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3D structure of detachment faulting and related tectono-sedimentary processes in the SE South China Sea

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Before Break-Up, the opening of the South China Sea Passive Margin (SCS) was characterized by a wide rift mode during Cenozoic rifting. Such wide extensional margin (>600 km wide) is controlled by a set of hyper-extended sub-basins separated by basement highs.

These basins infill recorded a polyphased extensional deformation hence resulting in complex 3D sedimentary evolution. Based on a recent industrial 3D seismic reflection survey along the Sabah area (southern margin of the SCS), this contribution aims to investigate the detailed 3D geometries of extensional structures as well as their control on the overlying successive sedimentary sequences and relation to crustal deformation.

We mapped and analyzed several crustal-scale rolling hinge structures controlled by a series of low-angle normal faults. Deeper crustal levels are likely exhumed along the core of these rolling hinge structures, separated by extensional allochthones blocs of upper continental crust. Our structural analysis enables us to identify three main extensional phases corresponding to distinct sedimentary packages: (1) a synrift sequence 1 controlled by small offset normal faults formed during incipient rifting; (2) an intermediate synrift sequence 2 recording the development of extensional detachment faults. (3) a thick syn-rift sequence 3 recording a continuation of extension along the detachment faults resulting in the dismembering of the syn-
rift sequence 2. Intra-basement seismic reflectors dipping towards the north-west are observed, onto which extensional structures often seem to root. Some of these reflectors are interpreted as interleaved thrust sheets from a dismantled accretionary wedge of the former Mesozoic active margin (Yenshanian magmatic Arc).

Our results provide new key observations on the 3D mechanisms of detachment faulting and its control on sedimentary evolution as well as coeval crustal deformation. 3D approach throw some light on the detailed geometries of a metamorphic core-complex in relation with crustal boudinage, shear zones and lower/middle crust exhumation below the syn- rift sediments. These geometries can be compared to those described in the Basin and Range province or the Aegean Sea. Consequently, our results have implications for our understanding of rift and breakup mechanisms of marginal basins as a whole.