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Sedimentological Aspects of the Ôura River Estuary and its Environs on the East Coast of Northern Okinawa Island

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Abstract

The sedimentological aspects of the estuary area of the Ôura River and its neighboring seas are revealed by various analytical approaches; *i.e.* mechanical grain-size analysis, ignition loss method, bulk chemical analysis using atomic absorption spectrometer and sand-grain composition analysis. The estuary area is characterized by the coarser sediments (coarse-grained sands), by the lower values of CaCO₃ (less than 50 wt.%) or Sr (less than 1600 ppm) content and by the higher content of Fe, Al or K per non calcareous clastic content, which is an index of terrigenous material input, respectively. This estuary is also occupied with brackish water elements of benthic foraminifera.

On the other hand, offshore sites are characterized by the finer sediments (medium- to very fine-grained sands, by the higher values of CaCO₃ (more than 50 %) and Sr (more than 1600 ppm) contents, and by the lower values of Fe and Al (both less than 2 wt.%) contents as a whole. The sediments at these offshore sites contain various taxa of benthic foraminifera. All signals suggest that normal neritic environments can be recognized at the offshore sites.

Introduction

Several synthetic studies on coral sea sediments from various places of the Ryukyu Island Arc have been accomplished and published by sedimentologists of the University of the Ryukyus (*e.g.*, Ujiié and Shioya, 1980; Ujiié *et al.*, 1983; Midorikawa and Ujiié, 1987; Yamamoto and Yuine, 1985; Ujiié and Oshiro, 1993). Majority of these studies, however, little dealt with estuary sediments.

In this work, we treat the estuary sediments of the Ôura River along with the adjacent bay sediments. Mangoves have thrived in this estuary until a decade ago but greatly diminished at present due to the land development of its hinterland. The results would offer us some fundamental information for mangrove conservation, if they could be compared with the further study which should be carried out on sediments of such well-developed mangrove estuaries as have been preserved on Iriomote Island, southern Ryukyu Island Arc.

Geographic Setting

The Ryukyu Island Arc, a forearc at the northwestern margin of the Pacific, extends for approximately 1,000 km between Lat. 31° N. and 24° N. The Kuroshio Warm Current runs northeastward along the boundary between the East China Sea continental shelf edge and the Okinawa Trough, which is a backarc basin running in parallel to the Ryukyu Island Arc (Fig. 1). The arc is surrounded with coral reefs because of warm water influence and of such a condition as the Okinawa Trough is trapping terrigenous material

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Some Benthic Foraminifera from the Ôura River Estuary and its Environs, Okinawa

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Abstract

In this paper, we describe and/or illustrate 26 species of benthic foraminifera, among more than 154 taxa found in the estuary of the Ôura River and its environs on the north-eastern coast of Okinawa Island, faced to the Philippine Sea. *Stilostomelloides*, n. gen. (type species: *Sagrina virgula* Brady, 1879) and *Cribrorhaphidium okinawaense*, n. sp. are also proposed.

Introduction

Coral seas yield numerous taxa of benthic foraminifera as has been demonstrated by many authors. Hatta and Ujiié (1992) described/or illustrated 249 species from 62 stations in the coral seas between Ishigaki and Iriomote Islands, southern Ryukyu Island Arc. Even thirteen species must be added to this monograph in a form of appendix of a paper (Ujiié and Hatta, in prep.) which discussed on their distributional ecology. Since these 62 stations do not contain estuary sediments, additional species could be found by treating such sediments.

Rifardi and Ujiié (1993) studied benthic foraminifera from the estuary area of the Ôura River and its adjacent sea on the east coast of northern Okinawa Island as a part of synthetic sedimentological investigation. In this estuary, mangroves most typically thrived in the Okinawa Island region before a decade ago. Although the majority of 154 benthic foraminiferal taxa is common with those illustrated by Hatta and Ujiié (1992), about a dozen species were newly found here. A part of this difference is ascribed to that we treat estuary environment. The results of faunal analysis, mainly based on Q-mode cluster analysis, have been shown by Rifardi and Ujiié (1993).

Systematic Description

(Following the system of Loeblich and Tappan, 1988)

Order Foraminiferida Eichwald, 1830

Suborder TEXTULARIINA Delage and Hérouard, 1896

Superfamily TEXTULARIACEA Ehrenberg, 1838

Family TEXTULARIIDAE Ehrenberg, 1838

Genus *Textularia* DeFrance, 1824

Textularia candeiana d'Orbigny

(Pl. 1, figs. 1a, b)

Textularia candeiana d'Orbigny, 1839, p.144, pl.1, figs. 17, 18, 32-34 ?; - Hatta and Ujiié, 1992, p.58,

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QUANTITATIVE ESTIMATION AND DISTRIBUTION OF DETRITAL CLAY MINERALS IN THE SURFACE SEDIMENTS OF SOUTH YATSUSHIRO KAI, JAPAN

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ABSTRACT

Quantitative estimation of clay minerals in the clay fractions of the surface sediment samples from South Yatsushiro Kai is obtained from the X-ray diffraction patterns of the clay mineral suite that contains illite, chlorite, kaolinite, smectite and 10 Å halloysite. Among the clay species, illite and chlorite are exceptionally abundant and they comprise more than 60% of the total clay minerals present in most sediments. Relative amounts of other clay minerals varies markedly with locality particularly kaolinite and 10 Å halloysite and they tend to concentrate only near the point source except smectite which has a more unique behavior of transport and settling characteristics than other minerals.

The relatively high supply of land-derived materials from various rock lithology surrounding South Yatsushiro Kai is the dominant contributing factor in outlining the trend of clay mineral distribution. Most, if not all, clay minerals are believed to be current-transported which shows that bottom water flow and shallow water currents are significant agents responsible for the distribution of various clay minerals.

