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Sea-level control on the submarine fan architecture in a deepwater sequence of the Niger Delta Basin

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1 **Sea-level Control on the Submarine Fan Architecture in a Deepwater** 2 **Sequence of the Niger Delta Basin**

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10 **Abstract**

11 Submarine fan architecture has long been considered much complicated as controlled by both
12 allogenic and autogenic mechanisms. However, to which extent the allogenic sea-level change
13 controls the submarine fan architecture is still unclear. This study uses integrated 3-D seismic,
14 well-log and core data to characterize the submarine fan architecture in a deepwater sequence of the
15 Niger delta basin. Correlation of the timing of architecture units to high-frequency sea-level curve
16 helps to investigate the sea-level control on architecture distribution and evolution of submarine fan
17 systems.

18 The studied sequence is a 3rd-order sequence that formed during 12.5–10.5 Ma and contains a
19 lowstand systems tract (LST) and a transgressive-highstand systems tract (TST-HST). We find that
20 the LST develops a single channel system that is terminated by a lobe system; whereas the TST-HST
21 develops two mutually incised channel systems and mudflow deposits, which are distinct from the
22 conventional condensed sections and interpreted to result from the repeated 4th-order sea-level cycles
23 during the TST-HST of the 3rd-order sequence. Single submarine fan systems, which last for ~0.3–0.6
24 Myr, are assumed to form in response to single 4th-order sea-level cycles since they are well
25 correlated with each other. Each single submarine fan system contains several vertically stacked
26 complex sets, which are well correlated with 5th-order sea-level cycles that last for ~0.1–0.2 Myr,
27 suggesting their potential genetic links. Different complex sets in a single submarine fan system
28 exhibit variable architectural features, which are interpreted to result from the evolution of
29 gravity-flow types as the 4th-order sea-level fluctuates. Thus for the Niger system, at time scales >0.1
30 Myr, the allogenic sea-level change is considered to have played a major role in controlling the
31 submarine fan architecture at the scale of submarine fan systems and complex sets, whereas
32 autogenic effects on the submarine fan architecture may increase and become dominant on time
33 scales <0.1 Myr.

34 **Keywords:** submarine fan system; depositional architecture; high-frequency sea-level change; Niger
35 Delta Basin

36 **1. Introduction**

37 Submarine fan systems have been the subject of extensive studies because of their enormous
38 hydrocarbon potential. Due to the multiple triggering mechanisms of deepwater sediment gravity

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