

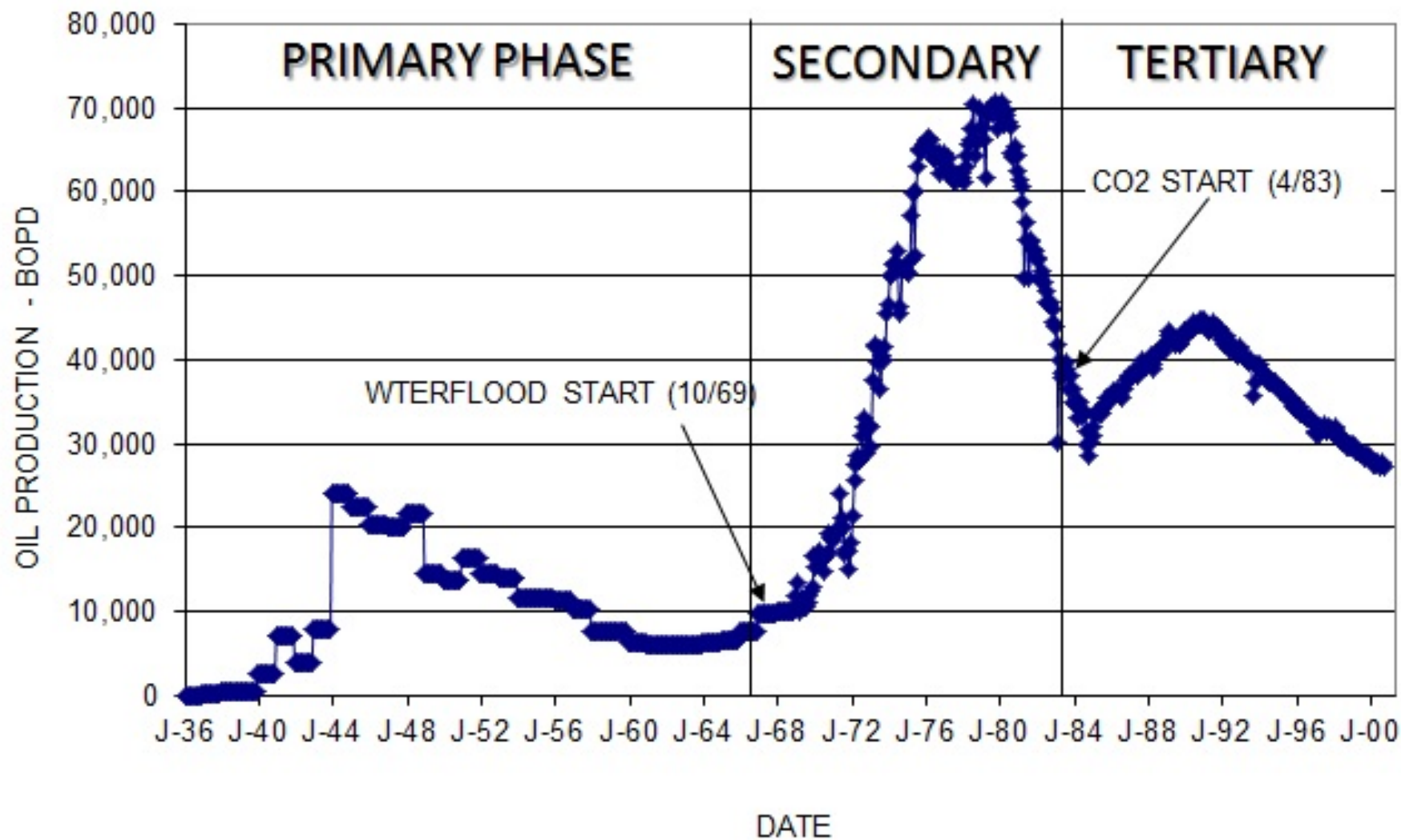
Introduction to Flooding in the Residual Oil Zones