Key words: Quantitative estimation, surface sediments, clay minerals, clay mineral distribution, South Yatsushiro Kai

INTRODUCTION

Yatsushiro Kai is a semi-enclosed bay-like body of water in the west central margin of Kyushu mainland. Study of marine sedimentology in this area was carried out in early 1996 to determine the textural characteristics of the surface sediments and the general behavior of the bottom currents. A follow-up investigation involving mineralogical observation of sediments was undertaken in the same area using all the available raw data and samples provided by Rifardi (1996) who conducted the sedimentological examination of the bottom sediment in the southern portion of Yatsushiro Kai. In undertaking the mineral research, some analytical methods of mineralogical identification like the X-ray Diffractometry (XRD) and the Scanning Electron Microscopy (SEM) were utilized to describe the detailed composition of clay materials distributed in the sediments. Determi-

Preliminary Report on the Mineralogical Studies of Bottom Surface Sediments of South Yatsushiro Kai

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Abstract

Mineralogical investigation of bottom surface sediments was conducted in the relatively shallow marine environment of South Yatsushiro Kai. Identification of clay fraction minerals in this study was made chiefly by XRD analysis complimented with SEM method in determining the type of clay and non-clay mineral suites present in the sediments. Based on analysis results, detrital clay minerals are dominated by illite; chlorite is the second most abundant clay mineral type, followed by kaolinite, smectite and the least abundant 10 Å halloysite. This suite occurs in all samples analyzed and closely reflects the type and character of the surrounding source rock and soil sediments. It is unlikely that homogenization of clay mineral suite occurred in this environment since variable transport mechanisms and associated sediment mixing are operative.

Sediment samples also contain considerable proportion of other materials not usually regarded as clay minerals such as quartz, calcite/aragonite, feldspar and subordinate amount of pyrite, hornblende, gypsum and clinoptilolite.

Key words: bottom sediment, mineral suite, clay fraction, South Yatsushiro Kai

Introduction

Yatsushiro Kai is a semi-enclosed, bay-like body of water in the west central margin of Kyushu mainland. It is one of the most thoroughly studied sites of water effluent and environment pollutant in Japan since the discovery of Minamata disease in 1950's. Other significant studies conducted in the area include the ecological investigation of benthic

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Sedimentary environments based on textures of surface sediments and sedimentation rates in the South Yatsushiro Kai (Sea), southwest Kyūshū, Japan

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The main purpose of this study is to clarify the relation between characteristics of sediments and environmental conditions, based on the analysis of core samples from the South Yatsushiro Kai (Sea) which is located off the west coast of central Kyūshū Island, Japan.

Bottom sediment samples were collected at 74 stations in the southern part of the Yatsushiro Kai using gravity corers in March 1996. 62 core samples were used for the mechanical analysis by the settling-tube method, and Q-mode cluster analysis was carried out based on the proportion of grain size distribution (Wentworth size classes). 61 core samples were available to estimate the sedimentation rates (during c. 50 years) which were recognized from the first appearance of high mercury contents of cores. On the other hand, the topmost one centimeter of 73 core samples, which is approximately 10 cc of wet sediments, was utilized for foraminiferal study.

The general trend of the bottom current system in the area was discussed, based on the mechanical analysis data of bottom sediments, the distribution of sedimentation rates and the distributions of the number of individuals of planktic and living benthic foraminifera. Based on the results mentioned above, the South Yatsushiro Kai is subdivided into the following five areas: 1) the area near the straits characterized by coarse sediments under the influence of strong tidal and bottom currents; 2) the southern part and the area off the mouth of the Minamata River, both of which are characterized by relatively coarse sediments under the influence of longshore currents and poorly sorted sediments supplied by the Komenotsu and Minamata Rivers; 3) the northwestern and eastern parts characterized by fine-grained sediments accumulated under conditions of rather stagnant water masses; 4) the central area, characterized by relatively fine sediments and a large number of planktic empty tests deposited on the sea bottom under the condition of rather weak tidal current systems; 5) the northern part characterized by gravels or gravelly sands which were derived from shallow coastal areas.

Judging from the distribution pattern of the maximum mercury content at some horizons of each core, the fine-grained sediments polluted by mercury were transported northeastward and southward by weak longshore currents and spread toward north and west across the northern and southern parts of the South Yatsushiro Kai.

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Key words : Yatsushiro Kai, bottom sediments, sedimentation rates, foraminifera, discharged mercury

南部八代海における底生有孔虫の L/Tl 値から見積もられる 相対的堆積速度とタフォノミー

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Relative sedimentation rates and taphonomy inferred from the L/Tl values of benthic foraminifers in the southern Yatsushiro Kai (Sea), southwest Kyūshū, Japan

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Abstract The ratio of the number of living specimens to the total number of living specimens and empty tests (L/Tl value) of benthic foraminifers in the bottom surface sediments has been used as an index of relative sedimentation rate at each sampling station. In an attempt to clarify whether or not the L/Tl values can be applied to shallow and semi-closed inland seas, where high energy current system persist, we analyzed the benthic foraminiferal assemblages in the topmost sediments of 73 core samples collected from 74 stations in southern Yatsushiro Kai (Sea). The L/Tl values were calculated and compared with the sedimentation rates, which were independently estimated by the vertical changes of mercury contents in the cores. It has been shown that the L/Tl values near the straits influenced by strong bottom currents were higher than the expected sedimentation rates, suggesting that the foraminiferal tests had been transported and/or destructed after death. The L/Tl values were also higher in the area of fine- to very fine-grained sand substrata surrounding the straits, a result which can be explained by the post-mortem destruction of the empty tests especially of the species that have a thin test. Furthermore, the L/Tl values in nearshore areas were lower than expected, probably reflecting the extraordinary rainfalls in the last few years that supplied an unusual amount of sediments through rivers. These results indicate that the L/Tl values need to be used with caution when applying to the sediments of shallow inland seas.

