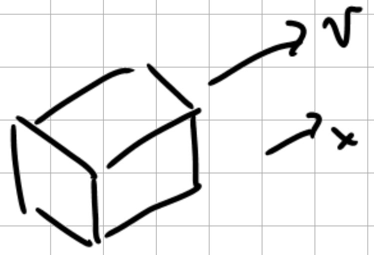
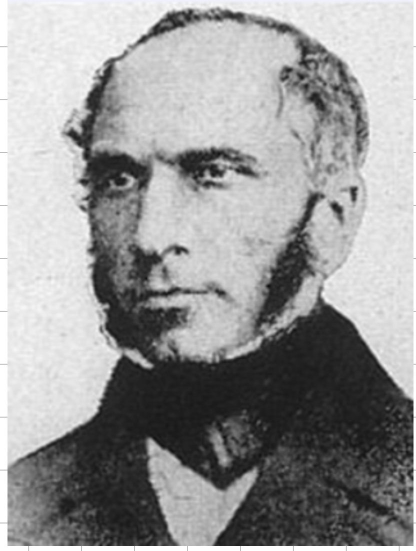
Darcy's law

$$v = \frac{k}{\mu} \cdot \frac{dP}{dx}$$

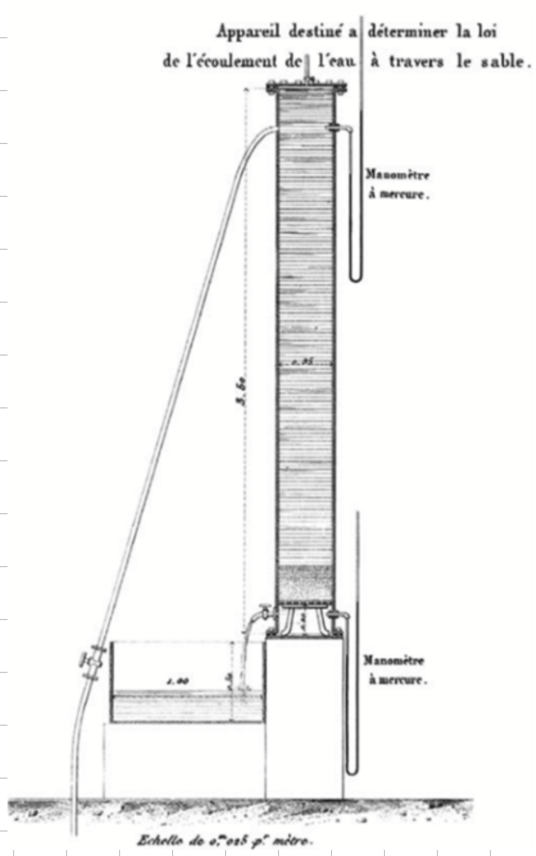


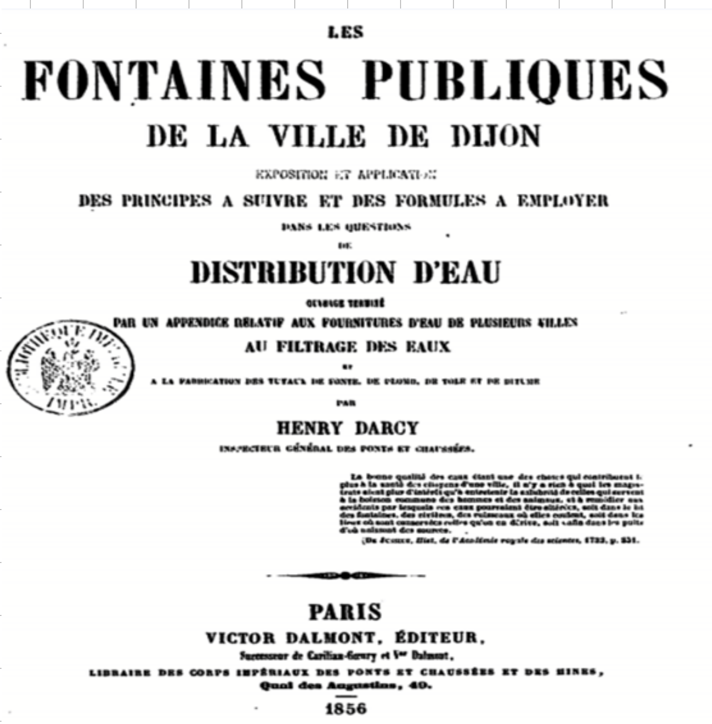


Dijon

1856 → Retired to Dijon

1858 → died





LES

FONTAINES PUBLIQUES

DE LA VILLE DE DIJON

EXPOSITION ET APPLICATION

DES PRINCIPES A SUIVRE ET DES FORMULES A EMPLOYER

DANS LES QUESTIONS

DE

DISTRIBUTION D'EAU

OUVRAGE TERMINÉ

PAR UN APPENDICE RELATIF AUX FOURNITURES D'EAU DE PLUSIEURS VILLES

AU FILTRAGE DES EAUX

ET

