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THE CARBONATE BEACH SEDIMENTS ALONG THE GEUMGERI COAST, JIN ISLAND, KOREA

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ABSTRACT

Over 50 carbonate samples were collected from the Geumgeri coast, Jin Island. Textural characters, percent calcium carbonate and nature of the carbonate sediment were determined.

Apparently the carbonate beach sediments were derived from the adjacent nearshore. The carbonate sediments contain over 90 percent of molluscan shell particles, especially oyster shell fragments. The volumetric contribution of the shell fragment to the carbonate sediments is so large that the pre-existed oyster-reef like banks in the nearshore off the Geumgeri coast, Jin Island represent a spectacular example of carbonate sedimentary processes.

INTRODUCTION

This study was initiated for the aims of determining the nature and sources of the carbonate sediments developed along the Geumgeri coast, Jin Island as well as carbonate sedimentation (Fig. 1-a.b). Over 50 samples from the carbonate deposits between two rocky points in the Geumgeri coast, Jin Island were collected. The carbonate sediment deposit is about 8 meters in thickness and 1.8 kilometers in length.

Kim and Yuhn(1971) explained the carbonate deposit as coquina deposit in the geologic explanatory text of the Jin Island geologlic map sheet(1:50000). They described that the carbonate materials were mostly abraded of broken shells of pelecypods and gastropods. Park and Chung(1973) investigated the carbonate deposits in terms of sedimentary environmental characters. However, up to now there has not been detailed sedimentological study for a better understanding of the nature of the carbonate deposit in the coastal area. After the study was initiated, the following sedimentological problems became apparent:

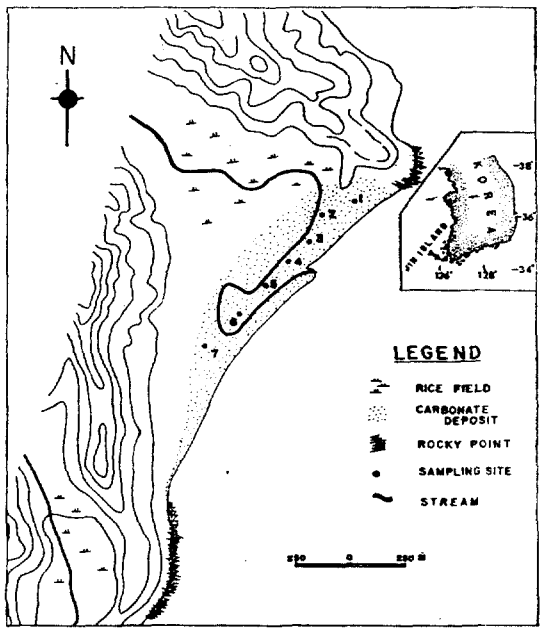

Fig. 1-a. Index map of the study area and locations of the major sampling sites.

Fig. 1-b. A Photography showing the study area beach.

(1) How is the ratio between clastic shell carbonates and noncarbonate sediments?
(2) What are the origin of these carbonate deposits?
(3) What are the textural natures of the carbonate sediments?

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GEOLOGIC SETTING

In 1971, the Geumgeri coastal area and other main regions of Jin Island were mapped by Kim and Yuhn at a scale of 1:50000. According to the data Figure 2 is presented. As it is shown

