# The Occurrence of Biogenic Gas in the Denver Basin

COLORADO SCHOOL OF MINES
MUDTOC

**WITTAYA IMURAI (KEN)**

**MS SPRING 2024**

# OUTLINE

- Background & Experiences
- Interested topic
- Propose study topic area
- Study objectives

# BACKGROUND & EXPERIENCES

Oil Field Exploration and Development

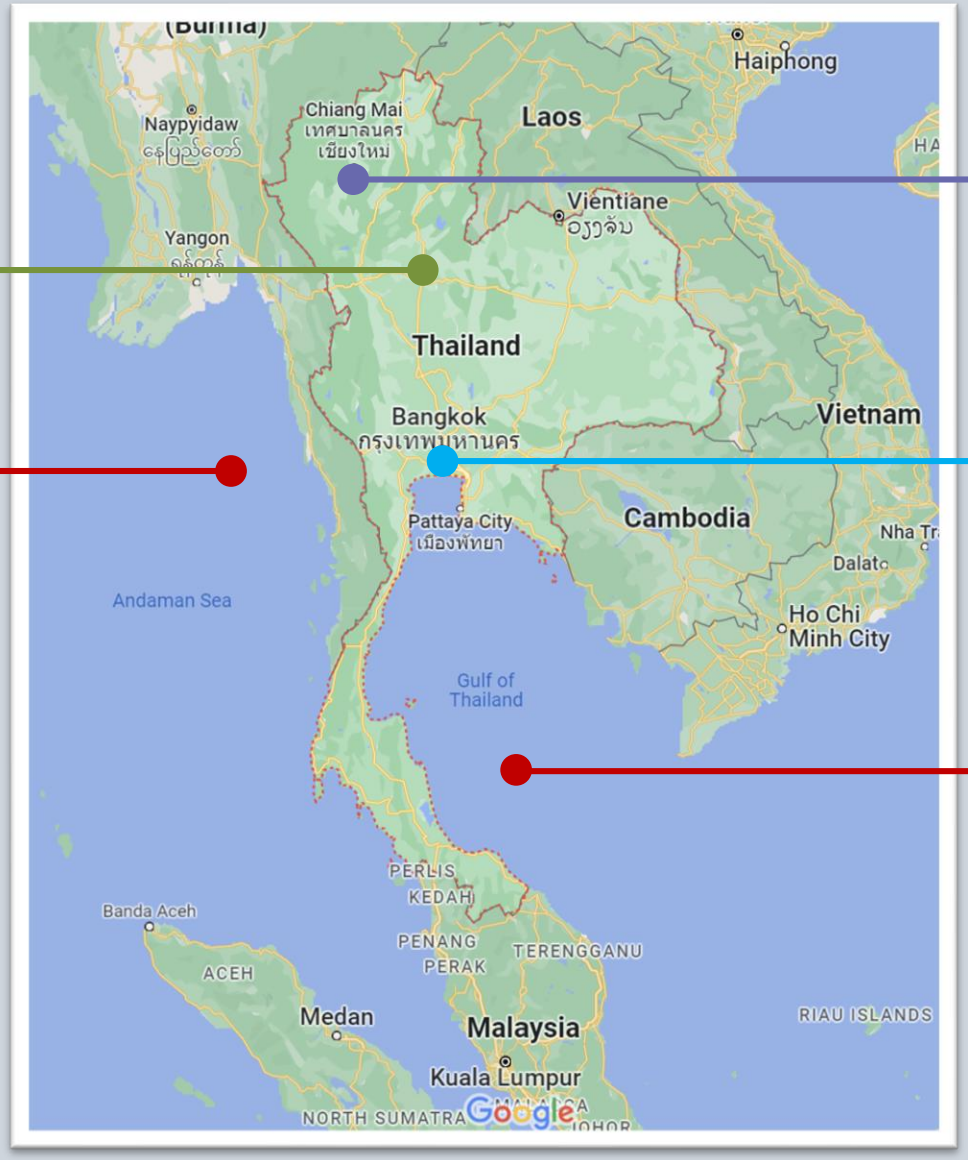
Onshore Thailand

~ 2 years

Exploration and Development Gas Field

Gulf of Moattama, Myanmar

~ 2 years




CHIANG MAI UNIVERSITY

Bachelor's degree in geology 2015

PTTEP

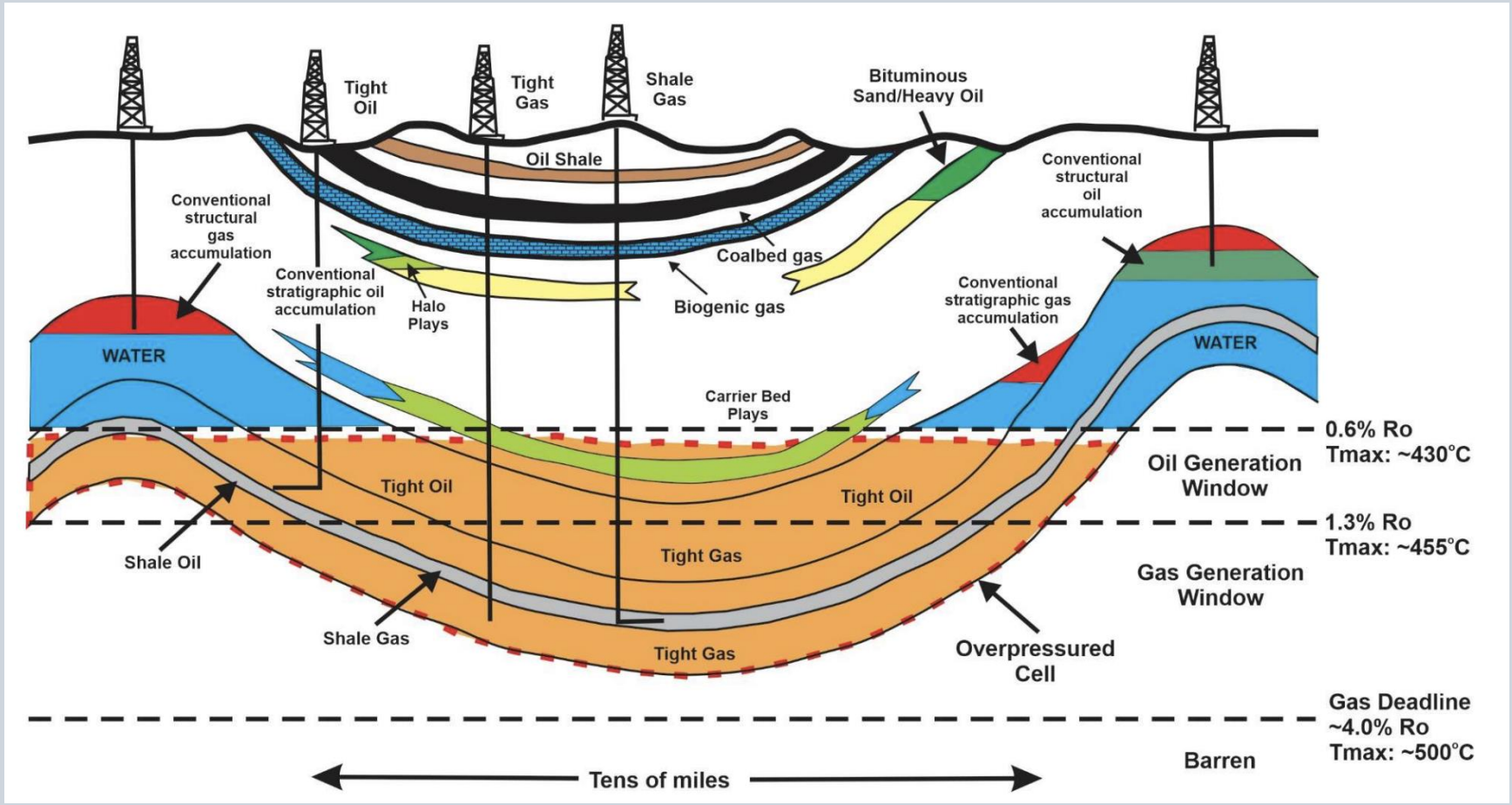
Working with PTTEP as Geologist since 2015

