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Evolutionary model of the oblique rift basins- Central African Rifts

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The geometry of oblique-rifting basin is strongly related with the angle (α) between the trend of rift and that of regional major extensional stress. The main purpose of this study is to investigate characteristics of geometry and kinematics of structure and tectono-stratigraphy during basin evolution of Central African Rifts (CAS). In this study, we simulated the formation of oblique-rifting basin with Particle Flow Code 3-Dimensions-(PFC 3D) and compared the simulation results with the tectonic settings of a series of basin in CAS.
CAS started to develop in Early Cretaceous (130Ma) and lasted until the Late Cretaceous (85Ma-80Ma). The following collision between the African and Eurasian plates imposed compressional stress on CAS and folded the strata in the rift basins. Although the characteristics of rift basin formation remain controversial, palinspastic sections constructed in this study show that, in the Early Cretaceous, the rift basins are mainly characterized by normal faults and half-grabens. In the Late Cretaceous, the morphology of the rift basins was altered by large-scaled tectonic compression with the active Borogop Fault of regional scale. Also, en echelon trend of normal faults in the basins were measured and the angles between the trend with that of the rift axes of each basin were demonstrated, indicating that the development of CAS was affected by the regional extensional stress with a dextral component during the rifting process and, therefore, the rift basins were formed by oblique-rifting.
In this study, we simulated the oblique-rifting basin model of various α with Particle Flow Code 3-Dimensions-(PFC 3D). The main theory of PFC 3D is based on the Discrete Element Method (DEM), in which parameters are applied to every particle in the models. We applied forces acting on both sides of rift axis, which α are 45°, 60°, 75° and 90° respectively, to simulate basin formation under oblique-rifting process.
The study results of simulation models indicated that: 1. the en echelon faults in the rifting basins are sub-orthogonal to the trend of major extensional stress; 2. the density of en echelon faults in rift basins decreases gradually when α is close to 45°; 3. in these models, the α angles, which are 45°, 60°, 75° and 90°, correspond to the angles of 0°, 15°-20°, 25°-30° and 50°-60° between the rift trend and en echelon faults trend. According to the simulation results, the possible dircetions of major extensional stresses during the formation of CAS can be speculated.

Key Words: Central African Rifts, oblique-rifting, DEM, PFC 3D