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Paper E 14A

A STUDY ON THE EROSION OF NIIGATA BEACH FROM ERTS-A IMAGERY

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ABSTRACT

One of the causes of coastal erosion is the cultural construction works such as flood control dam, short cut channel or breakwater, which reduce the transportation of river effluents such as silt and sand.

ERTS-A imagery makes clear the relations between the status of erosion, effluents pattern affected by the coastal current and the cultural construction works.

1. OBJECTIVES OF THE STUDY

Niigata alluvial plain, faced with Japan Sea, is produced by two big rivers, Shinano River and Agano River.

Niigata shore line is composed of fine sand deposits which are transported mainly by Shinano River, the third biggest river in Japan, with 12,000 square kilc meters in catchment area and 370 kilo meters in distance.

While clear water flows in Agano River at any time, water in Shinano River is rich in sand and silt, especially in the flood season and at the snow resolution time.

In the ancient time before about 80 years ago when the cultural structures such as river improvement works or flood control dams had been carried out along Shinano River, Niigata shore line had grown in the offshore direction with average rate of 30 meters to 120 meters in a year. Fig. 1 shows schematic change patterns of Niigata shore line in the past.

About 70 years ago, the breakwater for the construction of Niigata Port was constructed at the outlet of Shinano River as shown in Fig. 2.

Since Ohkozu short cut channel was excavated 50 years ago to prevent Niigata City from flood, outflow of sand and silt through the outlet of Shinano River remarkably decreased.

Since then, interactions between the breakwater, the short cut channel, wind, wave and current began to attribute erosions at the both sides of the west beach and the east beach in different ways.

The shore line at the west beach has been eroded with the magnitude of 360 meters at maximum for 60 years since the completion of the breakwater, while the shoreline at the east beach, 300 meters at maximum for 40 years since the construction of the Ohkozu short cut channel.

Although a number of countermeasures such as submerged breakwater, sea walls and revetments have been constructed, erosion is still progressing.

In 1972, another short cut channel was completed against the erosion of the west beach. This new channel, however, would not be effective for improving the erosion of the east beach.

As it can be considered from the above mensioned background, the objectives of the study are as follows.

a. To investigate the distribution pattern of the sand deposit transported by Shinano River, and its behavior.
b. To study the effect of the cultural structures upon the sand sedimentation.
c. To establish the method of the preservation of coastal environment against erosion.

The use of ERTS imagery will be effective in feasibility studies of a. and b., and c. finally.

2. GROUND TRUTH SURVEYS

Following ground truth data are available from the existing surveys.
a. Change patterns of Niigata shore line.
b. Contour map of depth of Niigata beach. (Fig. 3)
c. Surveys of settlement of the beach
d. Predominant wind and its velocity.
e. Wave height.
f. Classification of the sand deposits.

3. ERTS-A IMAGERY OF NIIGATA BEACH

Following ERTS-A imagery are available for the interpretation of the erosion of Niigata beach.

Date and time;	29 August, 1972
Identified number;	032, 064, 096, 128
Format;	MSS 70mm positive
Center point;	37°20'N, 139°12'E

Cloud coverage;   about 10 percent in the mounta-
                               eneous sites
Major features included;   Niigata City, Sado Island, Shinano
                               River, Agano River, Japan Alps,
                               Inawashiro Lake

Fig. 4 shows contact prints of four bands made from ERTS-A.

Fig. 5 shows the enlarged print of the band MSS 4 in the scale
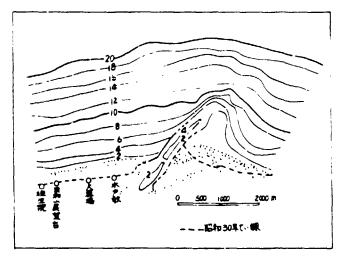of 1:1, 000, 000 with effluent pattern superposed.

Fig. 6 shows the more enlarged print of Niigata shore line in
the scale of 1:200, 000 which can provide more detail information about
the relations between effluents, breakwater and short cut channel, and
coastal current.

