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Grayburg Formation (Permian, Guadalupian) Reservoir Facies and Non-Reservoir Facies, McElroy Field, Permian Basin, West Texas

McElroy field, discovered in 1925, has produced over 400 MMBO from 2.2 BBOIP. The field has undergone primary recovery, waterflood pilots, field-wide waterflood, CO2 and steam-injection pilots. It has been infill drilled to 10 acre spacing, with some 2.5 acre spacing.

Grayburg Formation, deposited on a tectonically modified carbonate ramp, can be divided into lower and upper sequences that form a composite sequence. Lower sequence contains the main reservoir and a smaller reservoir. Upper sequence contains a series of porous intervals that form the remainder of the reservoir. Highstand Systems Tracts contain reservoir facies, whereas non-reservoir facies are in Transgressive Systems Tracts. The composite sequence includes at least four high-frequency sequences and ~70-80 shallowing-upward cycles.

Reservoir facies are composed of evaporitic, dolomitized, skeletal, peloidal packstone/grainstone, with micro, intercrystal, interparticle, microvugular, vugular, and fracture porosity. Mid-Tertiary meteoric recharge, into the Permian Basin, caused deep-burial dissolution of evaporite cement and dolomite and solution-widened all pore types, including fractures.

Non-reservoir facies are composed of dolomitized, evaporite cemented, fusulinid, peloidal packstone/grainstone and ooid packstone/grainstone. Some fusulinid, peloidal packstone/grainstone contain low reservoir quality. Cores and borehole-imaging logs reveal that some solution-widened fractures were recemented by gypsum cement and that anhydrite nodules hydrofractured during conversion from anhydrite to gypsum.

Updip, evaporite-cemented carbonates form the lateral stratigraphic trap. Subsequent burial dissolution etched one mile updip into the stratigraphic trap and created partially effective porosity, which expanded the field width.