はじめに

Phleger (1951) は、海底表層堆積物に含まれる底生有孔虫の総個体数(生体殻+遺骸殻)に対する生体の個体数の割合が採泥地点間の相対的堆積速度を表すことを示唆した。Walton (1955) は、この割合が相対的堆積速度 (relative sedimentation rate) の指標として利用できること

を指摘した。この割合はその後の研究者 (Uchio, 1960; Matoba, 1970) によって L/T 値 (L : 生体の個体数; T : 総個体数) として呼ばれ、有孔虫群集の解析に用いられてきた。大木 (1986), Ōki (1988, 1989) は、底生有孔虫遺骸殻が底層流によって周辺海域から運搬され総個体数に加算される結果、相対的堆積速度が低く見積もられる可能性を指摘し、それぞれの地点に生息している種のみについて総個体数に対する生体の個体数の割合 (L/Tl 値) を算出することによってこの欠点を解消できると考えた。そして、この考えに基づき、鹿児島湾を例として L/T 値と L/Tl 値 (Tl : 生体の認められる種の総個体数) の比較を行い、 L/Tl 値から得られた相対的堆積速度の地理的分布が、海底地形、底質の分布、海洋学的データ (湾内恒流、水温、塩分濃度など)、浮遊性有

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Mercury contamination in the Yatsushiro Sea, south-western Japan: spatial variations of mercury in sediment

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Abstract

Mercury-contaminated effluent was discharged into Minamata Bay from a chemical plant over a 20-year period until 1965 (from 1958 to 1959, effluent was discharged into Minamata River), causing Minamata disease. In an effort to characterize the extent of the contamination in the Yatsushiro Sea, the vertical and horizontal distributions of mercury in sediment were investigated. Sediment was sampled at 62 locations in the southern part of the sea from 4 to 6 March 1996. In the lower layers of the long cores of sediment, the total amount of mercury was at a relatively uniform low concentration. We interpret these low values to represent the background concentration absent of anthropogenic influence. The background value thus estimated for the Yatsushiro Sea was 0.059 ± 0.013 mg kg⁻¹ (mean \pm S.D., $n = 51$). The highest concentration in each sample ranged from 0.086 to 3.46 mg kg⁻¹ (mean, 0.57 mg kg⁻¹). The higher values were obtained at stations near Minamata Bay and the Minamata River (the sources of the pollution). Concentrations decreased with distance from the source. An inspection of the vertical profiles of mercury concentration in cores suggested that the deposited mercury had not been fixed in sediment but had been transported, despite 30 years having past since the last discharge of contaminated effluent. At nine stations, extractable inorganic and organic mercury concentrations were determined differentially. Inorganic mercury is the predominant species in sediment and organic mercury comprising approximately 1% of the total. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Mercury pollution; Marine sediment; Yatsushiro Sea; Dispersion of pollutant

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STUDY ON SEDIMENTOLOGY FROM THE MESJID RIVER ESTUARY AND ITS ENVIRONS IN THE RUPAT STRAIT, THE EAST COAST OF SUMATERA ISLAND

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ABSTRACT

The sedimentological aspects of the Mesjid River Estuary and its neighboring seas are revealed by various analytical approaches; i.e. mechanical grain size analysis, ignition loss method, metallic element analysis and sand grain composition analysis.

The estuary area is characterized by fine sediments (very fine sand to very fine silt). Based on the relation between the character of bottom sediments and the environmental condition, the the Mesjid River Estuary and its Environs is divided into the following three areas: 1) The western part of the study area characterized by rather coarse-grained sediments and low mud content under the influence of longshore current and poorly sorted sediments supplied by the Mesjid River, 2) The southern part of the study area characterized by coarse-grained sediments under the influence of strong tidal currents, 3) The northern and eastern parts of the study area characterized by fine-grained sediments and high mud content under conditions of sea water masses. The texture and organic matter content of the sediments play important role on the growth of the mangrove which thrive along the coast of the study area.

Keywords: Sedimentology, coastal management, sediment characteristics, abrasion

I. INTRODUCTION

Since establishment of the Marine Science Center, Riau University in the vicinity of Mesjid River Estuary, the estuary has become one of the area's most intensively studied location in reference to the pollution of water, sediments and marine fauna. Significant studies in ecological and oceanographical aspects of the area have been carried out by many scientists. However, only a few papers among them are concerned with bottom sediments from the sedimentological point of view.

In an attempt to clarify the relation between characteristics of sediments and

environmental condition, the surface sediment was analyzed. The sediment were collected from the Mesjid River Estuary and its Environs in which mangrove have thrived. The writer wishes to utilize the results of the present study as the fundamental information for the mangrove conservation and for the study of coastal management in future.

II. PHYSIOGRAPHIC SETTING

The Rupert Strait, a strait separated from Malaca Strait by Rupert Island, is located on the east coast of the Riau

Original paper

ECOLOGICAL ANALYSIS OF LIVING BENTHIC FORAMINIFERA IN SURFACE SEDIMENTS FROM THE SOUTH YATSUSHIRO KAI (SEA), SOUTHWEST KYUSHU, JAPAN

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ABSTRACT

Bottom sediments were collected from 74 stations in the South Yatsushiro Kai (Sea), Japan, using gravity corer in March 1996. Aimed at clarifying the relation between living benthic foraminiferal assemblage and environmental conditions, the Q-mode cluster analysis was carried out based on the predominant species of living benthic foraminifera recognized at the topmost one centimeter of 73 core samples.

The results of this study show a trend of a large number of living benthic foraminifera found in the central part of the sea. On the other hand, a small number is seen in the northern and southern part. The study area is characterized by 469 species of living benthic foraminifera belonging to 114 genera.

In relation to the five divisions of the marine environment based on oceanographic data, mechanical analysis data and sedimentation rates, the foraminiferal assemblages in the South Yatsushiro Kai were grouped into five populations. Population I occupies the areas near the straits under the influence of strong tidal and bottom currents. Population II occupies the areas surrounding the straits (Gannoshiri Seto and Kurono Seto) influenced by water masses flowing through the straits. Population III occupies the areas of rather stagnant water masses in the northern and southern parts of the sea. Population IV occupies the areas located in the northeastern and southeastern parts of the sea, and influenced by river waters. Population V occupies the area close to the shore located in the northeastern, and influenced by the water masses which flow southward from the North Yatsushiro Kai.