Melzer Consulting, Advanced Resources International, and the Enhanced Oil Recovery Institute



Melzer Consulting

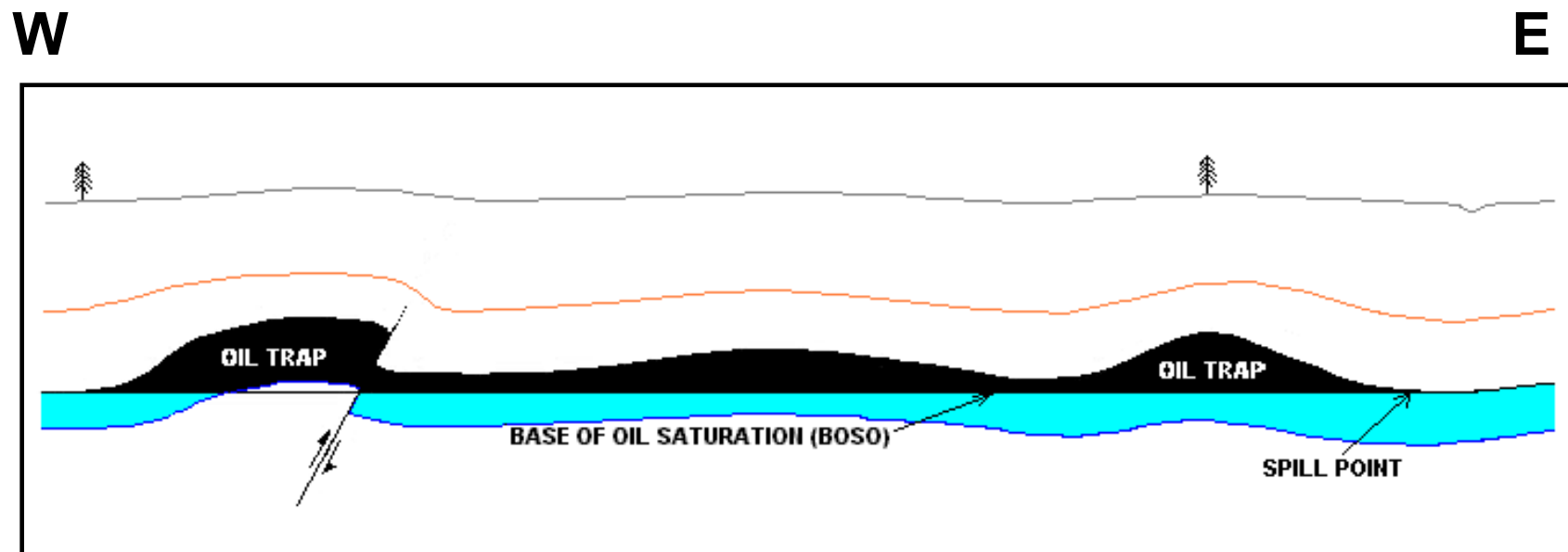
CLASSIC PRIMARY, SECONDARY (WATERFLOOD), AND TERTIARY (CO₂ FLOOD) HISTORY OF A PERMIAN BASIN FIELD



