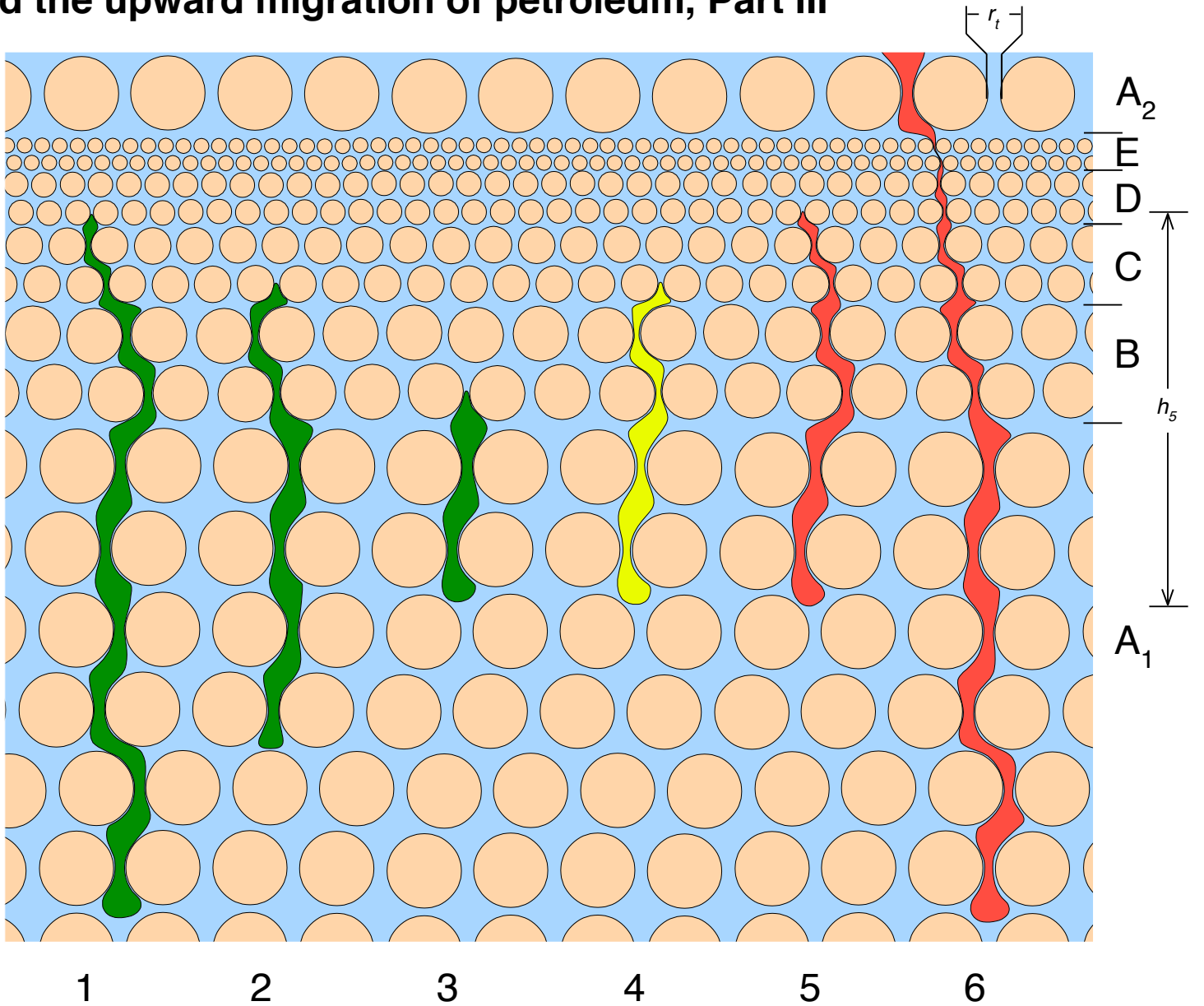
Buoyancy, seals, and the upward migration of petroleum, Part III

The very schematic diagram at right portrays columns of oil (green), very light oil or wet gas (yellow), and gas (red) that have risen through water (blue) in the pores of an assemblage of detrital grains (tan). These columns of fluids less dense than water move upward through the water because of their buoyancy, which increases with the vertical extent of the column. However, smaller openings limit the upward movement of these columns because of the interfacial tension between these non-aqueous fluids and water. The result is that materials with small pores can act as seals trapping petroleum accumulations.

The point of this diagram is that a layer of sedimentary rock may act as a seal for one column of hydrocarbons but as a pathway for upward migration of another column. For example, Layer B (perhaps a fine sand) is a seal to Column 3, the short column of oil, but it is a pathway of migration to the longer columns of oil (1 and 2) as well as to the wet gas (4) and gas (5 and 6). Layer C (perhaps a siltstone) is a seal to Columns 2 and 4 but a migration pathway to 1, 5, and 6. Column 6, the long column of gas (so that both the long column and the small density of gas give it great buoyancy) passes through all of the otherwise sealing layers and escapes entirely – neither B, C, D, nor E is a seal for it.



This document is a very generalized presentation of ideas in Berg, R.R., 1975, Capillary pressure in stratigraphic traps: *American Association of Petroleum Geologists Bulletin*, v. 59, p. 939-956.