A LA FABRICATION DES TUYAUX DE FONTE, DE PLOMB, DE TOLE ET DE BITUME

PAR

HENRY DARCY

INSPECTEUR GÉNÉRAL DES PONTS ET CHAUSSÉES.

PARIS

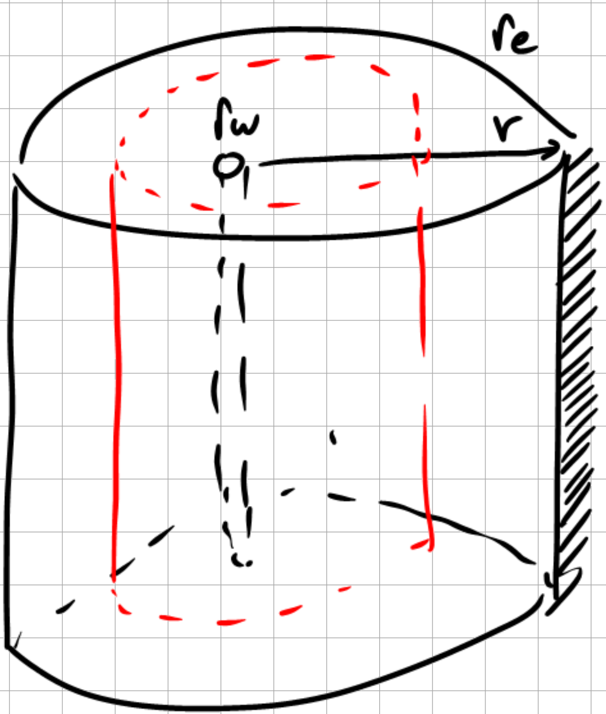
VICTOR DALMONT, ÉDITEUR,

Successeur de Carilian-Gœury et Vor Dalmont,

LIBRAIRE DES CORPS IMPÉRIAUX DES PONTS ET CHAUSSÉES ET DES MINES,

Quai des Augustins, 49.

1856



SS, PSS } $\frac{\partial}{\partial t} = 0$

$$v = \frac{k}{\mu} \frac{dP}{dr}$$

$v \rightarrow q_{\bar{o}}$

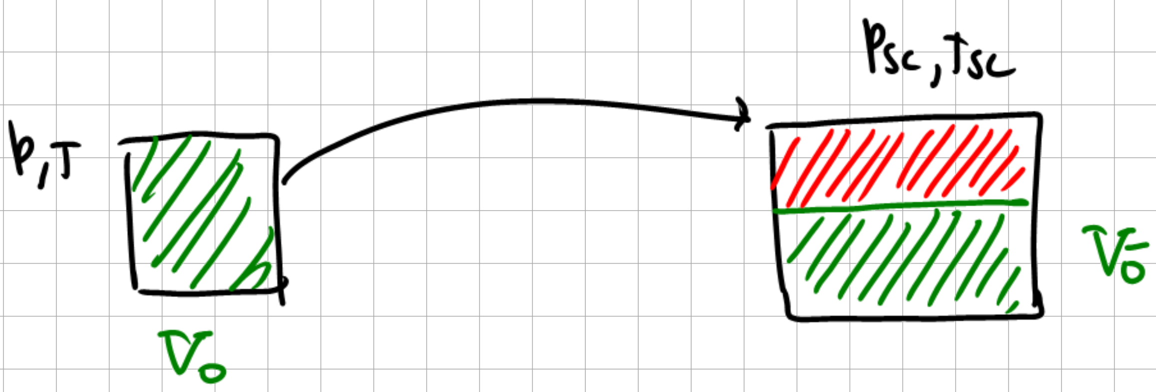
$$v = \frac{q_o}{A} \rightarrow (m^3/d) \quad (m^3/s)$$

$A \rightarrow 2\pi r h$

$q_{\bar{o}}$?

