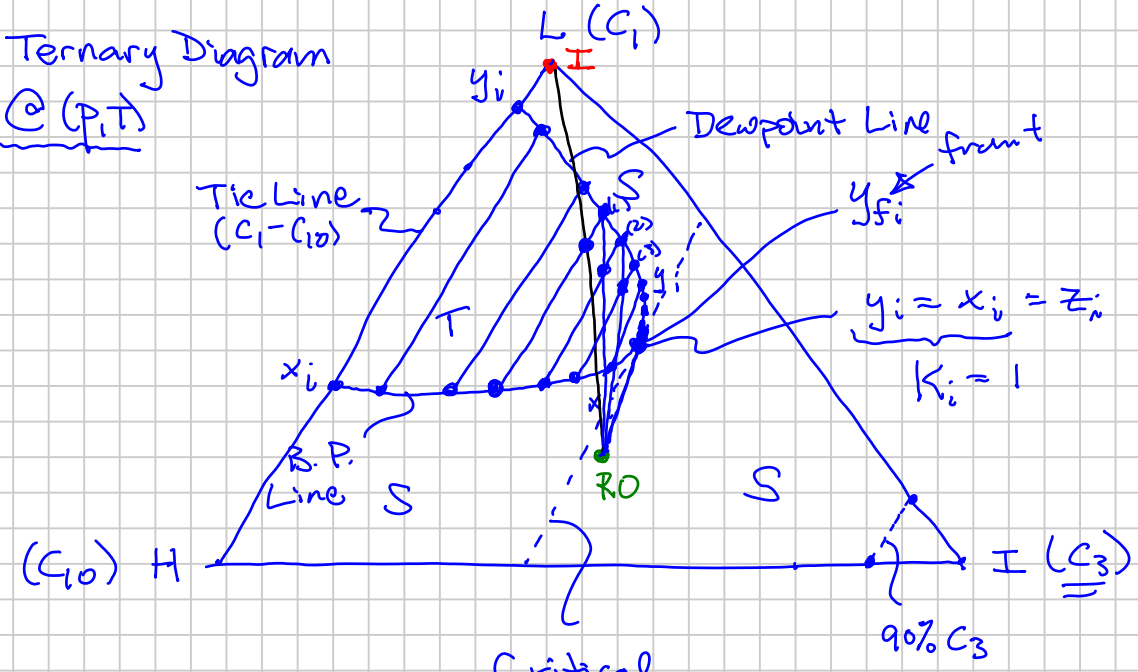
Gas Injection EOR
Developed Miscibility (Ch. 8)

Note Title 1/25/2018

Ternary Diagram @ (P, T)