Key words: Benthic foraminifera, sediment, marine division, population

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INTRODUCTION

The study of recent benthic foraminifera in the seas surrounding the Japanese Islands was initiated by Brady (1884). Since Brady's work, many Japanese foraminifero- logists, mostly paleontologists, have devoted their attention to the ecology and distribution of Recent foraminifera.

In Kyushu Island waters, ecological studies of the recent benthic foraminifera have been made since the early 1950's; Shuto (1953, 1965), Asano (1956, 1958 and 1960), Kuwano (1956), Eto (1970), Aoshima (1978), Kameyama (1984), Oki (1986a, b, and 1989), and Kobayashi (1992). However, only one of them (Kobayashi, 1992) treated the recent

KARAKTERISTIK SEDIMEN PADA MUSIM BERBEDA DI SUNGAI KAMPAR SEKITAR DAERAH AKTIVITAS MASYARAKAT

(Sediment Characteristics based on the Seasonal Changing from Kampar River in the Vicinity Area of Society Activities)

Rifardi

Peneliti Pada Pusat Penelitian Kawasan Pantai dan Perairan
Lembaga Penelitian Universitas Riau

ABSTRACT

The main purpose of this study is to clarify the relation between the season and sediment characteristic based on surface sediment which was taken from Kampar river. Bottom sediment samples were collected at 9 stations in Kampar River using grab sampler in the different seasons, namely, transition of dry to rainy season (T.I), and of rainy to dry season (T.II). The samples were used for mechanical analysis by the wet sieving method, and the results were analyzed using Shepard Triangle.

The results of study show that bottom sediment in Kampar River is dominated by sand and mud fractions: 6-99%, 3-92% respectively, whereas gravel fraction is only found in small amount of the bottom sediments, which are indicate that Kampar River is influence by the vicinity area of the river which composed of muddy sand and peat. Season plays important role to characterize the bottom sediment as shown by sand fraction domination in the transition of dry to rainy season (T.I), and by mud fraction domination in the transition of rainy to dry season (T.II). In additon to, the sediment is affected by activities around the river are stronger that run off system.

Key Words : Sediment Characteristics, Seasonal Changing, Kampar River, Society Activities.

PENDAHULUAN

Pesatnya pertumbuhan penduduk pada penghujung abad ke-20 menyebabkan daerah aliran sungai menjadi salah satu alternatif pusat pengeksploitasian sumberdaya alam yang ada di sekitar dan sepanjang aliran sungai. Dampak dari aktivitas ini dapat dirasakan pada awal abad ke 21 seperti terjadinya tekanan ekologis pada perairan, dimana kondisi ini telah digambarkan oleh berbagai hasil penelitian yang dilakukan para peneliti diantaranya Syafril *et al* (1999), Tim Peneliti Laboratorium Fisipol (1999), Syahza (2000), Rifardi *et al* (2001), Rifardi *et al* (2002) dan Nedi (2002). Secara dominan penelitian ini menggambarkan kondisi perairan Sungai Kampar dari aspek fisika,

kimia, biologi maupun sosial ekonomi dan budaya.

Perubahan dan tekanan ekologi sepanjang Sungai Kampar terjadi pada badan air yang ditunjukkan dengan nilai keragaman hayati lebih rendah dari kondisi alami dan pengaruh aktivitas masyarakat terhadap kenaikan konsentrasi koliform (Syafril *et al*, 1999 dan Rifardi *et al* 2001). Walaupun Sungai Kampar merupakan perairan lotik, perubahan ini diduga juga terjadi sampai pada ekosistem dasar perairan, dimana ekosistem ini merupakan salah satu habitat yang menentukan tingkat kesuburan perairan. Perubahan yang terjadi pada ekosistem ini dapat disebabkan oleh berbagai faktor, diantaranya tekanan dari aktivitas yang berlangsung di

Original Paper

DISTRIBUTION OF SEDIMENT, BENTHIC FORAMINIFERA AND MERCURY IN THE SOUTH YATSUSHIRO SEA, KYUSHU, JAPAN

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Received : April, 23, 2008 ; Accepted: May, 29, 2008

ABSTRACTS

Bottom sediment samples were collected at 74 stations in the South Yatsushiro Sea, off the west coast of central Kyushu Island, Japan using gravity corer. 62 core samples were used for bottom sediments analysis and for determination of mercury content. Among these samples, only 5 core samples were used for this study in an attempt to clarify the relationship between the vertical distributions of benthic foraminiferal assemblages (*Bulimina denudata*) and mercury contents in core sediments. The distribution pattern of sediment median diameter and of the maximum mercury content at some layers of each core show that the fine-grained sediment polluted by mercury were transported both northeastward and southward by weak longshore currents and spread toward north and west across the northern and southern part of the South Yatsushiro Sea. *Bulimina denudata* shows the highest frequency at every layer which has high mercury content ranging from 0.14 to 3.46 ppm, and is comparatively low at all unpolluted layers. The frequency of *Bulimina denudata* slightly decreased at the layers showing more than 3 ppm. All these signals suggest that *Bulimina denudata* does not prefer the bottom sediments showing high mercury contents but tolerates mercury pollution.

Keywords: Bottom sediment, benthic foraminifera, mercury.

