

# Paper Number: 2605

## Coastal systems of Japan

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Holocene coastal systems in Japan have been grouped into four depositional systems: deltaic, strand plain, barrier and estuary, and fan-delta systems. These coastal environments are closely linked with each other, with coastal oceanography and with sediment discharge from rivers in a composite system that has evolved over the last 6–7 ka. Most of the coastline facing the Pacific Ocean, the Japan Sea and the Sea of Okhotsk is wave- or storm-dominated, with mean wave heights of 0.8–1.3 m and wave heights exceeding 5 m during storms. In contrast, more sheltered areas such as the Seto Inland Sea and enclosed bays (e.g. Tokyo Bay) have mean wave heights of less than 0.5 m. Mean maximum tidal ranges are 1.0–2.0 m for coasts facing the Pacific Ocean, <0.5 m in the Japan Sea, 1.0–1.5 m in the Sea of Okhotsk (micro-tidal), ~2 m in Tokyo Bay and Ise Bay, >2 m in the Seto Inland Sea (micro- to mesotidal), and >4 m in Ariake Bay of Kyushu (macrotidal). In summary, Japan has wave- or storm-dominated coasts facing open seas and tide-wave-dominated coasts in enclosed bays other than the tide-dominated Ariake Bay.

The four depositional systems have their own characteristic distributions, resulting from sediment delivery and coastal oceanography. Most of the delta systems are in enclosed bay areas, where wave influence is relatively small. Fan-delta systems are mostly located in central Japan, where very steep rivers deliver coarse sediment to the coast. Barriers and estuary systems are on open coasts facing wave- or storm-dominated seas. Some of the lagoons or central basins of the estuary systems have been filled by sediment supplied from bay-head deltas (or lagoonal or estuarine deltas) or supplied by longshore currents through inlets. In these cases, bay-head rivers discharge into open seas, forming deltas or strand plains. It can be difficult to discern older depositional systems by looking only at the present-day coastal morphology.

Relative sea level is another important factor controlling depositional systems in Japan. After an initially rapid sea-level rise in the early Holocene, stable and falling sea levels for the last 6–7 ka have exposed wide coastal plains and changed transgressive coastal depositional systems into regressive systems. Some of the barriers and estuaries, which are typical transgressive systems, have evolved into other systems after the infilling of central basins and lagoons. Currently, most of the large rivers in Japan empty directly into open seas and thus deliver sediments to open coasts. During the middle Holocene (6–8 ka) when marine inundation was at its maximum, the coastal geomorphology and associated depositional systems in Japan were very different from their present counterparts. This contribution has been adapted from Saito et al. (2016).

### References:

[1] Saito Y et al. (2016) Coastal geology and oceanography. In: *Geology of Japan*: Geological Society, London