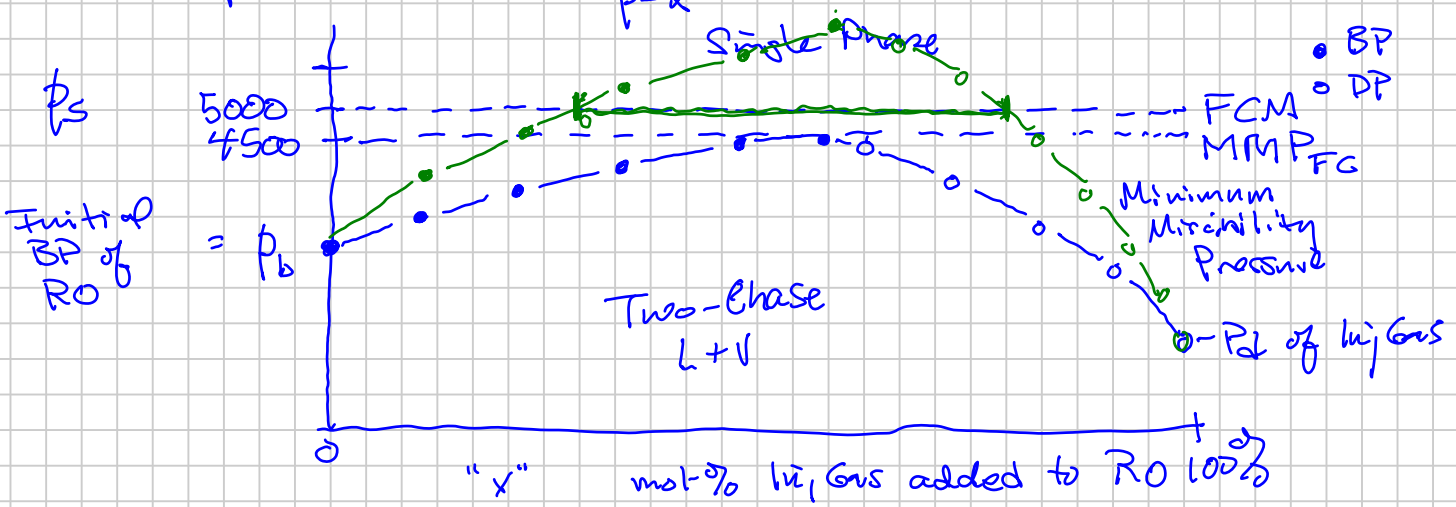
S: single phase
T: Two-phase

Equilibrium Ratio (K-value), $K_i \equiv \frac{y_i}{x_i}$

First Contact Miscibility:

Inj Gas always miscible w/ Res. Oil

— Gas Inj: C_2-C_3
— (Normal HC Gas Inj)



Developed Miscibility

Gas Injectant Reservoir Oil

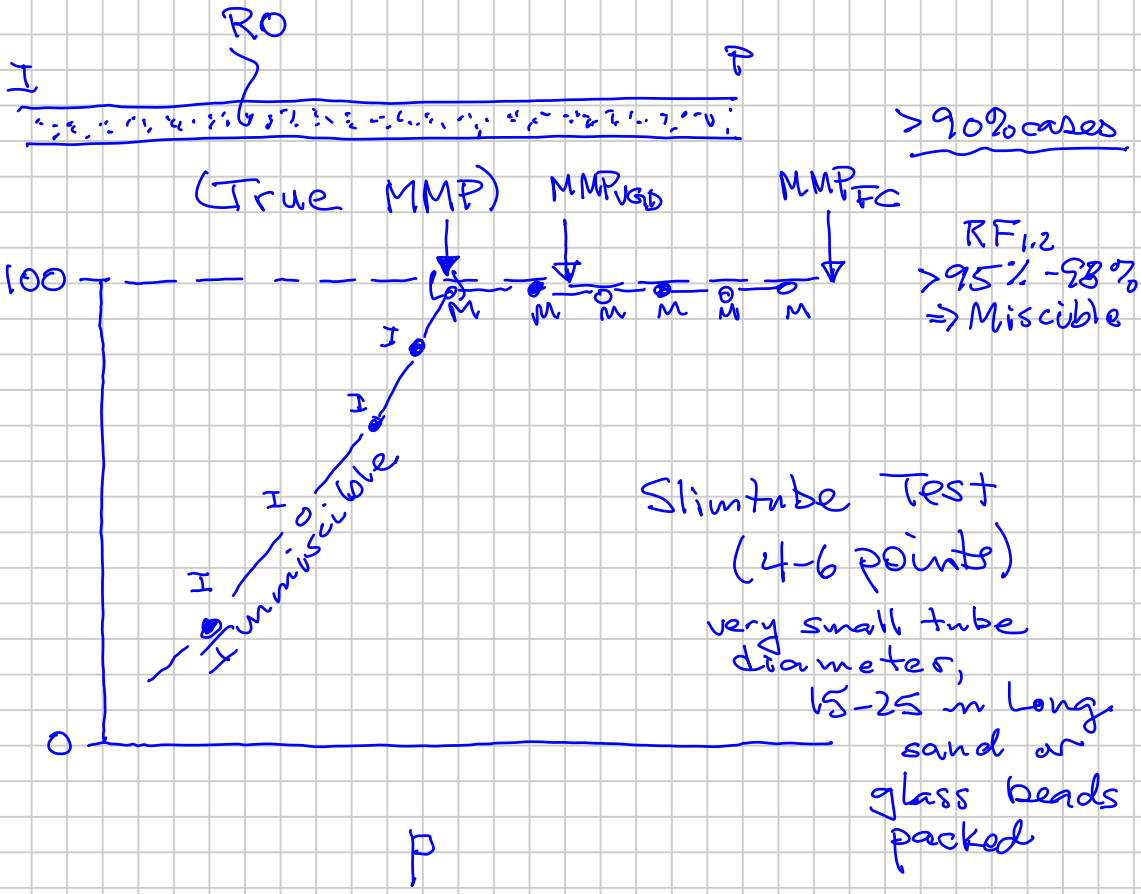
Vaporizing Gas Drive Miscible Process (VGD)