Gas Field Development

Gulf of Thailand

3 years

# INTERESTED TOPIC




Sonnenberg, A. S. (2023)

Biogenic Charge:

- Source rock Richness
- Maturity Boundary

Thermogenic Charge:

- Source rock Richness
- Maturity Boundary

# INTERESTED TOPIC

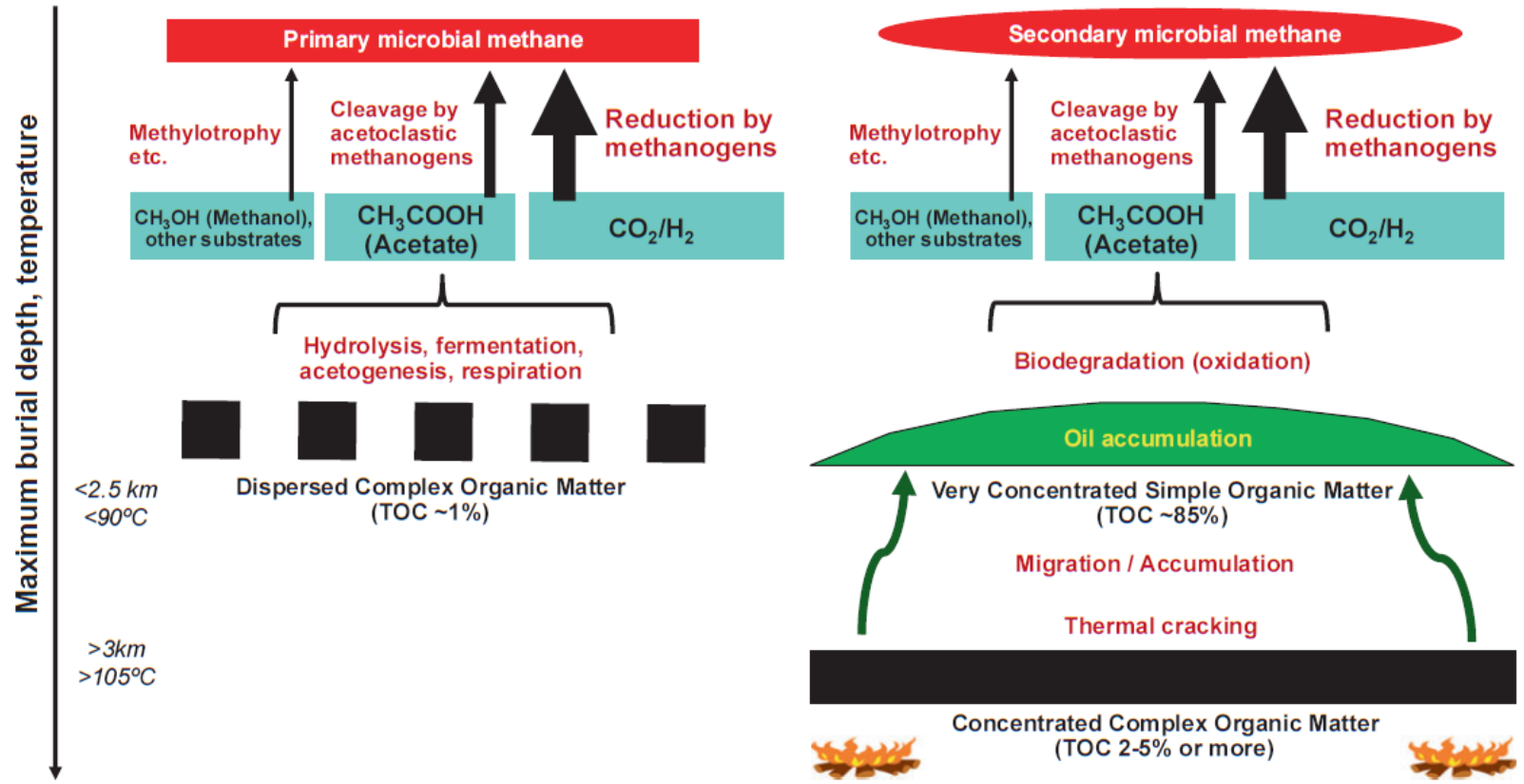


