Please fill in the name of the event you are preparing this abstract for.	International Petroleum Technology Conference
Please fill in your 5-digit IPTC manuscript number and IPTC Control number.	Top Rated Paper from IPTC Sponsoring Societies
Please fill in your abstract title.	Integrated Reservoir Characterisation of the Wattenberg Field, Colorado, USA

Please fill in your author name(s) and company affiliation.

Given Name	Surname	Company
Jacquelyn	Daves	Colorado School of Mines
Ning Daisy	Yanrui	Colorado School of Mines
Ahmed	Alfataierge	Saudi Aramco
Sheila	Harryandi	Colorado School of Mines
Matthew	Copley	Colorado School of Mines
Jim	Simmons	Colorado School of Mines
Ali	Tura	Colorado School of Mines

Abstract

Objectives/Scope:
This study focuses on dynamic reservoir characterization of the Niobrara unconventional resource in the DJ basin. Our work on hydraulic fracture simulations presents insight into how to properly incorporate reservoir heterogeneity. The hydraulic fracture simulation results are history matched and input into a flow simulator and ran for 2 years of production. The results are then integrated with both microseismic and time-lapse multi-component seismic. In addition, a seismic based facies inversion gives insight into future well planning.

Methods, Procedures, Process:
A 3D geomechanical model incorporates faults, lithofacies changes and variation in reservoir and elastic properties. This utilized seismically derived horizons, well log derived velocity model, facies classification from core description and, petrophysical analysis from well logs. A 3D numerical model was populated with the geomechanical model for simulation. 3D hydraulic fracture (HF) simulation illustrates the effect of geological heterogeneity on fracture lengths, heights, and conductivity, while identifying intervals with bypassed potential. History matching verify the model. Hydrocarbon flow simulation is run for 2 years of production. The HF and flow simulations are integrated with 4D seismic responses and microseismic events.

Results, Observations, Conclusions:
Through our analyses, we have determined that landing depth and reservoir facies greatly impact production performance. Due to structural complexity and geological heterogeneity the placement of horizontal wells has been variable. Hydraulic fracture efficiency is significantly greater in chalky zones than marl zones. The wells that have landed within the chalk intervals are the highest performers and the wells that intersect marl zones are deemed bypass pay. This study identifies valuable geophysical techniques and processes that aid in the exploitation and exploration of this reservoir; ways to utilize geophysics to improve our understanding of the reservoir and guide the drill bit to boost production. Our conclusions incorporate results of seismic facies inversion, microseismic, 4D seismic, hydraulic fracture simulations, the integration of the hydraulic fracture interpretations into the flow simulator and EOR modeling. The main conclusions: Hydrocarbon production varies based on landing depth and facies in the reservoir. A heterogeneous fracture model as input to the production simulation improved the history

matching results (compared to a homogenous fracture model) as the reservoir is not uniformly stimulated because lateral and vertical geologic heterogeneities control fracture conductivity.

Novel/Additive Information:

Our approach to reservoir characterization utilizes the integration of geology, engineering and geophysics through the use of a multitude of datasets. We present updated modeling methods for simulation that greatly improve results. In addition, we detail ways to utilize geophysics to guide the drill bit and design completions.