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INTRODUCTION

The South Yatsushiro Sea, a semi-closed inland sea, is located off the west coast of central Kyushu Island, Japan. Mercury-contaminated effluent was discharged into Minamata Bay from a chemical plant (Shinnihon Chisso Hiryo Co.) over a 20-year period until 1965, causing Minamata disease. Rifardi *et al.* (1998) and Rifardi and Oki (1998) clarified the relation between characteristics of sediments and environmental conditions, based on the analysis of 62 core samples taken from 74

stations in the South Yatsushiro Sea. Further, they roughly estimated the sedimentation rates of each station by the first appearance of high mercury contents and showed the distribution of the maximum mercury content analyzed at some layers of each core. Tomiyasu *et al.* (2000) reported that the surface sediment associated with the mercury contamination is not stable and apparently still moving even though 30 years have passed since the discharge of mercury-contaminated effluent ceased. The

Analisis Ekologi Foraminifera Benthik pada Permukaan Sedimen Perairan Muara Sungai Mesjid dan Selat Rupas Pantai Timur Sumatera

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Abstrak

Penelitian ini bertujuan untuk menjelaskan hubungan kelompok foraminifera benthik dengan kondisi lingkungan di perairan muara Sungai Mesjid Selat Rupas. Q-Mode Cluster Analysis dilakukan berdasarkan spesies foraminifera benthik dominan yang ditemukan di sedimen permukaan dari 6 stasiun di perairan ini. Hasil penelitian ini menunjukkan bahwa foraminifera benthik ditemukan dalam jumlah banyak di daerah bagian tengah Selat Rupas. Sebaliknya jumlah yang kecil/sedikit ditemukan di mulut Sungai Mesjid. Jumlah foraminifera benthik yang paling banyak ditemukan di daerah transisi yang terletak diantara bagian tengah Selat Rupas dan mulut sungai. Berdasarkan hubungan antara data oseanografi, hasil analisis mekanikal sedimen permukaan dengan distribusi foraminifera benthik, maka seluruh foraminifera benthik di esturia Sungai Mesjid Selat Rupas dikelompokkan menjadi tiga kelompok yang masing-masing menempati daerah bagian tengah Selat Rupas yang dipengaruhi oleh massa air laut yang mengalir melalui selat ini, daerah transisi yang merupakan pertemuan dua massa air yaitu massa air dari Selat Malaka dan muara Sungai Mesjid serta yang menempati mulut Sungai Mesjid dan secara dominan dipengaruhi massa air Sungai Mesjid.

Kata kunci: foraminifera benthik, sedimen, muara

Abstract

The main purpose of this study is to explain relationship between group of benthic foraminifera and environment condition on the River Mouth of Mesjid of the Rupas Strait. Q-mode cluster analysis was carried out based on the predominant species of benthic foraminifera recognized at surface sediment collected from 6 stations in the sampling site. The results of this study show that a large number of benthic foraminifera were found in the area close to the central part of the strait. On the other hand, small number is recognized in the river mouth. The largest number is seen in transition area located between the central part of the strait and the river mouth. Based on the relationship oceanographic data, mechanical analysis of surface sediment, and benthic foraminifera distribution, the foraminiferal on river mouth of Mesjid of Rupas Strait were grouped into three groups. The first group occupies central area of the strait under the influence of marine water masses flowing through the strait, the second occupies the transition area that may correspond to the boundary between the marine water masses and fresh water masses of Sungai Mesjid and the third inhabitates the river mouth area dominantly influenced by fresh water run from the river.

Key words: benthic foraminifera, surface sediment, river mouth

Pendahuluan

Foraminifera merupakan organisme yang bersel tunggal ditemukan di seluruh lingkungan laut mulai dari daerah intertidal sampai pada laut paling dalam seperti palung laut. Organisme ini hidup mulai dari jutaan tahun yang lalu sampai saat ini, oleh sebab itu sering digunakan oleh berbagai ahli sebagai indeks lingkungan untuk menggambarkan kondisi lingkungan

masa lampau (*paleoecology*) dan sekarang serta memprediksi kondisi lingkungan masa mendatang.

Penelitian tentang *recent* foraminifera benthik mulai dilakukan pada awal abad ke 19, di sekitar laut kepulauan Jepang. Setelah masa ini, penelitian foraminifera benthik berkembang pesat hampir diseluruh perairan dunia, yang dilakukan oleh banyak ahli diantaranya Hatta & Ujiie (1992), Ujiie & Rifardi

Deposisi Sedimen di Perairan Laut Paya Pesisir Pulau Kundur-Karimun-Riau

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Abstrak

Penelitian ini bertujuan untuk menjelaskan hubungan antara distribusi sedimen, jarak dan waktu sedimentasi dengan aktivitas penambangan bawah air dan karakteristik oseanografi, arus dasar dan pasang surut. Sedimen permukaan diambil dari 41 stasiun sampling di Laut Paya dan sekitar Pulau Kundur Propinsi Kepulauan Riau. Hasil penelitian menunjukkan bahwa, bagian utara dari daerah aktivitas penambangan dicirikan oleh sedimen yang dipengaruhi oleh massa air Selat Malaka, sedangkan bagian selatan didominasi oleh sedimen yang berasal dari Pulau Sumatera. Selain itu, sedimen Laut Paya berasal dari hasil abrasi dan lithifikasi pantai Pulau Rangsang dan Kundur, yang berada di depan perairan tersebut. Sebaran sedimen ditentukan oleh arus dasar dan pasang surut, dan penambangan. Ada dua rute sedimentasi, yaitu rute selatan dan utara dari daerah aktivitas penambangan yang ditentukan oleh pola arus pasang surut dan bathimetri perairan. Pada saat pasang, sedimen pasir sangat halus ditransportasikan dari daerah dumping dan penambangan menuju arah selatan. Sebaliknya pada saat surut sedimen ini akan ditransportasikan ke arah barat laut dari daerah dumping dan penambangan. Jarak dan waktu deposisi sedimen ini lebih besar dan cepat selama pasang dari pada surut. Perbedaan jarak dan waktu deposisi mengindikasikan bahwa kecepatan arus memainkan peranan penting dalam proses deposisi sedimen.

Kata kunci : deposisi, sebaran sedimen, penambangan bawah air.

