AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

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Principal Tectonic Events in the Exmouth Sub-basin and their Relationship to Palaeo-stresses along the Australian Northwest Shelf

A structural interpretation based on 3D seismic reflection data has been integrated with the geohistory modeling of well data in order to extract the temporal and spatial variations in tectonic subsidence and strain rates through time for the Macedon and Pyrenees fields, Exmouth Sub-basin, Australia. The link between the two independent analyses is critically assessed to determine correlations and ambiguities in the relevant interpretations. A model of field evolution has been developed through constraining structural mechanisms and their subsequent sedimentary processes, and by quantifying the dominant tectonic processes responsible for their formation. This model has then been assessed with a regional analysis of the Northwest Shelf in order to model the changing intra-plate stresses through time and their link with changing deformation patterns and in particular to gain a predictive framework to distinguish between low and high-integrity fault traps. Focus is given to determining the styles and timing of deformation and from this extracting an analysis of the prevailing tectonic forces. From this, the structure and morphology of the fields have been assessed with respect to the relationship between the faulting styles, timing and spatial distribution, and the modeled subsidence and uplift profiles from well data to define periods of structural activity during basin development. The resulting palaeo-stress, structural data and fault kinematic interpretation, have provided important boundary conditions on evolving plate tectonic processes that affect the continental margin.