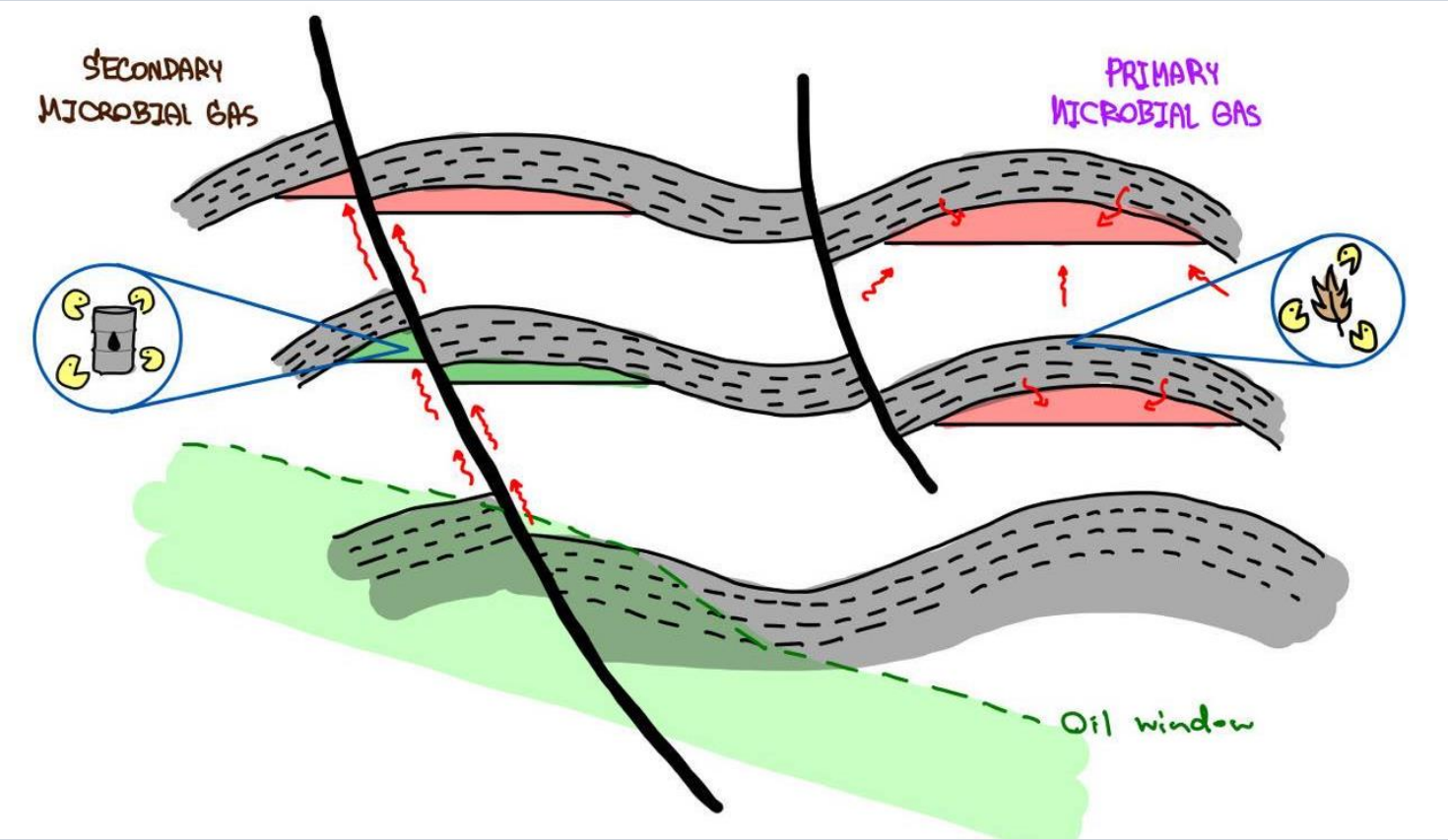

**Fig. 1** Formation of primary microbial methane (left panel) and secondary microbial methane (right panel) in the subsurface. Thickness of the black arrows indicates the assumed relative significance of methanogenic pathways

