



Provenance, structure, and formation of the mud wedge along inner continental shelf of the East China Sea: A synthesis of the Yangtze dispersal system

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ABSTRACT

Surficial grain-size and down-core clay mineralogical data show that sediment along the inner-most part of the continental shelf in East China Sea is mainly derived from the Yangtze River (Changjiang), spanning from the Yangtze mouth (33°N) ~1000 km southward to the southwestern corner of the Taiwan Strait (24°N). High-resolution CHIRP seismic profiles reveal an elongated mud wedge extending along the inner shelf, with a northern depocenter on the modern Yangtze delta and a southern depocenter at 27.5°N. Four distinct acoustic units are delineated within the mud wedge (from bottom up): unit I (late-Pleistocene, mainly valley fills), unit II (formed by transgressions, thin strata), unit III (11–2 kyr BP, downlapping strata) and unit IV (2–0 kyr BP, flat and opaque strata). Incised valleys, up to 15-m deep, are filled by flat-lying or inclined strata in unit I. The thin (<3 m) and acoustically transparent unit II is only seen between 30 and 26°N in water depths between 40 and 90 m. Separated by acoustically opaque strata or unconformities, units III and IV are widely distributed. During the past 11 kyr Yangtze sediment accumulation has been unsteady, showing two high and one low accumulation-rate periods. The high-accumulation period at 5–8 kyr BP may be related to maximum East Asian summer monsoon precipitation in the Yangtze basin; the other high-accumulation period, 0–2 kyr BP, probably reflects intensive human activities in the river's watershed. The low-accumulation-rate period at 2–5 kyr BP, which is seen in both northern and southern Yangtze depocenters, is probably related to low river discharge and/or intensified Taiwan Warm Current and China Coastal Current.

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1. Introduction

Rivers provide the bulk of sediment deposited in the global oceans, approximately 15–20 billion tons/yr (Milliman and Meade, 1983; Milliman and Syvitski, 1992), but during sea-level highstands much of this sediment is sequestered in coastal and nearshore environments. More than half of global fluvial sediment is delivered by Asian rivers (Meade, 1996), such as the Ganges–Brahmaputra, Yangtze and Yellow rivers. Historically the Yangtze and Yellow rivers have transferred ~480 and ~1000 million tons/yr (Mt/yr) to the East China Sea (ECS), Bohai

Sea, and Yellow Sea (Fig. 1), representing ~10% of global sediment discharge.

The fate of this bulk sediment from the Yangtze and Yellow rivers is largely controlled by counter-clockwise circulation in the ECS and Yellow Sea (Fig. 1). The dominating current is Kuroshio Warm Current, which flows along the eastern edge of the ECS and pushes the Yellow Sea Warm Current northward along western Korea (Fig. 1). Completing this circulation, the China Coastal Current flows southward along the western side and brings colder water into the southwestern ECS.

Debouching onto a wide (>600 km) epicontinental shelf, the Yangtze and Yellow rivers have formed three distinct mud deposits in the ECS: a mud wedge along the entire inner shelf, a mud patch southwest of the Cheju Island, and a deeper (>1000 m water depth) deposit in the Okinawa Trough (Fig. 2). While most of the ECS floor is covered by sand, the inner shelf (landward of ~80-m isobath) is