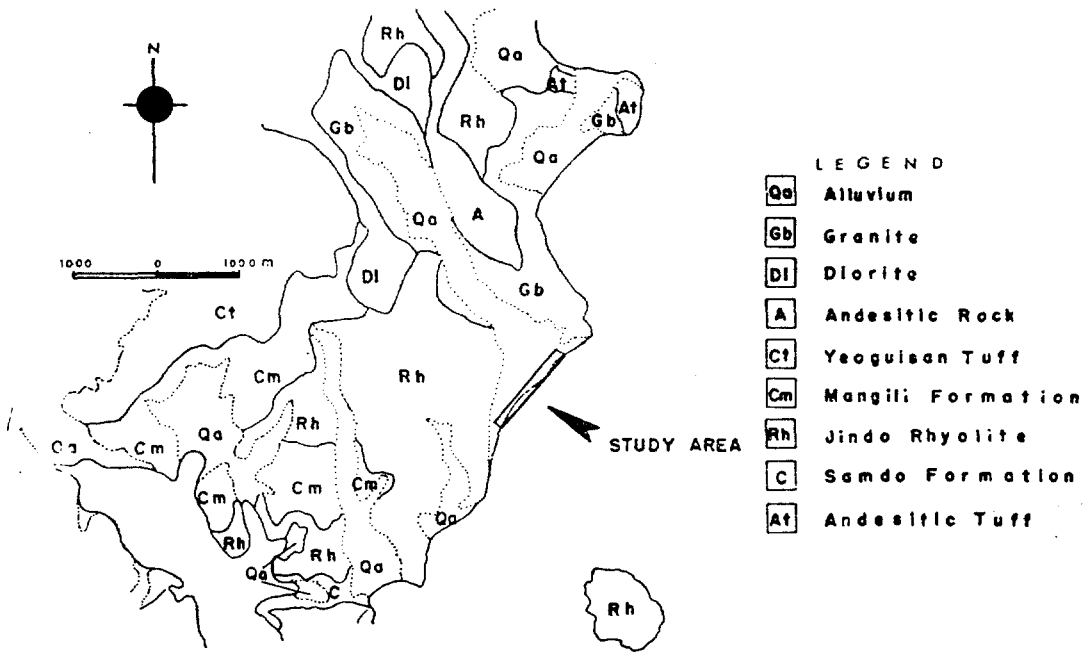

Fig. 2. Brief geologic map of the study area.

in Figure 2, the Geumgeri coastal region is composed of Cretaceous granite, granite porphyry, diorite, volcanic and sedimentary rocks. The sedimentary rocks are arkosic and tuffaceous sandstone and mudstone.

Therefore, there is not any possible source of carbonate sediments from the existing geologic formations exposed on the coastal region investigated.

Kim(1964) carried out a brief geologic survey on the carbonate shell deposit under the rock name of limestone. He reported that the limestone deposit overlay unconformably the Cretaceous feldspar porphyry and tonalite porphyry.

However, the present writer describes the deposit as clastic carbonate shell sediments rather than limestone, because the deposit is not consolidated.

The chemical composition of the deposit based on the deposit based on the data by Kim and Yuhn(1971) is as follows; CaO: 45.32%, SiO_2: 15.44%, MgO:0.53%, R_2O_3: 1.83%.

METHODS

In the laboratory, the samples were dried and 150 to 200 grams desited for shaking were obtained by quartering. Separation of the sample into its component sizes was performed on a mehanical shaker. After the size fractions had been weighed, the percentages were calculated and cumulative curves were constructed.

Under the binocular microscope the percentage of shell fragments and clastic inorganic component was calculated.

The grain size parameters were calculated based on the equation by Folk and Ward.

The sedimentary structures were investigated in the field directly and in the laboratory indirectly.

The determination of calcium carbonate of the shell fragments was done by using X-Ray diffractometer.

RESULTS

Grain Size Parameter

As shown in Figure 3 the grain size of the sedimentary deposit range from gravel(>2mm) to very fine sand. Most of coarse-sized grains are oyster shells and other shell fragments. They are in general larger than 2mm. However, the grains smaller than 2mm are mosty broken shell particles and inorganic clastic particles. It is seen that from all sampling sites the gravel-sized grains (>2mm) are more than 40%, whereas fine sand or very fine sand-sized grains(0.125mm-0.062mm) are mostly less than 2%. It is characteristic that the clastic carbonate shell deposit in the area investigated is rather coarse-grained in comparison with other clastic carbonate sedimentary deposits reported already up to now. However, the statistical mean size of the sediments ranges from 1.4mm to 0.56mm.