Milkov, V. A. (2018)

Biogenic Charge:

- Source rock Richness
  - Primary VS Secondary
- Maturity Boundary
  - Bacteria Accumulation

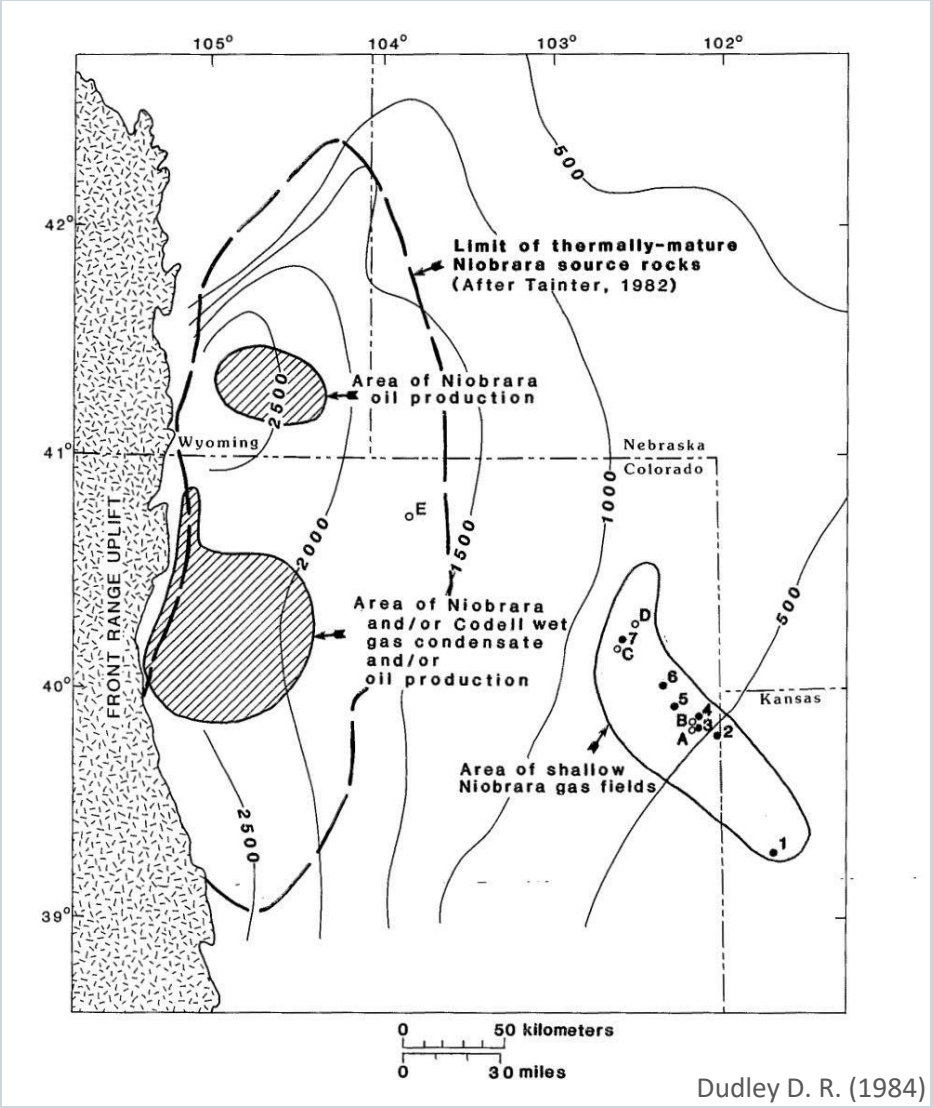
# INTERESTED TOPIC




**Kitchen Area:**

- Primary Microbial Gas: Bacteria accumulation + High organic matter area
- Secondary Microbial Gas : Bacteria accumulation + Hydrocarbon accumulation areas