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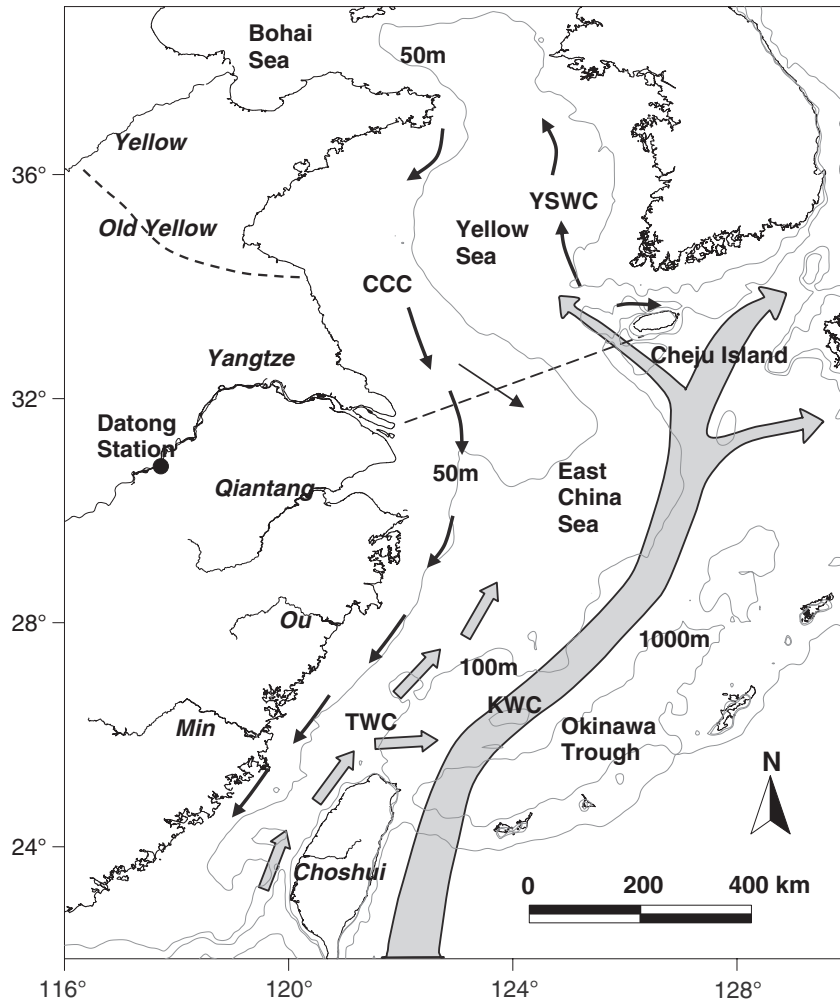


Fig. 1. Bathymetry and major currents in the East China Sea and Yellow Sea. KWC, Kuroshio Warm Current; TWC, Taiwan Warm Current; CCC, China Coastal Current; and YSWC, Yellow Sea Warm Current. Dashed straight line from Yangtze mouth to Cheju Island is the dividing line between the East China Sea and Yellow Sea. The old Yellow River entered the Yellow Sea from 1128 to 1855 AD (dashed course).

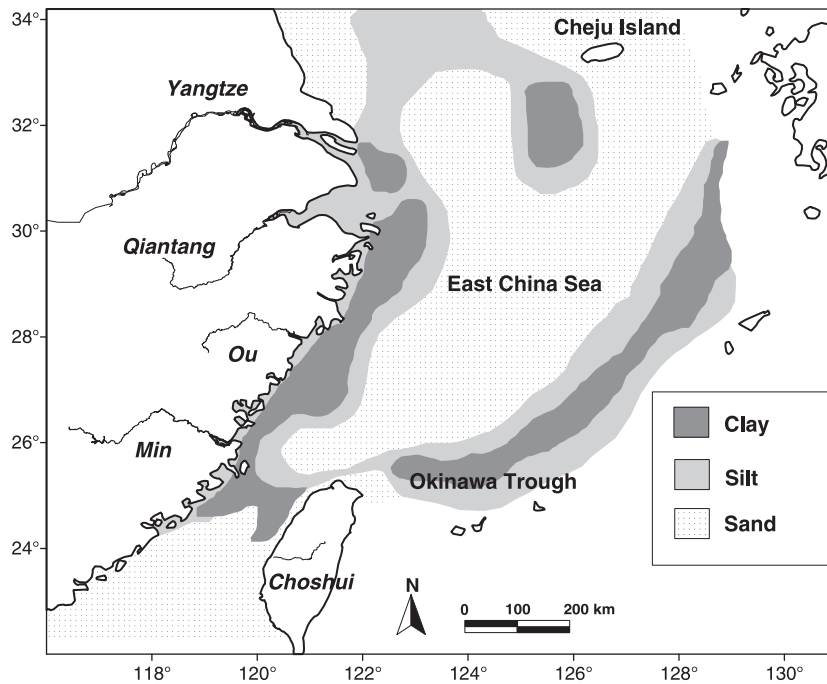


Fig. 2. Surficial sediment types in the East China Sea. There are three major mud deposits: inner shelf, southwest of Cheju Island, and deeper Okinawa Trough. Middle and outer shelf surficial sediments are primarily relict sands.

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