High Resolution Geophysical Signals to Reveal the Depositonal System of a Spit --- Northern Taiwan

Joseph Chow*
National Taiwan Ocean University, Keelung, Taiwan
jdchow@mail.ntou.edu.tw

and

Su-Kai Chang
National Taiwan Ocean University, Keelung, Taiwan

The Fulong area is located near the northeastern corner of Taiwan. The sandbars in this area tend to be barrier spits. The Fulong spit is a distinctively-shaped river mouth landform composed of large amounts of silt and sand deposited by the Shuangsi River.

Barrier depositional systems in the subsurface have also been the site for many significant oil and gas discoveries over the last several decades. A resurgence of geologic interest in barriers as targets for oil and gas exploration has lead to increased research, making knowledge of their internal geometries important for oil field development. Additionally, an evolving awareness exists that many of the ancient barriers were deposited in an environment influenced by high wave energy with a 2- to 4-m tide range (mesotidal). These ancient depositional settings were probably different than the lower tidal and wave energy conditions of the present-day Atlantic and Gulf coasts of the U.S. from where most of the depositional models have been generated.

The Shuangsi River barrier spit is a coastal landform in a state of dynamic balance. While aerial photography and remote sensing technologies have been used to study the area, geophysical exploration technology has not been applied. Because the area has little exposure and the sand is extremely loose, trenching is impractical. Furthermore, since grain size is relatively uniform, it would still be difficult to observe sedimentary structures even if drilling was performed. While use of radar signal yielded very good cross sectional radar images of the area, until this study, no government unit or research organization had used radar signal to study spit evolutionary mechanisms at the mouth of the Shuangsi River.

Data regarding the stratigraphy and internal structure of cheniers and other beach-ridge deposits are limited. However, radar signal allows rapid collection of detailed and laterally extensive sedimentological information from such landforms. This non-invasive geophysical technique is being increasingly used in many disciplines, including sedimentology. In sedimentological studies, low-conductivity, unsaturated or freshwater-saturated sands and/or gravels provide particularly favourable ground conditions for radar deployment. Interpretation of resulting radar reflection profiles can provide information about both the deposits' internal structure and

sedimentary architecture. This can be verified and supplemented by additional information from natural field exposures, trenches and boreholes.

Radar is a nondestructive technique enabling the collection of continuous subsurface data. Out of various geophysical exploration methods, radar is therefore the best technique for investigating the sedimentary structures in this area. This study investigated the length of the Fulong Spit in a grid pattern, and used 3D software to map the forms of sequences tops. This study used hydrological data in conjunction with radar reflection characteristics and sedimentary structures to study the environmental mechanisms affecting the formation of the Fulong spit, while also providing information to guide research on sandbar deposition in other locations.

The deposition system of the Fulong spit started with summer typhoons and torrential rains scouring bottom sediments and transporting them offshore. Northeasterly waves accompanying the northeast winter monsoon then move sands back inshore, depositing the sand on bedrock in the form of drumstick. These inshore sediments eventually form a beach ridge after reaching a certain height. Monsoon waves with sufficient energy may then wash over the beach ridge, and this washover flow creates low-energy sheet flow sediment deposits in backshore washover basins.

References

Neal, A., Richards, J. and Pye, K., 2002, Structure and development of shell cheniers in Essex, southeast England, investigated using high-frequency ground-penetrating radar: Mar. Geol., **185**, 435–469