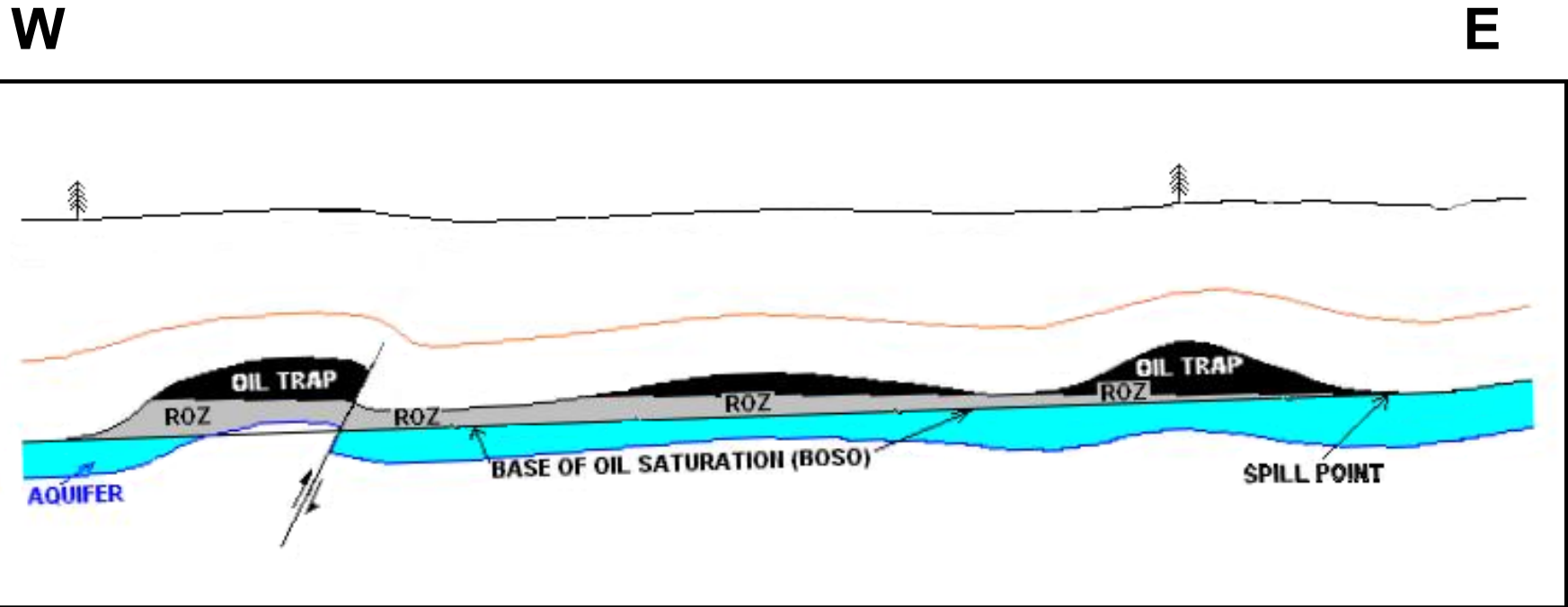
Mother Nature Can Waterflood Too!!

- 1) Deposition
- 2) First Stage Tectonics: Basin Subsidence,
Hydrocarbon Generation and Migration to a Trap
- 3) Second Stage Tectonics (Moving Oil Around):
 - I – Basinal Tilt,
 - II – Breached Seal,
 - III – Uplift and Lateral Sweep

Original Oil Accumulation Under Static Aquifer Conditions (A Hypothetical Example)



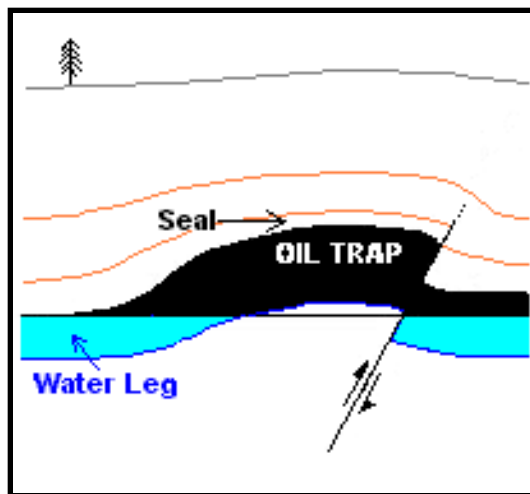
Original Accumulation Subject to a Westward Regional Tilt & Forming a ROZ



