

PERMEABILITY DETERMINATION

CTV VI

Model Permeability

Static Modeling Permeability

Wireline log data were acquired with measurements that include but are not limited to spontaneous potential, natural gamma ray, borehole caliper, compressional sonic, resistivity, neutron porosity, and bulk density. Wells with log data are shown in **Figure 1**

Formation porosity is determined one of two ways: from bulk density using 2.65 grams per cubic centimeter (g/cc) matrix density as calibrated from core grain density and core porosity data, or from compressional sonic using 55.5 microseconds per foot ($\mu\text{sec}/\text{ft}$) matrix slowness and the Wyllie time average equation. The compaction coefficient (Hilchie, 1978) was calculated using a depth dependent shale travel time.

Volume of clay is determined by spontaneous potential and is calibrated to core data.

Log-derived permeability is determined by applying a core-based transform that uses capillary pressure porosity and permeability along with clay values from XRD or FTIR. **Claimed as PBI**

The transform and core data is illustrated in **Figure 3**.

Figures 4a and 4b show the porosity and permeability histograms for **Claimed as PBI** Injection Zones. Porosity is derived from open-hole well log analysis and permeability is a function of porosity and clay volume. Volume of clay is determined by spontaneous potential and is calibrated to core data. Porosity and volume of clay are distributed using sequential Gaussian simulation (kriging) within the static model and permeability is populated by applying the porosity-volume of clay-permeability transform at each cell. **Figure 5** shows the distribution of permeability and porosity in the static model.

Claimed as PBI

Figure 1. Location of wells with open-hole log data used to develop static and computational models.

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Figure 2. Location of wells with core data used for permeability transform and constitutive relationships

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Figure 3. Permeability transform for CTV VI Injection zones. Claimed as PBI

The black data points are core from a well specific to the CTV VI model area. Data shown is limited to those core data points representing sand, with a clay volume from XRD of less than 25% clay and exclude any percussion sidewall derived permeability values.

Claimed as PBI

Figure 4a. **Claimed as PBI** Injection Zones porosity and permeability distribution used in static model.

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Figure 4b. Claimed as PBI Injection Zones porosity and permeability distribution used in static model.

Claimed as PBI

Figure 5. Sections through the static grid showing the distribution of porosity and permeability in the reservoir.