# PROPOSE STUDY TOPIC AREA




Dudley D. R. (1984)

**Table 3. Biogenic Gas Fields in Rocky Mountains, United States**

| State | Field | Producing Unit[1] | Depth (m) | $^{13}C_1$ (‰) | $C_1/C_{1-5}$ | |
|---|---|---|---|---|---|---|
| Colorado | Armel | Niobrara Fm. | 482 | −62.5 | 0.981 | Doubt? |
| | Beecher Island | Niobrara Fm. | 491-518 | −60.8 to −60.1 | 0.982 to .981 | |
| | Republican | Niobrara Fm. | 691 | −59.7 | 0.981 | |
| | San Luis basin | Alamosa Fm. | 300 | −70.2 to −69.7 | 0.999 to .998 | |
| | Vernon | Niobrara Fm. | 647 | −58.8 | 0.98 | |
| | Whisper | Niobrara Fm. | 842 | −54.7 | 0.976 | |
| Kansas | Wildcat | Niobrara Fm. | 328 | −65.4 | 0.993 | |
| Montana | Bell Creek | Muddy Ss. | 1,387 | −65.1 | 0.98 | Secondary |
| | Black Coulee | Eagle Ss. | 349 | −66 | 0.996 | |
| | Bowdoin | Bowdoin and Phillips ss.[2] | 224-445 | −72.3 to −68.6 | 0.997 to .995 | |
| | Cassady | Eagle Ss. | 385 | −70 | 0.998 | |
| | Cedar Creek | Eagle Ss. | 517 | −69.7 | 0.996 | |
| | Guinn | Eagle Ss. | 171 | −65.2 | 0.987 | |
| | Hardin | Frontier Fm. | 253 | −65.9 | 0.989 | |
| | Leroy | Eagle Ss. | 470 | −68.7 | 0.996 | |
| | Liscom Creek | Shannon Ss. Mbr. of Gammon Shale | 829 | −64.8 | 0.992 | |
| | Lohman | Eagle Ss. | 318 | −68.1 | 0.997 | |
| | Tiger Ridge | Eagle Ss. | 347-432 | −65.5 to −63.5 | 0.997 to .991 | |
| Nebraska | Wildcats | Niobrara Fm. and Dakota Ss. | 394-655 | −66.5 to −62.8 | 0.956 to .998 | |
| New Mexico | Wagon Mound | Dakota Ss. | 119-134 | −59.8 to −55.3 | 0.999 | |
| South Dakota | West Short | Shannon Ss. Mbr. of Gammon Shale | 417-605 | −70.0 to −69.7 | 0.996 to .998 | |
| | Pine Hills | | | | | |

[1]Cretaceous age except Pliocene or Pleistocene Alamosa Fm.
[2]Subsurface usage.

Dudley D. R., George E. C. (1981)

**Produced gas in Denver Basin has biogenic character**

- Low range of $^{13}C$ isotope from methane
- High methane ratio (very dried gas)

# STUDY OBJECTIVES

## Main Question

- What is the effect of primary and secondary microbial gas on exploration and development?

## Minor Questions (Depended on available data and time)

- What are the controlling factors for methanogen microbial accumulation?
- What are suitable criteria to evaluate biogenic gas source rock?

# Thank you to our Sponsors!

COLORADO SCHOOL OF MINES MUDTOC

## Sponsoring Member Companies

Antero Resources

Boomtown Oil

HELIS OIL & GAS, L.L.C.

Chevron

CIVITAS

FUNDARE RESOURCES COMPANY, LLC

GMT Exploration Company LLC

COTERRA

HALLIBURTON

OXY

Red Willow Production Company

TGS

EOG Resources

## In-Kind Supporting Companies

GeoMark

IHS

Mike Johnson & Associates

MJ LOGS

PRA Platte River Associates, Inc.

Schlumberger

ENVERUS


COLORADO SCHOOL OF
MINES
MUDTOC