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Influence of Structural Position on Fracturing in the Austin Chalk

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ABSTRACT

Outcrops of Upper Cretaceous Austin Chalk in south-central Texas (San Antonio area) were investigated to produce a baseline assessment of fracture network characteristics and relationships with respect to regional structural position. This area represents the nearest outcrop exposures of Austin Chalk to significant active drilling in the Eagle Ford Formation and overlying Austin Chalk. These Austin Chalk exposures are within the Balcones Fault System, which is the updip portion of the Gulf of Mexico marginal fault system. In the study area, the fault system consists of a right-stepping en echelon array of generally northeast-striking normal faults, within a major relay structure—the San Antonio relay ramp—between the Haby Crossing Fault to southwest and the Balcones Escarpment Fault to the northeast. Similar extensional fault patterns exist in the subsurface Austin Chalk in the exploration and production area. Reconnaissance field investigations at 36 stations within a ~20 km by 40 km region in the San Antonio area document significant variability in failure modes (extension versus shear failure), fracture orientations, and fracture intensity (or spacing). Incompetent beds within the Austin Chalk localize fracture terminations and in some cases have caused fault (shear fracture) dip change (refraction). Our observations indicate that fracture network characteristics are related to mechanical rock properties and structural position, with fault and fracture orientations and timing relationships reflecting stress rotation and structural overprinting within the San Antonio relay ramp. These observations are directly relevant to subsurface interpretation and hydrocarbon production from the Austin Chalk, particularly for exploitation of the Austin Chalk as a self-sourced or conventional fractured reservoir.

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