Reservoarfluider og Strømning
Reservoir Fluids and Flow
Course TPG 4145

Homework Problem 2

Handed Out: Jan. 30, 2017
Due Date: One week after handed out
Hand in on ItsLearning as a single Excel file; one sheet for 1.1 and another sheet for 1.2.
File Naming (mandatory!!!): LastName-Problem-1-Solution.xls

Problem 2.1 – **Reservoir Classification – *Gas or Oil?***
Consider the reservoir Fig. 1 below. Due to geological events, the original reservoir (upper sketch) is faulted into three "fault blocks": H (high), M (middle) and L (low). The reservoir temperature and pressure increase with depth.

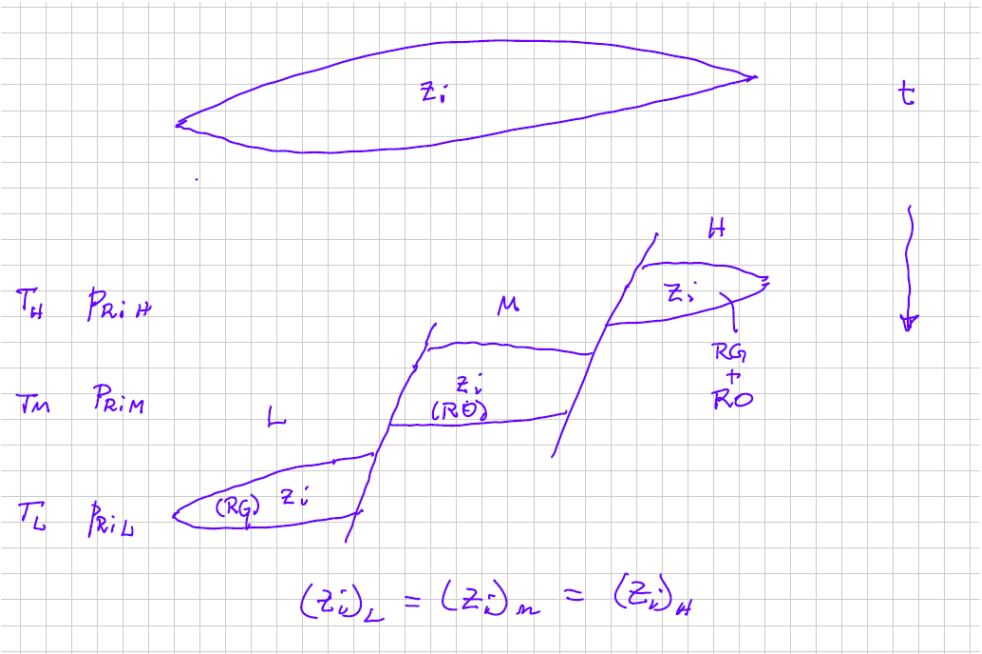

Fig. 1 – Sketch of reservoir, originally (above) and after faulting (below).

The total reservoir hydrocarbon fluid composition is the same in all blocks, z_i. However, one of the blocks is labeled an oil reservoir (RO), another a gas reservoir (RG), and the third one contains both oil and gas at initial reservoir conditions (RG+RO). To answer the following questions, use the p-T diagram given in Fig. 2.12 in the Phase Behavior Monograph.

Assume reservoir pressure of the middle fault block is 160°F and 2650 psia at mid-reservoir depth of 5300 ft. Temperature gradient is 0.02°F/ft and pressure gradient is 0.5 psi/ft for all three blocks.

a. Come up with initial conditions (mid-reservoir depth, p_R, T_R) for the Low fault block (RG-only), assuming its maximum *liquid by volume* is 30% (from Fig. 2.12).
b. Come up with initial conditions (mid-reservoir depth, p_R, T_R) for High fault block (RG+RO) assuming the volumetric percentage of the reservoir contains 50% "oil", $V_{RO}/(V_{RG}+ V_{RO})$.