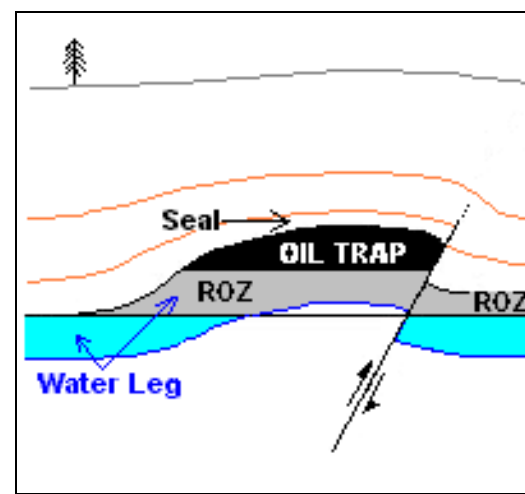
TYPE 1 ROZ

Original Accumulation with a Breached then Repaired Seal & Forming a ROZ

ORIGINAL



POST BREACH

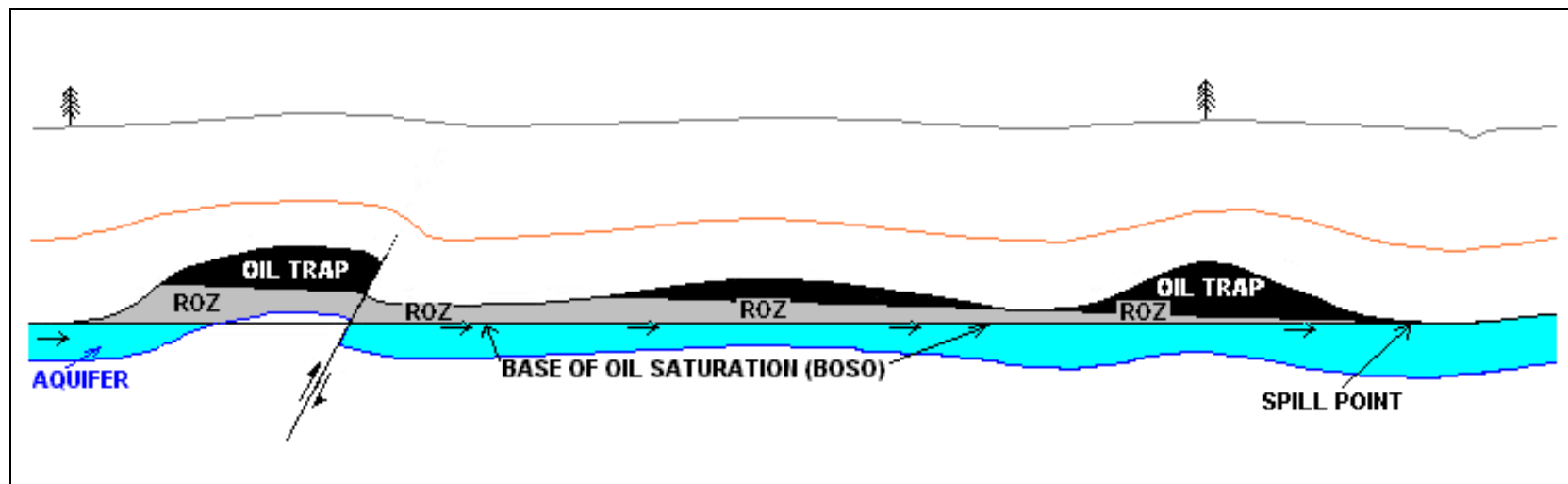


TYPE 2 ROZ

Change in Hydrodynamic Conditions, Sweep of the Lower Oil Column, Oil/water Contact Tilt, and Development Of The Residual Oil Zone

