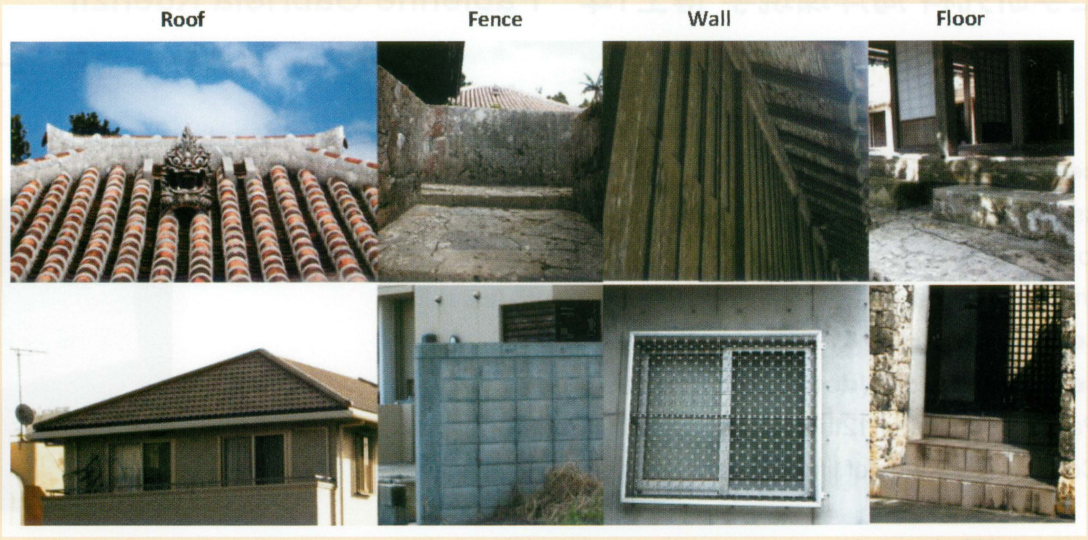
The objective of this research is to study how American culture influencing on Okinawa residential design. Okinawa prefecture is one of Japan's southern prefectures. The Battle of Okinawa was occurred on the Ryukyu Islands of Okinawa, and it was the largest amphibious assault in the Pacific of World War II. After the end of World War II in 1945, Okinawa was under administration of the United States for 27 years. Almost all traditional Okinawan houses were disappeared during that time. In the past, traditional Okinawan houses were made of natural materials such as wood and stone. At present, almost all Okinawan houses are constructed by concrete material. The concrete houses are strongly influenced by American culture. Concrete construction was introduced by the US engineers (Ogura, N. 2004). Technology of construction and American culture cause modern living in Okinawa.

This research aims to make a comparison between material of traditional houses and material of contemporary houses in Okinawa in order to understand the influence of American culture on Okinawan houses.

Result: Change of material design in Okinawa. In the past, natural materials were probably simple materials using for construction such as wood and stone. The Nakamura house is a typical traditional house in Okinawa. The house is protected from seasonal typhoons by using the surrounding Fukugi (kind of tree) and stone wall. Presently, contemporary houses are made of concrete, because of serious typhoon problem. (Ogura,N. 1995) Therefore, seasonal typhoon is an important cause to select materials used for construction in Okinawa.

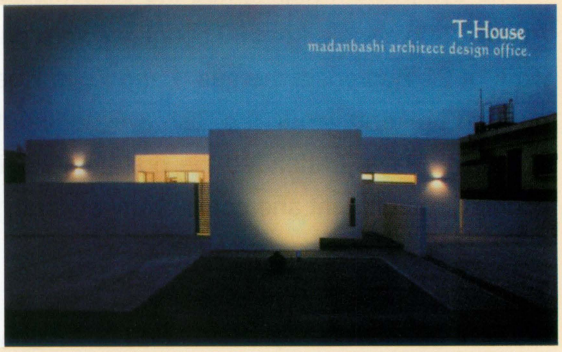
Okinawa lifestyle is changed because of the strong influence from American culture. Also, social change (Miyagi, E. 1995) in the postwar impacts the change in interior space. The modern living is expressed through the design of dining room; kitchen and bathroom. Those designs are typical style from American living. In the kitchen, there are sink, stove, refrigerator, cabinet and electrical appliances. In dining room, there is dining table with chairs instead of short leg dining table with Japanese cushions. Modern living is comfortable for modern lifestyle.

Contemporary housing in Okinawa always has traditional Japanese-style room such as Tatami room. If the house owners need more space for activity, they will move up fusuma sliding door in order to connect rooms into larger room. Although living pattern has been changed, rooms and spaces are arranged basing on traditional house. Okinawa contemporary housing is combined between traditional Okinawa living and American living in order to fit people's needs.

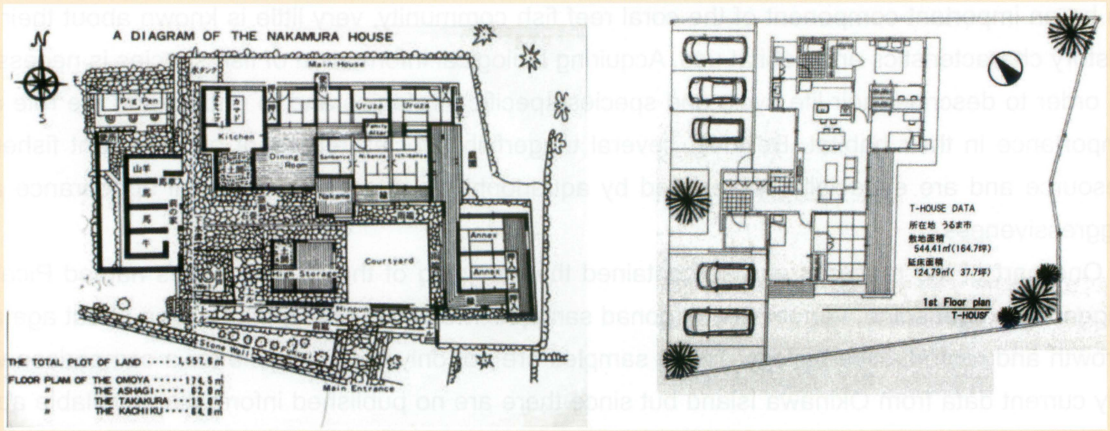



▲Figure 3: Comparison between material of traditional houses and contemporary houses in Okinawa.

▲ Figure 4: Layout plan of Nakamura house
（第31回住宅設計展作品集」、沖縄県建築士事務所協会、2010年）




▲ Figure 5: T-house.




▲Figure.6 Layout plan of Nakamura house and T-house.

▲Figure 8: Interior of Nakamura house