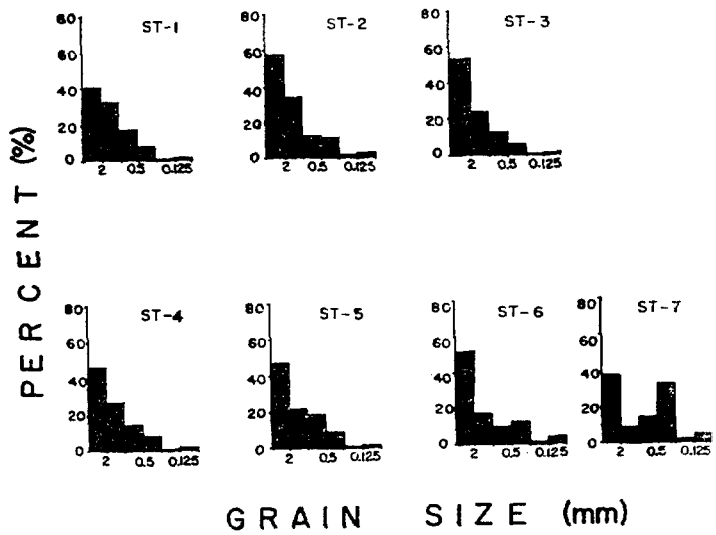

Fig. 3. Histograms from grain size analysis of the carbonate sediments.

Most oyster shell sediments were shortly transported to the beach ridge judging from

the shape and abrasion degree of these shell particles.

Figure 4 shows the range and characteristic pattern of the sorting values of the carbonate sediments. Based on these data it is seen that the sorting value ranges 0.92 to 1.46. The sediments, therefore, are moderately to poorly sorted. From the sampling sites 3 and 4 to both two ends, that is, rocky points, the sorting becomes better as shown in Figure 4. The reason for this sorting pattern is considered to be related to the pattern of the difference and distribution of waves energy and longshore currents. However, according to Giles & Pilkey (1965), the sorting value range of the Atlantic beach sediments is also 1.3 to 1.5. In a broad meaning the Jin Island sediments are rather slightly poorly sorted than other beach sediments reported.

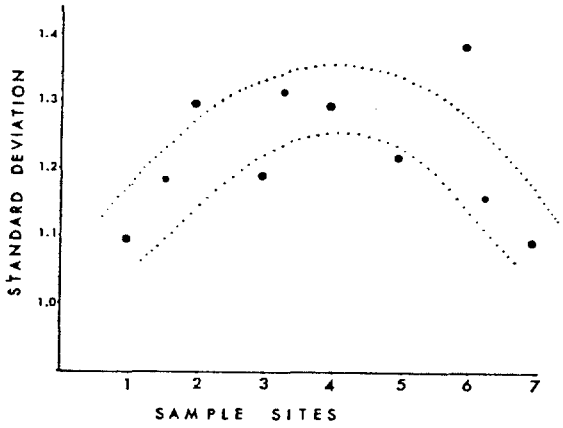

Fig. 4. The range and pattern of sorting values with the variable sampling sites in the area.

Composition

The Figures 5 and 6 readily show that the composition of the deposit is characterized to be composed mainly of clastic carbonate shell fragments and inorganic clastic sediments. These two kinds of sediment composition are variable in the amount at the different sampling sites. The average amount of the two dominant kinds of composition, that is, clastic inorganic and clastic shell sediments at each stations is represented in Figure 5. It is seen that there is an increase in the amount of inorganic clastic sediment fragments from the middle portion of the beach, that is, sampling sites of 3, 4 and 5 to both sides of north- and south-points, that is, sampling sites of 1-2 and 6-7. The reversed phenomenon, therefore, is seen in the component of clastic shell sediments. The facts that can be interpreted are the followings; (1) from both northern and southern ends of the beach there were rather great amount of inorganic clastic sediment input or (2) there was differential selective sorting action by longshore currents and waves. The almost symmetric relation in the change of increase and decrease of the two dominant components as shown in Figure 5 can be ascribed to the specific current system of the beach. The beach configuration and coastline geography of the beach area investigated are directly related to the conditions.

