

### **Integrated Subsurface Imaging in a Complex Geological Setting**

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The paper focuses on subsurface imaging of siliciclastic rocks on steam-affected-merged 3D seismic dataset of Mid-Miocene Temblor Formation in the Coalinga heavy oil reservoir of California. The objective is to identify, delineate, and demarcate reservoir heterogeneities by seismostratigraphic and seismogeomorphic analysis in the geologically complex San Joaquin basin. The San Andreas Transforms greatly controlled the basin evolution causing substantial reservoir heterogeneity while changing the depositional environment from shallow marine to near-shore fluvial and dissecting the reservoir interval by two unconformities.

The seismic dataset exhibits erratic, distorted reflection strengths and amplitudes as it was acquired during steam-injection-aided production. A Gassman fluid substitution analysis suggested a 27% P-wave velocity decrease in steam-saturated zones, a factor severely affecting the data quality. Seismic to well log ties were problematic due to the resulting statics, wavelet changes, and line mismatches. Flattening the dataset on a deeper horizon, however, allowed mapping of the internal unconformities and well ties which were crucial for seismostratigraphic sequence identification.

Geobody visualization of seismic attributes brought out two distinct, laterally and vertically extensive, porous, and interconnected facies tracts interpreted as incised valley fills and tidal-to-subtidal deposits as evidenced by bright, steam related amplitudes. Seismostratigraphic and seismogeomorphic interpretation reveal, hitherto unreported, two prominent channel-systems, recut and restacked in the central part of the area. The same are identified on seismic as high instantaneous attributes and are collocated with high gamma sand sequences as evident on logs and cores. The deeper channel, confined between the unconformities in the southwestern and northwestern part of the study area, shifts toward SSE with depth. It is scattered in the western-central portion. The shallower channel, originating in the southwestern part and running nearly parallel to the reservoir top, follows the bottom unconformity toward the north while shifting toward ES-ESE with depth. In the central part, it is incised by the top unconformity to form a run-off channel.

The investigation compartmentalizes the reservoir into channel, non-channel, and unconformity-bounded subunits which will help in designing of infill wells and steam injection plan for optimum production.