Subsurface imaging of Yumigahama Regressive Barrier by Ground Penetrating Radar

Fumitoshi Murakami[1]; takahiko inoue[2]; Takao Tokuoka[3]; Ayumi Fukita[4]; Kazuaki Watanabe[5]; Toru Tamura[6]; Futoshi Nanayama[6]

[1] AIST,IGG; [2] Graduate School of Sci. and Eng., Ehime Univ.; [3] Toku Lab.; [4] The Tokuoka Laboratory; [5] AIST; [6] GSJ/AIST

1. Introduction

The Yumigahama Peninsula is a large regressive barrier which divides the Nakaumi (brackish water lagoon) from Miho Bay, which faces to the Japan Sea. The length of the peninsula is about 17 km and the width is about 4 km. The peninsula is topographically divided into three zones based on the arrangement of beach ridges and inter ridge swales; the inner zone, the middle zone and the outer zone (Sadakata, 1991). The inner, middle and outer zones were formed during 6000-3000 yBP, 3000-2000 yBP and 1000-100 yBP by coastal progradation, respectively. The evolution of the Yumigahama barrier has been discussed based on results of topographic study and geological study by drilling cores so far. We tried to discuss the evolution of the barrier based on results of continuous subsurface profile by GPR (Grand Penetrating Radar).

2. Method

GPR is a useful geophysical method to image continuously a subsurface sedimentary structure of coastal plains. The subsurface profiling by GPR is similar to seismic reflection profiling, except that the GPR method uses reflection of electromagnetic wave which is reflected back to the ground surface at abruptly changed boundaries in dielectric properties. We used a Pulse EKKO 100 system with a 100 MHz antenna manufactured by Sensors & Software Inc. in this study. Antennae separation is 1 m and step of measurement points of reflection signal is 0.25 m. Common mid-point (CMP) surveys determined the velocities of EM of sediments. Elevation measurement for terrain correction of GPR data is carried out by a total station system.

3. Results

About 2.2 km of GPR profile data were obtained along NE-SW survey lines, which crossed the barrier around Yonago airport. GPR profiles are characterized by seaward-dipping (to Miho Bay) reflections. GPR reflections are generally divided into main reflections with relatively strong amplitude and good continuity, and sub-reflections which are recognized between two main reflections. The slope of main reflections becomes gentle at depth and almost becomes horizontal in the depth of -8m to -10m from the ground surface. The horizontal interval of the main reflections is about 20m to 100m. The sub-reflections downlap onto the main reflections in a general trend. We interpret the formation mechanism of the above structure at present as follows; the structure due to the main reflections seems to correspond to the stagnation episode of coastal progradation, and the structure due to the sub-reflections seems to be formed during the coastal progradation by accretion of sediments.