As shown in Figure 6, with the variation of

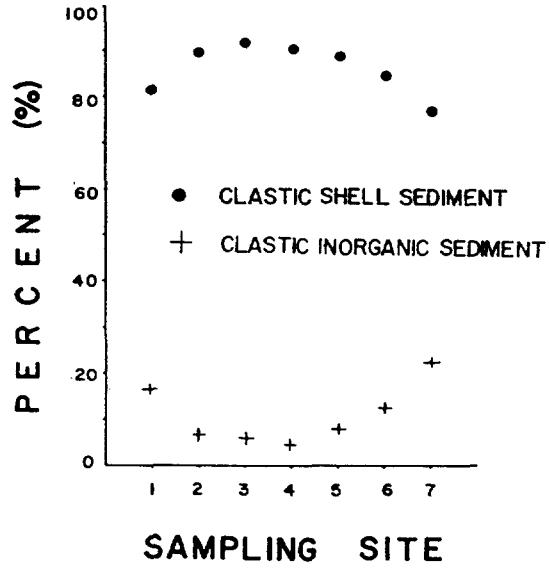

Fig. 5. Relationship between the average amount of calcium carbonate shells and clastic inorganic sediments with the positions of samples taken in the area.

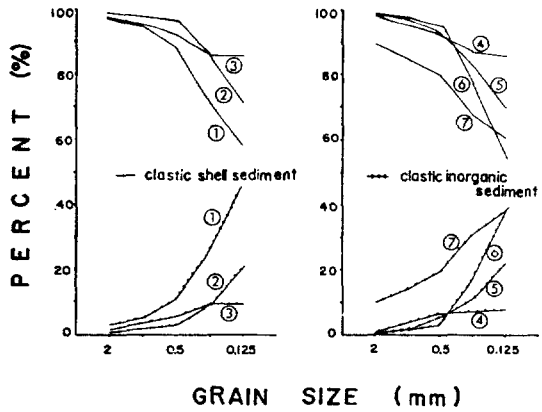

Fig. 6. Relationship between particle size, composition and percentage amount. Note the numbers in circle, which are sampling site.

the grain size distribution of the sediment comnponents with are clastic shell fragments there is a significant change in the amount of the two major constituents. It is significantly found that as the grain size becomes finer the amount of the inorganic clastic sediments becomes greater. However, the clastic grain size of the sediment gets coarser the clastic shell sediment increases in amount up to over 97% except the sample from the sampling site 7. The reasons for such textural and compositional characters seem to be related to the selective sorting action by the longshore currents and waves in the beach environment.

The carbonate content of the deposit studied is highest in the Geumgeri area. The highest clastic shell content can be essentially attributed to the high carbonate productivity of the local waters. The oyster shells are calcite in mineral composition based on the determination by X-Ray diffraction.

Sources of Beach Sediments

As mentioned previously, the composition of the sediment is characteristically high in carbonate. The most carbonate sediments are molluscan shell fragments. Especially, oyster shell particles are over 90 percent and other molluscas. The oyster reef bank was formed as the sources of the beach carbonate sediments. The absolute age of the shell sediments is reported as about 2,300 years old (Park & Chung). In the case of the south coast of Australia between 30° and 10°S there are also dense population of molluscas, bryozoans and algae for the carbonate sediments. Thus, much of the coasts is also bordered by shallow-water carbonate sediments.

CONCLUSIONS

1. The beach sediments along the Geumgeri coast, Jin Island has over 90 percent of carbonate shell fragments. They are mostly oyster shells.
2. It is found that the particle size and sorting pattern of these beach sediments vary with change in the distribution of wave energy and longshore current.
3. Thus, at the north and south ends of the beach higher energy is concentrated.
4. The source of these carbonate sediments is considered to be pre-existed oyster-reef bank.
5. The mineralogic composition of the oyster shells is calcite.

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