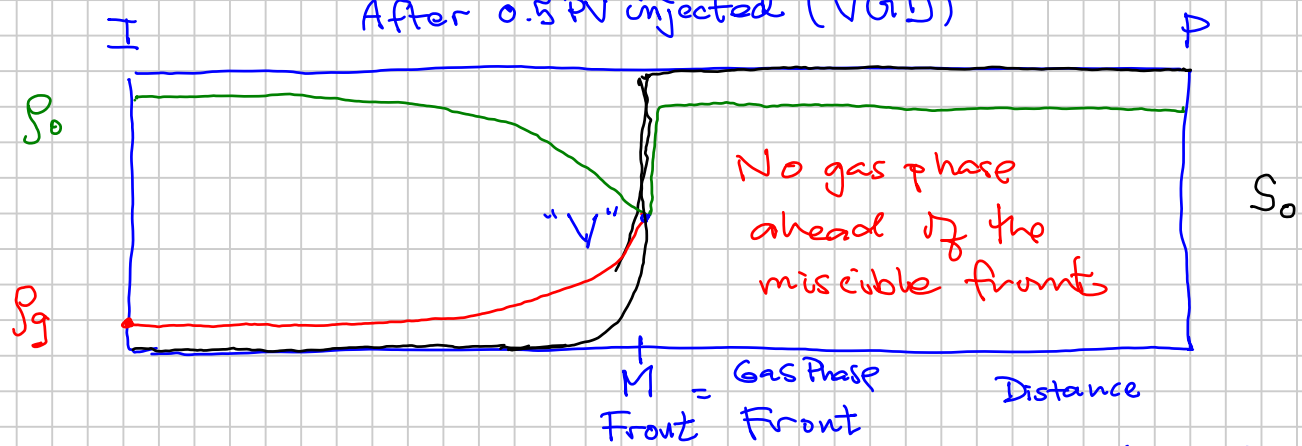
Inj. (lean) → becomes "richer" → frontal gas FCM with RO

- Inj. (lean): small amounts C_2–C_5
- becomes "richer": substantial amounts C_{2+}

- 5–10% of all Gas Inj Projects VGD is the actual mechanism of developed miscibility.
- Miscibility achieved at high (>6000 psia) pressures
- Miscibility develops at the gas front (between gas front and the producer: single phase oil (RO)
- Frontal gas has the maximum gas density
  - If miscibility achieved $\Delta\rho_{og} \to 0$ $N \to \infty$

Rising Bubble Apparatus ⇒ MMP_{VGD}





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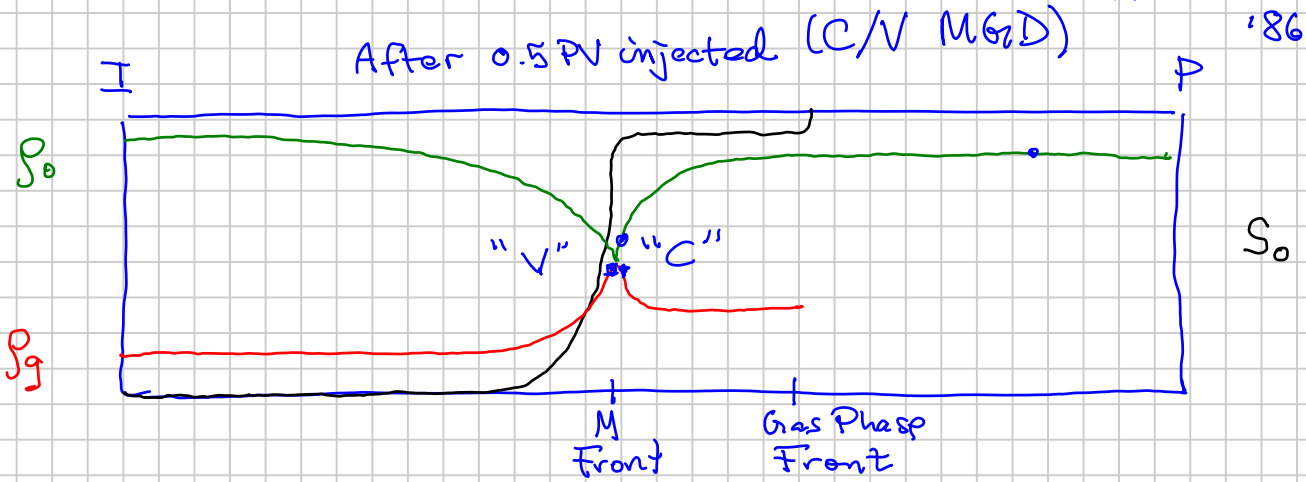


Hour Glass shape S_o / S_g

C/V 90-95% of all Miscible Gas Inj EOR projects

- HC
- CO_2
- (N_2 w/ light oil)