$q_{\bar{o}} \overset{?}{\rightarrow} q_o$

Black oil properties



oil volume factor

$$B_o(P,T) = \frac{V_o(P,T)}{V_{\bar{o}}} > 1$$

$$q_o = B_o(P,T) \cdot q_{\bar{o}}$$

$$B_o = [m^3/Sm^3]$$

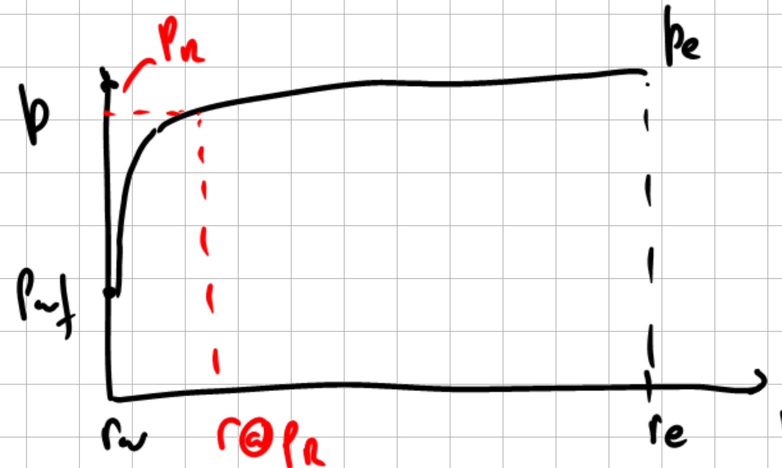
$$v = \frac{q_{\bar{o}} \cdot B_o}{2\pi r h} = \frac{k}{\mu_o} \frac{\partial P}{dr}$$

$f(P,T)$

$q_{\bar{o}} \stackrel{?}{=} f(r)$

$q_{\bar{o}} \neq f(r)$ } SS

$$\underbrace{\int_{r_w}^{r@p_R} \frac{dr}{r}}_{(1)} = \frac{2\pi k h}{q_{\bar{o}}} \underbrace{\int_{p_{wf}}^{p_R} \frac{dp}{B_o \mu_o}}_{(2)}$$