Abstract

In attempt to clarify the relationship between distribution of sediments, distance and time of deposition, and underwater mining activity and of oceanographic characteristic, surface sediments were collected from 41 stations in the Paya Sea of Vicinity Area of Coastal Area of Kundur Island, Riau Island Province. Present work revealed that Northern part of underwater mining activity is occupied by sediments influenced by water mass from Malacca Strait and in the contrary the southern part is dominated by sediment derived from Sumatera island. In addition, high abrasion and lithification along the coast of Rangsang and Kundur Islands facing the study area is assumed to discharge the sediment into the area. Sediment distribution is strongly affected by tidal and bottom currents, as well as sediment discharged from underwater mining activity. There were two routes of sedimentation, i.e., southern and northwestern route. The routes are determined by tidal current pattern and bathymetry of waters. During high tide, very fine sand sediment is transported toward the southern dumping and mining areas of underwater mining. On the other hand, during low tide, the sediment is transported toward the northwestern of the areas. The transport distance and deposition time of the sediment is greater and faster during the high tide than the low tide. The above situation indicate that current velocity play important role on the deposition of sediment.

Key words : deposition, sediment distribution, undermining.

Pendahuluan

Perairan Laut Paya Pesisir Pulau Kundur Kabupaten Karimun Propinsi Kepulauan Riau terletak pada jalur pelayaran internasional dan nasional, dan terbentang diantara Pulau Kundur, Karimun, Mendol dan Rangsang. Perairan Laut Paya secara dominan

dipengaruhi pola oseanografi Selat Malaka dan suplai dari pesisir timur Pulau Sumatera khususnya pengaruh pemasukan berbagai material dari Sungai Kampar. Oleh sebab itu perairan ini dicirikan dengan potensi sumberdaya alam bernilai ekonomis tinggi yang tersebar di wilayah pesisir dan lautan, diantaranya

Rifardi
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UKURAN BUTIR SEDIMEN PERAIRAN PANTAI DUMAI SELAT RUPAT BAGIAN TIMUR SUMATERA

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Abstrak

Penelitian ini bertujuan untuk menganalisis faktor-faktor dominan yang berperan dalam sebaran ukuran butir sedimen pada perairan pantai Dumai Selat Rupa, pantai bagian timur Sumatera. Sampel sedimen permukaan diambil dari sembilan stasiun sepanjang perairan pantai dengan menggunakan *grab sampler* pada tanggal 19-21 Mei 2008. Semua sampel dianalisa dengan menggunakan analisis mekanikal dengan metoda *settling-tube*. Hasil analisa berupa data proporsi ukuran butir dan statistika sedimen dianalisis dengan menggunakan Q-mode cluster analysis. Berdasarkan hasil analisis, seluruh sampel sedimen dikelompokkan menjadi dua kelompok pada skala jarak 5 dalam sebuah dendrogram, dan hal ini mengindikasikan bahwa perairan pantai dumai dapat dibedakan menjadi dua daerah berdasarkan sebaran ukuran butir sedimen, yaitu 1) daerah yang dicirikan oleh leptokurtik sedimen dan sedimen berbutiran sangat halus dibawah pengaruh gelombang dan arus dengan model transpor: *onshore-offshore transport dan longshore transport sediments*, dan 2) daerah yang dicirikan oleh platikurtik sedimen dan sedimen berbutiran halus dibawah pengaruh aktivitas antropogenik.

The Grain Size of Sediment in Dumai Coastal, Rupa Strait Eastern Sumatera

Abstract

The main purpose of this study is to determine the factors which influence the grain size distribution in Dumai Coastal Waters, Rupa Strait, Eastern Sumatera. Surface sediment samples were collected from 9 stations along the in the coastal waters using grab sampler in May 19-21, 2008. All the samples were used for the mechanical analysis by settling tube-method, and Q-mode cluster analysis was carried out based on the proportion of grain size distribution and statistical parameters of sediment. Based on the results of the analysis, the sediment samples can be classified by into the two clusters at level of 5 Rescaled Distance in dendrogram indicating that the Dumai Coastal Waters is divided into the following two areas based on the grain size distribution: 1) the area characterized by leptokurtic and very fine-grained sediments under the influence of onshore-offshore transport dan longshore transport sediments, and 2) the area characterized by platykurtic and fine-grained sediments under the influence of anthropogenic activities.

Keywords: *grain size, rupa strait, platykurtic, sediments*

Safitri, NA., Rifardi, Hamidy, R.
2009:5 (3)

**KONSENTRASI LOGAM BERAT (CD DAN PB)
PADA SEDIMEN PERMUKAAN PERAIRAN TELUK BAYUR
PROPINSI SUMATERA BARAT INDONESIA**

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***Cd and Pb Concentration in Surface Sediment from Bayur Bay
West Sumatera Province Indonesia***

Abstract

The purpose of this study is to clarify the ecosystem quality of Bayur Bay based on heavy metallic elements (Cd and Pb) behaviour in surface sediment. Sediment samples were collected using grab sampler from 4 stations in Bayur Bay, West Sumatera Province, Indonesia in March to April 2009. Surface sediment samples were used for the mechanical analysis by the settling-tube method, and mean size diameter was calculated based on the proportion of grain-size distribution. Concentration of Cd and of Pb in the samples were determined using Atomic Absorption Spectrofotimetry (ASS). One Way Analysis Variance (ANOVA) was carried to clarify the relation between the concentration of Cd, Pb and mean size diameter of sediment. General trend of Cd and Pb distribution strongly indicate that the ecosystem quality of Bayur Bay is in same level for all stations as shown by result of one way anova ($T_{\text{calculate}} < T_{\text{tabel}}$). The study area is under influence of human activities supplied Cd and Pb to the surface sediment. Results of linier regression analysis show negative correlation between Cd concentration and mean size diameter ($Y = -0.031x + 1.262$). Contrastingly, correlation between Pb concentration and mean size diameter shows positive value ($Y = 0,098x - 0,10$). Cd and Pb concentrations in surface sediment of Bayur Bay are lower than the ERL (Effect Range Low: Cd = 1,2 ppm; Pb = 46,7 ppm) and ERM (Effect Range Median: Cd = 9,6 ppm; Pb = 218 ppm) indicating the Bayur Bay ecosystem is not yet polluted by the concentrations.