Phase Diagrams of Reservoir Petroleum Systems

(1005 - 10005 compounds)

p - T

p - V (p - v)

p - x (RO - IG) p_s vs mol-% Liq Gas

Ternary (not recommended - be careful) Ch. 8

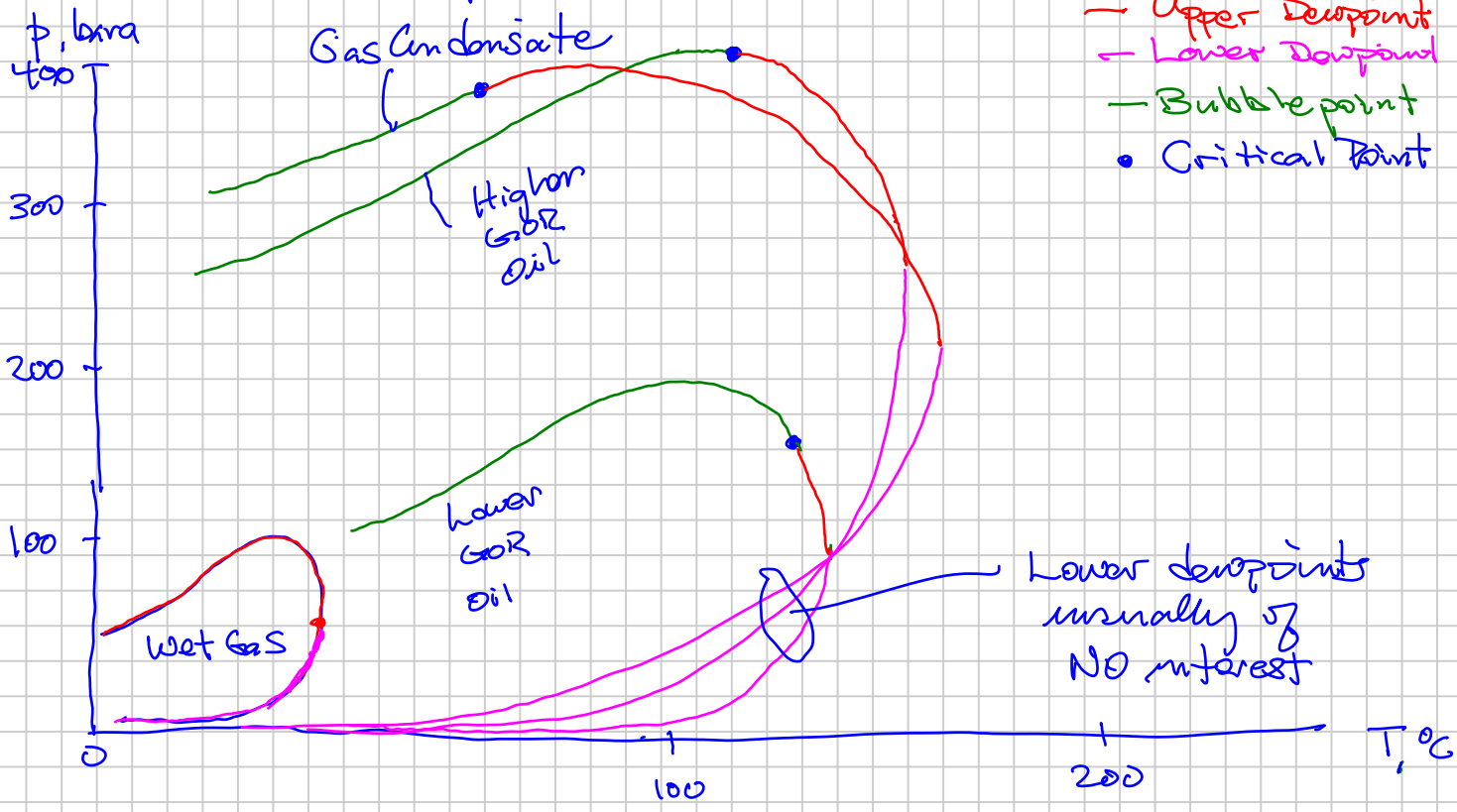
p - T Diagrams

① Orientation (only)

② For a given composition z_i ← (a) may vary spatially at time 0.
← This changes with time (b) at a given point in the reservoir

tells you where in (p, T) space you have
- single phase
- two-phase

} boundary (saturation p_s-T line)



Main use of P-T diagram is to define reservoir fluid type: Gas or Oil