$$p_R = \frac{\int_V p \, dV}{V}$$

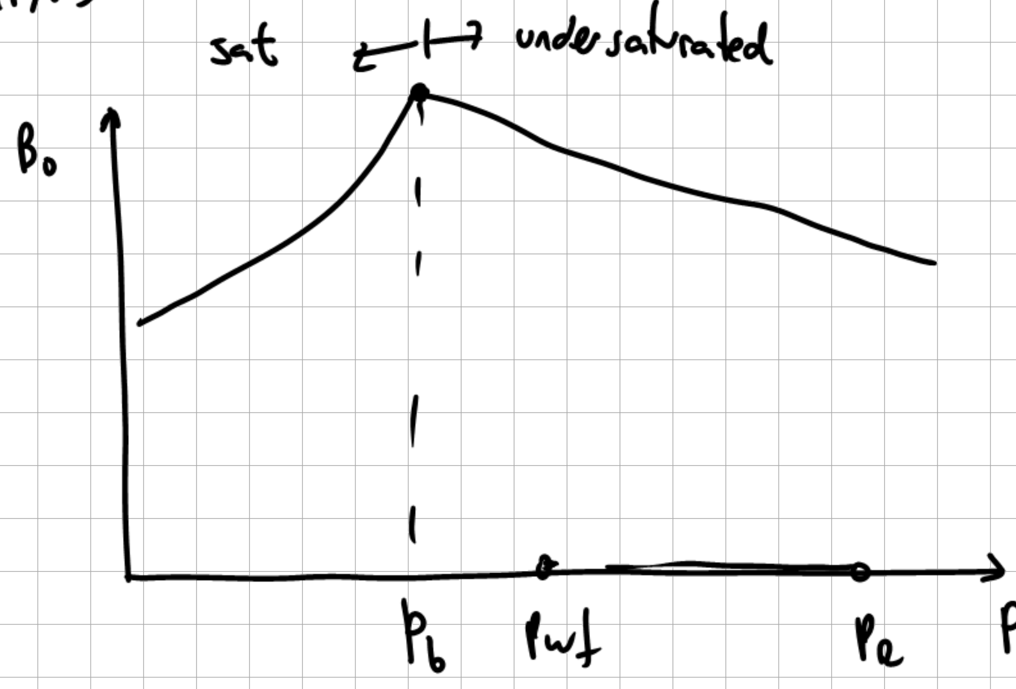
for SS, $r@p_R = 0.61\, r_e$

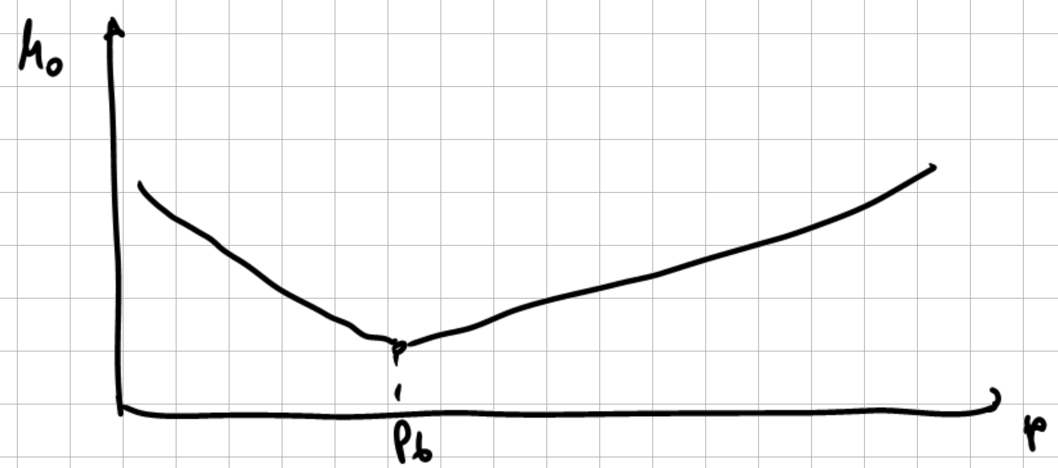
(1) $\ln\left(\frac{0.61\, r_e}{r_w}\right) = \ln(0.61) + \ln\left(\frac{r_e}{r_w}\right) = \ln\left(\frac{r_e}{r_w}\right) - 0.5$

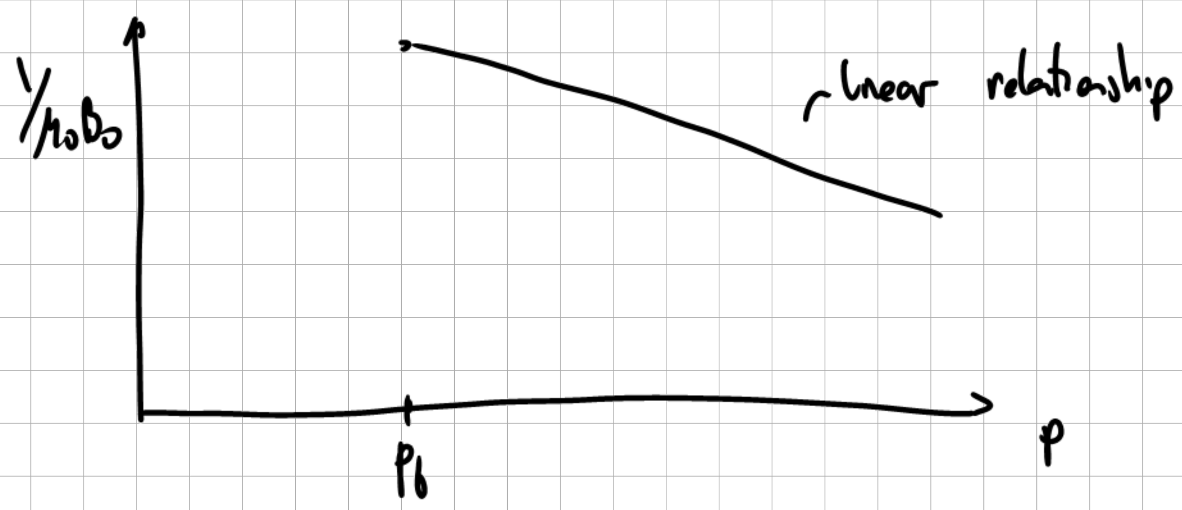
(2) $\int_{p_{wf}}^{p_R} \frac{1}{\mu_o B_o} dp$