Keywords: *Surface sediment, Bayur Bay ecosystem and human activities*

STUDY OF DISTRIBUTION AND LEVEL OF NITRATE AND NITRITE DISSOLVED O₂ (DO) CENTRAL ESTUARY AEK TOLANG PANDAN NORTH SUMATRA PROVINCE

Eryandi sitanggung¹, Mubarak² and Rifardi²

ABSTRACT

This research was conducted in May 2009, in the waters of Muara Aek Tolang Pandan Central Tapanuli of North Sumatra Province. The purpose of this study was to map the distribution pattern of nitrate and nitrite content and O₂ content (DO) dissolved in the mouth of the river Aek tolang horizontally. The method used in this research was survey method. The primary data obtained from direct measurements and sampling directly in the field and then tabulated and analyzed in the laboratory are discussed further in descriptive, while secondary data related to research obtained from the relevant authorities. spreading pattern of Nitrate and Nitrite concentration distribution was influenced by tides and currents. It can be seen by the differences in concentration at the surface and ground waters at high tide and low tide at the same station point. At the time of ups and downs have a much different variations on each station. The concentration of dissolved O₂ measurements conducted at research sites at high tide waters ranged from 111.6 ppt - 442.3 ppt. Based on measurements taken in Coastal Estuary Aek Tolang Pandan then the quality of waters in the study area no good.

Keywords: *Nitrate and nitrite content, O₂ content (DO) dissolved, Spreading*

I. PENDAHULUAN

1.1. Latar Belakang

Perairan muara sungai merupakan ekosistem peralihan (*ecoton*), dimana air tawar dan air laut bertemu dan bercampur. Secara umum muara sungai didominasi oleh substrat lumpur yang dibawa oleh air tawar dan air laut. Pada kawasan perairan muara terjadi dinamika fisika dan kimia perairan menurut ruang dan waktu, seperti perubahan suhu, salinitas, kecepatan arus, pasang surut, kedalaman, oksigen terlarut, serta substansi kimia lainnya. Selain itu, perairan muara merupakan ekosistem yang produktif dan mempunyai nilai ekonomis bagi kehidupan manusia.

Muara Aek Tolang merupakan muara aliran Sungai Aek Tolang, dimana sungai ini merupakan salah satu sungai terpenting di Kecamatan Pandan, dengan aktivitas masyarakat seperti pemukiman, industri, transportasi. Di sepanjang daerah aliran sungai Muara Aek Tolang terdapat beberapa industri

yang pembuangan limbahnya dialirkan ke sungai. Efek dari aktivitas tersebut menghasilkan limbah (di antaranya nitrat dan nitrit).

Kesuburan perairan banyak dipengaruhi oleh keberadaan Nitrat dan Nitrit Kedua unsur ini sangat penting dan merupakan faktor pembatas bagi produktifitas laut. Pada umumnya unsur ini ada di perairan dan meningkat seiring dengan tingginya aktivitas manusia. Akan tetapi perairan juga rentan akan bahaya pencemaran air seiring dengan tingginya aktivitas manusia.

Berdasarkan uraian di atas maka penulis tertarik melakukan penelitian tentang Studi Pola Sebaran Nitrat dan Nitrit serta kadar O₂ terlarut (DO) di Perairan Muara Aek Tolang Pandan, Provinsi Sumatera Utara.

1.2. Rumusan Masalah

Kawasan muara merupakan kawasan yang sangat potensial ditinjau dari segi kandungan sumber daya alamnya. Pemanfaatan muara sungai

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**Lingkungan Pengendapan Perairan Selatan Estuaria Bagan dan Sekitarnya
Pantai Timur Sumatera Indonesia**

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*Sedimentary Environments of the South Bagan Estuary and its Environs on the East Coast of
Sumatera Island, Indonesia*

Abstract

The main purpose of this study is to clarify the relation between characteristics of sediments and environmental condition based on the analysis of surface sediment samples and total suspended sediments from the Southern of Bagan Estuary which is located on the East Coast of Sumatera Island, Indonesia. Surface sediment samples and total suspended sediments were collected at 21 stations using sediment sampler and van dorm sampler, respectively, in June 2010. The samples were analyzed by various analytical approaches i.e. mechanical grain size analysis, ignition loss method, bulk chemical analysis using atomic absorption spectrometer and sand-grain composition analysis. In general, the estuary area is characterized by finer sediments (medium-grained sand), by the lower values of organic matters (less than 10%), and by the higher content of Fe and Al per non calcareous clastic content, which is an index of terrigenous material input respectively. Concentration of total suspended sediment near bottom is higher than that of surface water, indicating sediments turbulented by strong current system. Judging from the distribution pattern of the Fe and K contents at surface sediment, terrigenous materials were transported northwestward along the coast of Pekaitan Village and of Barkey Island by strong ebb current. Contrastingly, terrigenous materials were transported southeastward along the area located between coast of Pekaitan Village and of Barkey Island by strong tide current. Geographical distribution of sand grain composition (lithogenous) strongly indicate that terrigenous materials derived from the hinterland of Sumatera Island discharged through Rokan River to the Southern of Bagan Estuary. In addition to, terrigenous materials are also resulted from coast erosion of Pekaitan Village and of Barkey Island, and turbulented sediments.

Key Words : *Sedimentary, Bagan Estuary, terrigeneous*

KARAKTERISTIK DAN POLA SEBARAN SEDIMEN PERAIRAN SELAT RUPAT BAGIAN TIMUR

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ABSTRACT

The study was conducted in June 2013 in the eastern waters of Rupa Strait. The purpose of the study was to determine the depositional environment and environmental changes along Rupa Strait based on analysis of surface sediment, suspended sediment concentration, and sediment accumulation value. The method used was survey method. Location of the study was divided into 15 sampling points based on the pattern of tidal currents and source materials into the water. The results showed that the study area was dominated by fine s and sediments with as and sediment type. The average concentration of suspended solids in coastal waters of Sumatra was higher than that of the Rupa. The waters of the eastern part of the Rupa Strait received sediment from the coastal erosion and supply of material from the two major rivers; i.e. Dumai River and Masjid River. Characteristics and distribution patterns in marine sediments were influenced by the character of the sea bottom, the pattern of tidal currents and waves .