Significant results are obtained from ERTS-A as follows.

a. Effluents from Ohkozu short cut channel are refracted by the curved
    coast and Tsushima current, which flows in the direction of the
    north east. They disperse in the offshore far away from Niigata
    west beach and sand sedimentation is not active.

b. The new short cut channel is identified to contribute the sand deposi
    tion along the west beach as it was estimated by coastal engineers.

c. Effluents from the breakwater of Niigata port are distributed in the
    direction of the north east together with those from Agano River.
    They are also affected strongly by the coastal current.

d. The east beach has no tendency to have sand deposit from effluents.
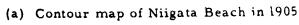   There will be increase of erosion at the east beach.

Further studies will be feasible by the use of ERTS imagery
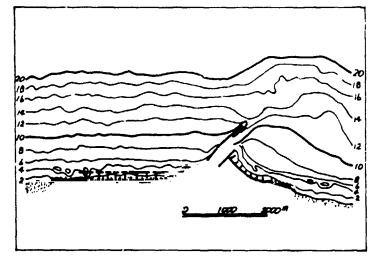as follows.

a. Estimate the volume of sand deposits discharged from Shinano
    River, and its ditribution, in the flood season and at the snow
    resolution time.

b. Surveys of the effect of the predominant winter wind on the erosion.

c. Determination of the sites of dredging and disposing sand deposit.

d. Study on the effect of the cultural works upon the coastal environ-
    ment.

e. Surveys of the correlation between pomping natural gas and the
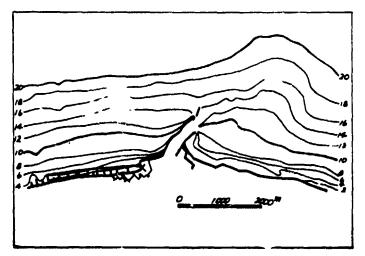   settlement of the ground in Niigata coastal area.

(a) Contour map of Niigata Beach in 1905

(b) Contour map of Niigata Beach in 1960

(c) Contour map of Niigata Beach in 1970
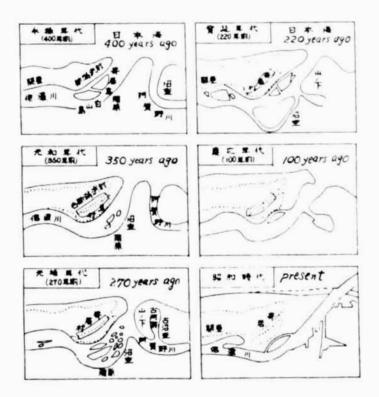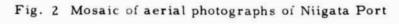
Fig. 3 Contour map of depth of Niigata Beach

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Fig. 1 Historical change pattern of Niigata Beach

Fig. 2 Mosaic of aerial photographs of Niigata Port

and its coastal environment (1958)
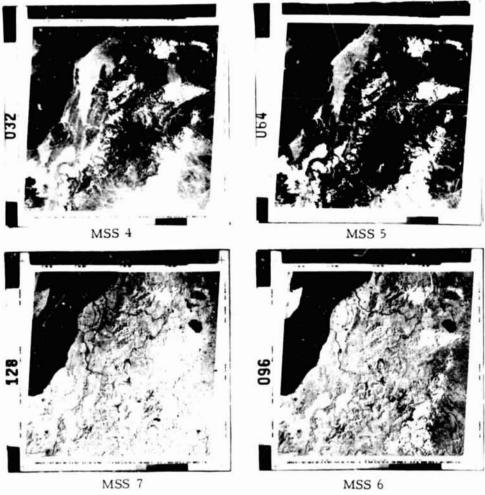
MSS 4

MSS 5

MSS 7

MSS 6

Fig. 4   Contact prints of four bands from ERTS-A

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Fig. 5 Enlarged print of the band MSS 4 with effluent

pattern superposed

Fig. 6 Enlarged print of ERTS Imagery
1:200,000