W

E



TYPE 3 ROZ

Note: Tilted Oil / Water Contact

Animations of the ROZ types are available at these three websites

www.residualoilzones.com

or

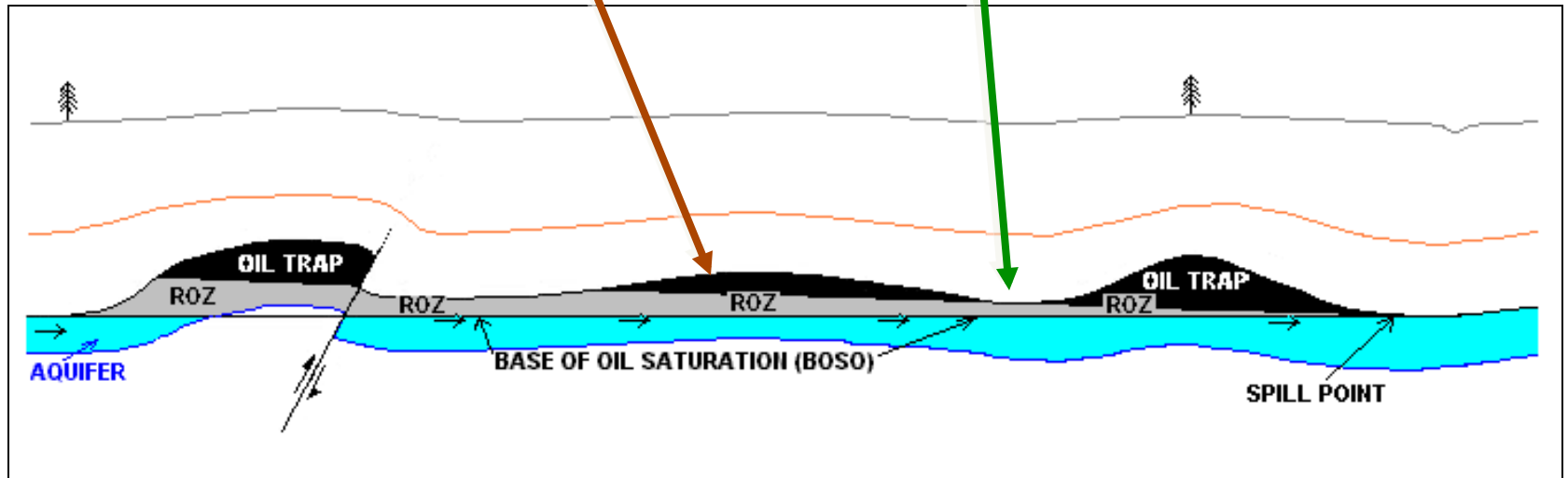
www.melzerconsulting.com

or

www.permianbasinCCS.org

ROZ Type 3

Brownfields and Greenfields



The Permian Basin Region of the Southwestern U.S. Major Carbonate Fields and Residual Oil Zone Fairways

Shading
Represents
Latest Mapping
of San Andres
ROZ “Fairways”

