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Fault System Evolution and Its Influences on Buried-hills Formation in Tanhai Area of Jiyang Depression, Bohai Bay Basin, China

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Buried-hills, paleotopographic highs covered by younger sediments, become the focused area of exploration in China in pace with the reduction of hydrocarbon resources in the shallow strata. A number of buried-hill fields have been discovered in Tanhai area located in the northeast of Jiyang Depression within Bohai Bay Basin, which provides an excellent case study for better understanding the structural evolution and formation mechanism of buried-hills. High-quality 3-D seismic data calibrated by well data makes it possible to research deeply buried erosional remnants. In this study, 3-D visualization of key interfaces, seismic cross-sections, fault polygons maps and thickness isopach maps are shown to manifest structural characteristics of buried-hills. Balanced cross-sections and fault growth rates are exhibited to demonstrate the forming process of buried-hills. The initiation and development of buried-hills are under the control of fault system. According to strike variance, main faults are grouped into NW-, NNE- and near E-trending faults. NW-trending main faults directly dominate the whole mountain range, while NNE- and near E-trending main faults have an effect on dissecting mountain range and controlling the single hill. In addition, secondary faults with different nature complicate internal structure of buried-hills. During Late Triassic, NW-trending thrust faults formed in response to regional compressional stress field, preliminarily building the fundamental NW-trending structural framework. Until Late Jurassic-Early Cretaceous, rolling-back subduction of Pacific Plate and sinistral movement of Tan-Lu Fault Zone (TLFZ) integrally converted NW-trending thrust faults into normal faults. The footwall of NW-trending faults quickly rose and became a large-scale NW-trending mountain range. The intense movement of TLFZ simultaneously induced a series of secondary NNE-trending strike-slip faults, among which large-scale ones divided the mountain range into northern, middle and southern section. After entry into Cenozoic, especially Middle Eocene, the change of subduction direction of Pacific Plate induced the transition of regional stress field. Near E-trending basin-controlling faults developed and dissected previous tectonic framework. The middle section of mountain range was further separated into three different single hill. Subsequently, the mountain range was gradually submerged and buried by overlying sediments, due to regional thermal subsidence. Through multiphase structural evolution, the present-day geometry of buried-hills is eventually taken shape.