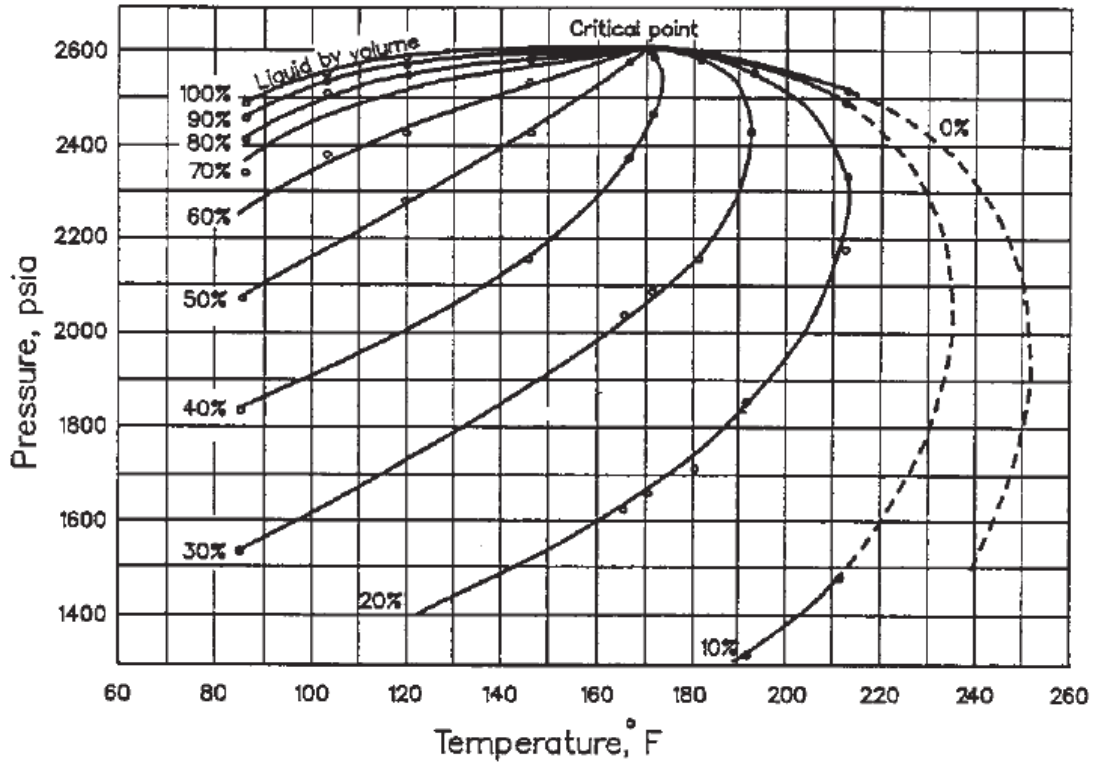

Fig. 2.12—*p-T* diagram for a gas-condensate system (after Katz *et al.*[5]).

Problem 2.2 – **Reservoir Fluid Composition**

This problem refers to Page 6 of 11 of PVT Report given in Appendix D in the Phase Behavior Monograph. Solve the following questions using Excel.

a. Reorder components in your Excel solution by normal boiling point, low to high.
b. Compute the average molecular weight of the fluid using data given in table on Page 6 of PVT study.
c. Calculate mole fractions (in mol-%) of each component from lab-measured mass (wt-%) fractions. Verify your results according to the lab table. Use Table A-1A (Appendix A) for component properties through n-C_5. Use Table 5.2 for C_6, and the numbers in the table below for C_{7+} (note: the three numbers (0.8142 | 42.1 | 190) are for C_{7+} (typographically misplaced).
d. Lab measurement of C_{7+} molecular weight is often prone to uncertainty. Assume an uncertainty of 10%, using M_{C7+}=190 kg/kg-mole instead of the reported value, then repeat steps (a) and (b).
e. Assuming a simplified surface process where C_{5-} components represent surface gas and C_{6+} components represent surface oil, calculate the gas-oil ratio in scf/STB (and Sm^3/Sm^3). Compare with the four two-stage GORs given by the lab on Page 5 of 11 (add together Separator and Stock Tank GOR values to get total for a given two-stage process, e.g. 875+134).

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File RFL 1064

Company The California Co. Data Sampled March 14, 1958
Well Central Oil Co. No. 5-2 County Smith
Field State Raleigh State Mississippi

HYDROCARBON ANALYSIS OF RESERVOIR FLUID SAMPLE

Component	wt%	mol%	Density at 60°F (g/cm^3)	°API at 60°F	Molecular Weight
Nitrogen	0.18	0.51			
Methane	9.54	45.21			
Ethane	2.80	7.09			
Propane	2.67	4.61			
iso–butane	1.29	1.69			
n–butane	2.15	2.81			
iso–pentane	1.47	1.55			
n–pentane	1.91	2.01			
Hexanes	5.01	4.42			
Heavier	72.30	28.91			
Carbon Dioxide	0.68	1.19			
	100.00	100.00	0.8142	42.1	190

Core Laboratories Inc.
Reservoir Fluid Div.

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