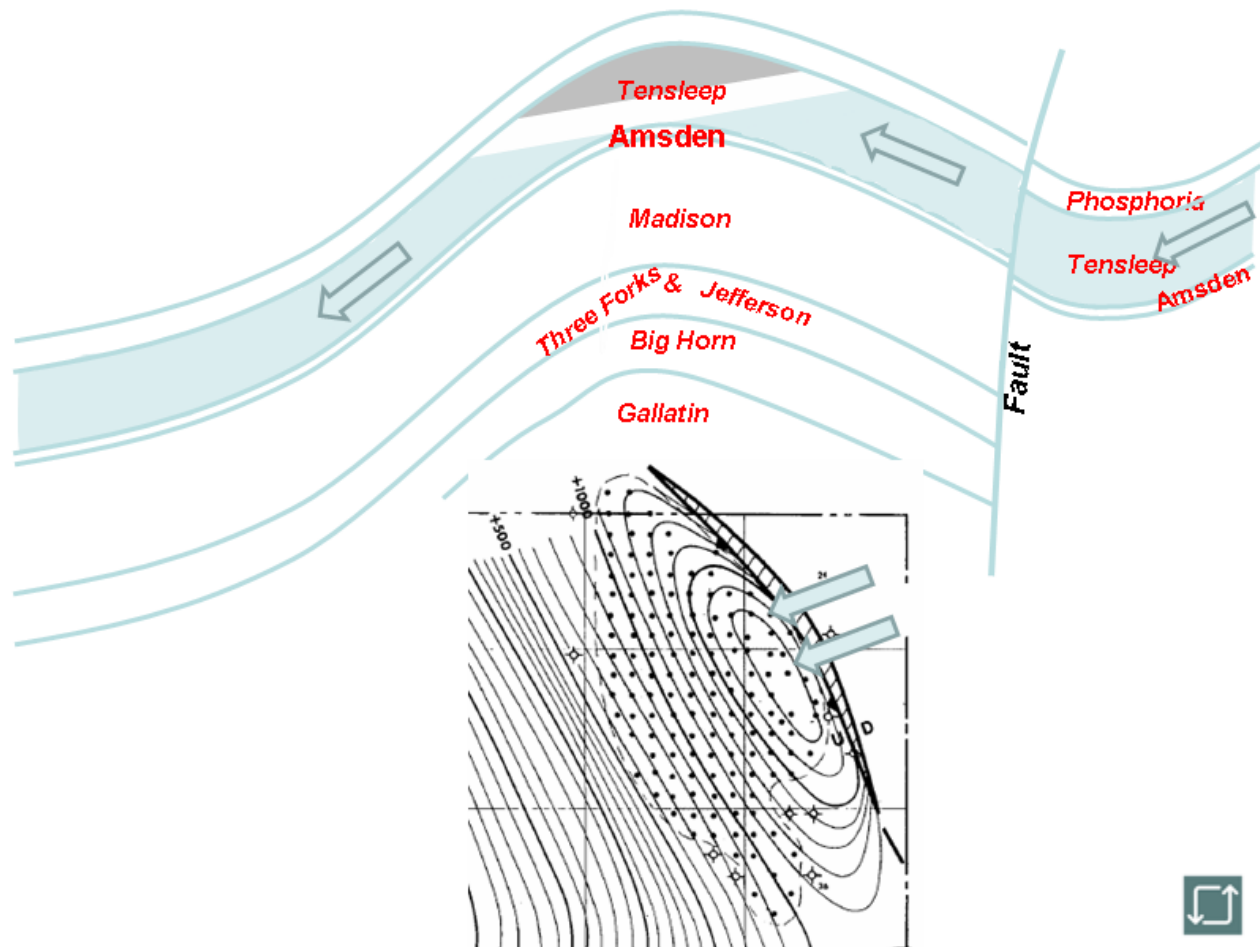


Research Sponsored by
The Research Partnership to Secure Energy for America

ROZs and Wyoming's Big Horn Basin

Dave Mohrbacher, Univ of Wy Enhanced Oil Recovery Institute

Reservoir with Tilted OWC





First Looks at the Size of the ROZ Prize

Vello Kuuskraa, Advanced Resources International

Calibrating the Oil Recovery Models and Estimating Technically Recoverable ROZ Oil – MPZ and ROZ Oil in Place (OIP)



56 fields in five major Permian Basin oil plays that have potential for significant TZ/ROZ resources were identified by ARI.

TZ/ROZ OIP in these 56 fields is estimated to be 30.7 Billion Barrels.

Field/Unit	MPZ OOIP (BB)	ROZ OOIP (BB)	No. of Fields	No. of MPZ Fields with CO ₂ -EOR Projects	No. of Fields with ROZ CO ₂ -EOR Projects
1. Northern Shelf Permian Basin (San Andres)	13.0	13.2	13	5	1
2. North Central Basin Platform (San Andres/Grayburg)	2.9	2.6	6	2	1
3. South Central Basin Platform (San Andres/Grayburg)	9.9	7.9	16	5	0
4. Horseshoe Atoll (Canyon)	5.4	2.9	10	4	2
5. East New Mexico (San Andres)	2.3	4.1	11	2	0
Total	33.5	30.7	56	18	4