Keywords : *Charackteristics of Sediments, Surface Sediment, Rupa Strait.*

PENDAHULUAN

Secara geografis Selat Rupa terletak di antara pesisir Pulau Sumatera dengan Pulau Rupa Provinsi Riau, merupakan jalur pelayaran nasional dan internasional.

Perkembangan yang pesat di sekitar Selat Rupa menyebabkan perairan ini mengalami tekanan akibat perubahan lingkungan dari kondisi sebelumnya. Sedimentasi merupakan parameter yang paling menonjol dalam hubungannya dengan penyebaran material bahan dasar laut atau pendangkalan dan bahan tersuspensi yang berada di dalam kolom air, selanjutnya proses ini akan merubah kedalaman dan

konfigurasi pantai sehingga merubah keadaan dasar laut, baik secara vertikal maupun horizontal (Uktoselya dalam Arby, 2007).

Perubahan lingkungan juga terjadi akibat faktor alamiah seperti arus dan gelombang yang mampu mengubah karakteristik sedimen dasar laut dan morfologi pantai disekitarnya akibat abrasi pantai dan ditambah oleh suplai sedimen dari sungai.

Rifardi (2008) menjelaskan bahwa pola dan karakteristik sedimen dipengaruhi oleh aktifitas artifisial (manusia) dan alam. Oleh sebab itu hasil penelitian tentang sedimen akan memberikan informasi tentang efek yang terjadi pada lingkungan yang disebabkan oleh kedua aktifitas tersebut.

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KOMPOSISI SEDIMEN BAGIAN TIMUR SELAT RUPAT PROVINSI RIAU

Composition of surface sediment in eastern part of Rupa Strait Riau Province

Oleh

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ABSTRACT

The research was conducted in June 2013 in Rupa Strait waters with the aim to determine the constituent materials in the sediment. The Eckman Grab was used to take samples and then the sediment was analyzed to determine the composition and content of organic matter. The results showed that the composition of the sediment composed of lithogenous and biogenous. Lithogenous composition especially in waters and rocks dominating presence evenly at each station. The highest composition found in a location close to the mainland and one of the areas that get the first time the influence of the tide, from the Strait of Malacca and the flow from Strait of Bengkalis. Lithogenous lowest percentage was found in areas close to the mangrove area where the station had high composition of litter biogenous. While the station containing the lowest organic matter was the station near the strait of Malacca. Mean while the station closed masjid river and Dumai river containing organic matter was high due to the flow of the river carrying a high content of organic materials.

Keywords: Composition, mangrove, Rupa Strait, tidal currents, sediment.

ABSTRAK

Penelitian ini dilakukan pada Juni 2013 di perairan Selat Rupa dengan tujuan untuk menentukan bahan konstituen dalam sedimen. The Eckman Grab digunakan untuk mengambil sampel dan dari sedimen dianalisis untuk menentukan komposisi dan kandungan bahan organik. Hasil penelitian menunjukkan bahwa komposisi sedimen terdiri dari biogenous pasir lithogenous. Komposisi Lithogenous terutama di perairan dan batuan mendominasi kehadiran merata di setiap stasiun. Komposisi tertinggi ditemukan di lokasi yang dekat dengan daratan dan salah satu daerah yang mendapatkan pertama kalinya pengaruh air pasang, dari Selat Malaka dan aliran dari Selat Bengkalis. Lithogenous persentase yang terendah ditemukan di daerah yang dekat dengan kawasan mangrove di mana stasiun memiliki komposisi yang tinggi dari sampah biogenous. Sementara stasiun yang mengandung bahan organik terendah adalah stasiun dekat selat Malaka. Sedangkan stasiun ditutup sungai masjid dan sungai Dumai yang mengandung bahan organik yang tinggi karena aliran sungai membawa tingginya kandungan bahan organik.

Kata kunci : Arus pasang surut, komposisi, mangrove, sedimen, Selat Rupa.

STRATIGRAFI SEDIMEN PERAIRAN SELAT RUPAT BAGIAN TIMUR

(Stratigraphy of sediment in eastern of Rupert Strait)

Oleh

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ABSTRACT

The stratigraphy of bottom sediments was investigated in eastern waters of Rupert Strait, Riau Province in June 2013. The analysis of sediment were conducted by two methods *i.e* : grain-size analysis and ignition loss methods. The result showed that the vertical characteristic of bottom sediments changed irregularly. The vertical characteristic change of sediments was represented by the grain-size distribution, both vertically and horizontally in the area. The similarity of sediment characteristic among the stations also represented by a cluster analysis. The cluster analysis showed that the sediments were divided into four clusters which showed clearly the different of sediment characteristic between station in this area.

Keyword : Core sediment, stratigraphy, Rupert Strait.

ABSTRAK

Penelitian stratigrafi sedimen di perairan Selat Rupert bagian Timur, Provinsi Riau. Dilakukan pada bulan Juni 2013. Bertujuan untuk mengetahui perubahan sedimen dasar perairan secara vertikal. 9 core sedimen dari titik sampling diambil dengan menggunakan gravity core. Sampel sedimen tersebut dianalisis dengan mekanikal analisis dan metoda ignition lose. Hasil analisis menunjukkan bahwa karakteristik sedimen secara vertikal berbeda antara titik sampling satu dan lainnya. Hasil analisis cluster juga menunjukkan hal yang sama, dimana 9 stasiun tsb menunjukkan perbedaan karakteristik sedimen secara vertikal.

Kata kunci : Core sedimen, stratigrafi, Selat Rupert.
