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The tidal sand ridges of the East China Sea outer shelf: evidences for recent activity under modern sea level conditions.

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Tidal sand ridges characterise tide-dominated environments and cover thousands of square km in shallow marine environments. Investigations of the East China Sea (ECS) revealed the existence of tidal sand ridge fields on the continental shelf, mainly along the retreat path of the Changjiang River and adjacent areas. Until now, these ridges were considered as “moribund” and their formation was interpreted as the result of the rise in sea-level after the last glacial maximum. Here, the study of a 7.8 m long piston core collected on the middle shelf brings new information concerning the internal structure, the depositional environment and the stratigraphy of these sedimentary bodies. It suggests that sand ridges of the ECS are sub-active features that record processes that took place during the last centuries. Data were acquired during the Donghaï cruise, with the French vessel "L’Atalante" in the framework of a French-Chinese co-operation in Marine Sciences. High-resolution seismic profiles were acquired with a SIG Sparker. Cores were collected using a Kullenberg system. The age model for the studied core has been established by the use of AMS 14C dating onto 9 samples. These dating provided essential references for chronostratigraphic correlation and validation of scenario formation. Core DGKS9611 was taken at a depth of 96 m from the south-west flank of a tidal sand ridge about 15 m in height. On the seismic lines, the overall architecture of the ridge consists of a complex organisation of bounding surfaces suggesting that erosional processes took place during the shaping of the ridges. Two major sedimentary facies have been identified within core DGKS9611: The upper part (0-90 cm) consists in fine to medium sand with numerous shell fragments and no apparent structures (Facies 1). This facies is underlain by an erosion surface. The lower part of the core (90-780 cm) corresponds to the internal facies of the sand ridge

(Facies 2). It consists in two distinct sub-facies alternating at a fairly regularly spacing of 20 to 25 cm: (a) successive silty-muddy planar laminae inter-bedded with thin silty layers, alternating with (b) sand dominant intervals. Shell debris are rare and trace fossils abundant. Four cyclic signals have been evidenced in bed thickness and lithology variation and are interpreted as related to neap-spring, annual and semi-annual tidal cycles and to ebb/flood Changjiang river seasonallity. Our investigations evidenced firstly that the sand ridges of the East China Sea contain a much larger part of fine sediments than previously thought, although lateral changes to sandy facies may occur within a ridge. Secondly, Yang and Sun (1988) proposed that the sand ridge field where core DGKS96-11 was sampled, have started forming around 12 750 B.P., when the palaeo-coastal line was 80 m lower then present, and that the ridges became progressively moribund when the sea level rose. However, our radiocarbon results do not fit with such a scenario. Indeed, the radiocarbon ages (eg. 1041 years B.P. at a depth of 384 cm) show that at least a part of the ridge formed during modern time, and therefore a sea-level typical for a middle to outer shelf environment. Our results suggest that less than 1500 years ago, a change in sediment supply and lithology occurred, maybe in relation with the deviation to the north of the Yellow river. They also demonstrate that “deep water tidal rhythmites” may form in an offshore environment, provided that supply in fine-grained sediment is sufficient.