Archipelago Tidal Flats in Korea: Sedimentological and Geoheritage Significance

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Abstract

Island-type tidal flats along the western coast of the Korean Peninsula have been developed due to tidal sea-level rise on broad marginal sea (Yellow Sea) since the retreat of the Last Glacial Maximum. The tidal flats are characterized by large elongate habit sand bars and broad intertidal and supratidal mud flats with spring tidal range reaching up to 7.8 meters. Geomorphic features, surface sediments and core data show that tidal flats can be divided into upper intertidal zone and lower intertidal zone. Upper intertidal zones doubly seaward with tidal creeks, which changes from mudflats to more sedimentary flats with seaward coarsening in average grain size. Dominant sedimentary facies are homogeneous mud (highly bioturbated) and thinly laminated sand/mud (coarsely interlaminated sand/mud and intermediate bedrock) showing seasonal stratifications. Surface topography of lower tidal flat is characterized as sand-bulk complex migrated landward. The bars are reaching up to 1.5m in height, and shore-parallel tidal creeks are developed between individual bars. Dominant sedimentary facies is sand-flat facies except for the mixed-flat facies occurring near boundary of two zones. Broad tidal flats around the islands of the Shinan and Seochem areas associated with macrotidal range in very shallow endogenous sea (Yellow Sea) display outstanding geological processes and geoheritage significance, which can be a strong potential for the nomination of natural World Heritage sites.

Introduction

World Heritage is the legacy from the past, what we live with today, and what we pass on to future generations. Our natural heritage is irreplaceable sources of life and inspiration. Special island-type tidal flats are mainly distributed in the southeast part of the Korean Peninsula, especially Shinan and Seochem counties. They consist of all kinds of tidal-flat like mud-flat, sand-flat, mixed-flat, and even rocky-flat, which are apparently distributed from area to area depending upon the location of islands and oceanographic conditions. The objectives of this project are to characterize the sedimentological and geoheritage significance of Korean island-type tidal flats and to show their outstanding universal values to be nominated as a serial natural World Heritage sites.

Geographic and Geologic Setting

Shinan Archipelago and Yuboodo Island are located in the southeast part of the Korean Peninsula. These serial nominated sites are composed of the Shinan Archipelago with 1004 islands and Yuboodo Island. These islands were formed by rapid sea-level rise on shallow broad continental shelf in Yellow Sea since the Last Glacial Maximum. Geology of the areas: Shinan Archipelago is composed of Cretaceous sedimentary rocks, volcanic and plutonic rocks and Yuboodo Island is composed of Precambrian granite and gneiss.

Oceanographic Setting

Yellow Sea is a part of the Asia continent where shallow sea was formed by flooding of seafloor onto broad shallow continental shelf due to rapid sea-level rise since the Last Glacial Maximum. The seafloor has been submerged and inundated many times during the alternating glacial and interglacial periods of the Pleistocene. Bathymetry: maximum depth (140m) / average depth (44m) Average tidal range: Shinan Archipelago (380.5 cm)/ Yuboodo Island (447.2 cm). Maximum tidal range: Shinan Archipelago (526 cm)/ Yuboodo Island (473 cm). Temperature / Salinity ranges: 13 ~ 16°C / 31.3 ~ 32.7 psu.

Shinan Archipelago

Yuboodo Island

Barrier Islands Moving Sand Islands

Wadden Sea

Shinan Archipelago

3D Geomorphology

Surface sediment distribution

Compared with the Other WH Site (Wadden Sea)

The only inscribed tidal flat site in the world is the Wadden Sea tidal flat from Denmark to Netherlands. The Wadden Sea tidal flat is entirely different from Korean tidal flat because Korean tidal flat area is surrounded by numerous islands and high mountains without any barrier islands whereas Wadden Sea tidal flat has barrier island parallel to the shoreline towards the sea. Thus, Wadden Sea tidal flat was influenced by incoming waves and tidal currents whereas Korean tidal flats are mostly affected by tidal currents around the islands.

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Summary and Future Plan

The Wadden Sea World Heritage (2009). Korean tidal flats have their own unique island-type tidal flats producing outstanding scenic views and a variety of tidal flat environments resulting from complex endogenic controlling factors on the tidal and shallow continental shelf. Therefore, the serial nominated sites of Korean tidal flats have a great potential to be inscribed as a Natural World Heritage based on criteria (Vii) and (ix).

Based on further research on ecology and human use of the nominated sites, the Phase II project will be carried out for the nomination as a mixed World Heritage site based on criteria (iv) and (v). Continuous biological monitoring will be necessary for this goal.

Criteria to Be Nominated

Criteria (iii) to contain outstanding natural phenomena or areas of exceptional natural beauty and aesthetic importance: Island-type tidal flats of Korea may be the only place to display exceptionally beautiful scenic views in the world because the tidal flats have formed in broad shallow sea (Yellow Sea) with numerous islands of varying heights. High areas became islands after the broad flat area was submerged due to rapid sea-level rise. Other tidal flats of the world mostly show a simple horizontal landscape.

Criteria (vii) to be outstanding examples representing major stages of earth’s history, including the record of life, significant and ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features: Island-type tidal flats of Korea may be the only place in the world showing the special sedimentological processes in a tidal flat environment between numerous islands on broad epeirricontinental shelf. Macrotidal currents combined with waves and typhoons in certain coastal-oceanic setting have provided unique geological and oceanographic conditions to produce massive tidal sediments. Various types of tidal flats (sand, mud, mixed and rocky tidal flats) could be produced because of the unique sedimentation processes between islands on a very shallow, broad and uniform continental shelf under the influence of macrotidal currents and frequent typhoons.