Fractures and Faults within the Cretaceous Section of the San Juan Basin

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North-south trending Laramide compressive stresses, created by southward indentation of the San Juan dome and northward indentation of the Zuni uplift, created pervasive fracturing within the Cretaceous strata that fill the San Juan Basin. Contemporaneous right-lateral transpressive wrench motion due to northeastward translation of the basin was concentrated at the basin margins (Nacimiento uplift and Hogback monocline on east and west edges respectively), with smaller amounts of shear within the basin along inherited basement faults, which propagated upward into the overlying strata as local linear fracture swarms.

Laramide fractures include a set of regional vertical extension fractures, striking generally N-S to NNE-SSW but with significant local variations. This set is present in the outcrop and subsurface within sandstones in both the Mesaverde Group and Dakota Sandstone. The compositionally immature Mesaverde sandstones typically contain relatively long, irregular extension fractures, whereas the quartzitic Dakota sandstones contain both short, sub-parallel, closely spaced, extension fractures, and local intersecting conjugate shear-plane pairs. Outcrops typically display secondary cross fractures but these are rare in the subsurface. Bioturbation and minimal cementation locally inhibited fracture development in both formations, while bedding planes and lithology contrasts typically arrested vertical fracture growth.

Outcrop analogs to the subseismic structures created by right-lateral transpressive motion within the San Juan Basin are present in northeast-striking normal faults of the Rio Puerco Fault Zone. These faults range from a couple hundred yards to over 2 miles in length. Dip-slip displacements vary from tens of meters to centimeters. Closely spaced conjugate fractures with no obvious offset are present locally. Characteristics of these fault zones include: 1) well-developed fault-parallel fractures, 2) an intensely fractured fault core, 3) lateral fault terminations that extend into corridors of fault- parallel fractures with no offset. While the regional fractures make production within these tight gas sands possible, the fault-related zones of enhanced fracturing are probably “sweet-spot” areas of enhanced production.