Structure styles and tectonic evolution of the Abrolhos Sub-Basin, Perth Basin, Western Australia

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Based on examination and re-interpretation of 2D seismic and well data, three groups of faults were recognized in the Abrolhos Sub-basin: a) major normal faults transecting the Permian, Triassic and Jurassic, b) small normal faults developed in the Early Permian, and c) small normal faults developed in the Triassic and Jurassic.

The major faults usually have large offsets and strike north-northwest. Most of these are at intra-basin boundaries, subdividing the area into an eastern margin, an eastern graben, an eastern horst, a central depocentre, a western horst and a western graben. Mostly these trend north-north-west, except for the eastern horst, which trends north-south and extends southward to join the western horst.

Some small faults developed in the Early Permian. They usually dip east and show strong syn-depositional character, indicating block rotation. These faults terminate at the Late Permian Unconformity. Other small faults developed in the Triassic and Jurassic. They usually dip west. These late faults and the major faults terminate at the Early Cretaceous Unconformity.

The Abrolhos Sub-Basin has undergone two main rifting stages. In the Early Permian the basin was initiated under east-northeast–west-southwest extension, resulting in development of north-northwest striking normal faults. During the Jurassic, northwest-southeast extension commenced. The oblique extension resulted in re-activation of some pre-existing north-northwest striking faults and generation of new strike-slip faults. Each rifting stage was followed by basin inversion due to the break-up of Gondwana. This resulted in regional uplift and formation of the two key regional geological boundaries: the Late Permian Unconformity and the Early Cretaceous Unconformity.