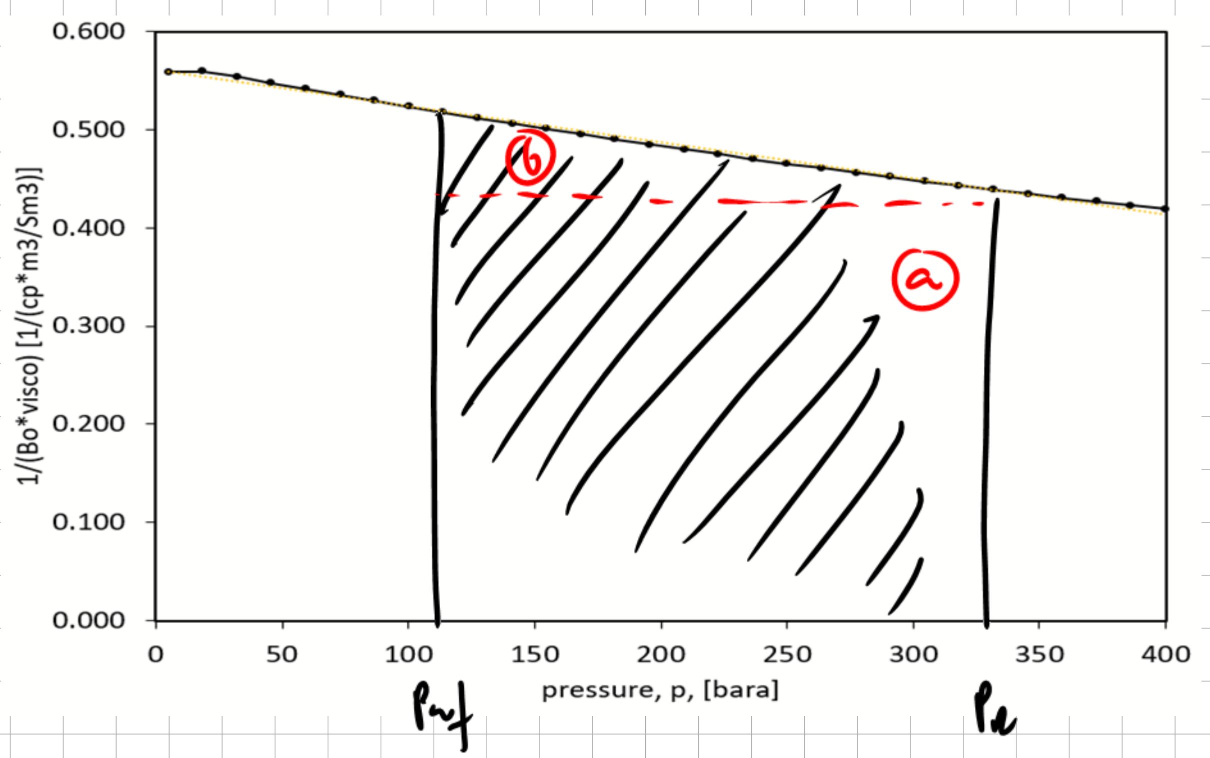
$\mu_o = f_1(p, T)$ @ reservoir T = constant = T_R

$B_o = f_2(p, T)$









$$② \int_{p_{wf}}^{p_R} \frac{1}{\mu_o B_o} \cdot dp \approx (p_R - p_{wf}) \cdot \left[\frac{1}{\mu_o B_o}\bigg|_{p_{wf}} + \frac{1}{\mu_o B_o}\bigg|_{@ p_R} \right] 0.5$$

$$\frac{1}{\mu_o B_o}\bigg|_{@ p_{av} = \frac{(p_R + p_{wf})}{2}}$$

$$② = \frac{(p_R - p_{wf})}{(\mu_o B_o)_{@ p_{av}}}$$

$$\ln\left(\frac{r_e}{r_w}\right) - 0.5 = \frac{2\pi k h}{q_o} \frac{(p_R - p_{wf})}{(\mu_o B_o)_{@ p_{av}}}$$

$$q_o = \frac{2\pi k h \, (p_R - p_{wf})}{(\mu_o B_o)_{@ p_{av}} \left[\ln\left(\frac{r_e}{r_w}\right) - 0.5 \right]}$$

$J \approx$ constant