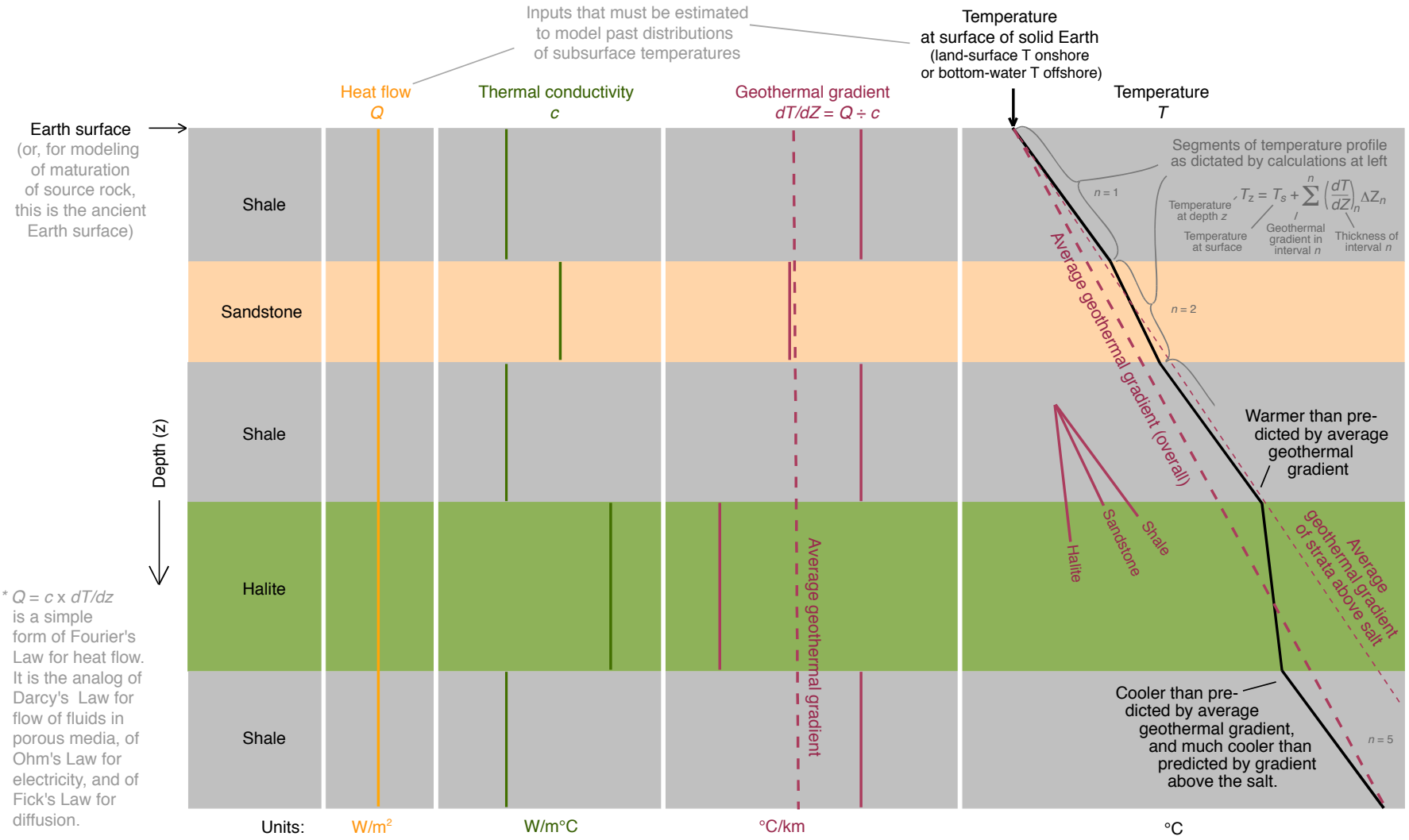
Heat flow, thermal conductivity, geothermal gradient, and subsurface temperatures

Understanding the time and place of maturation of source rocks for petroleum requires an understanding of past geothermal gradients. Attempts to estimate past geothermal gradients commonly involve modeling of the flow of heat through layers of sedimentary rock, as shown below.

Between the terms heat flow (Q), thermal conductivity (c), and geothermal gradient (dT/dz),

$Q = c \times dT/dz$ * or alternately $dT/dZ = Q \div c$

If one can make a reasonable assumption about the past heat flow in a sedimentary basin, one can use the thermal conductivity of the strata in the basin to calculate the geothermal gradient at any given time and thus estimate the past distribution of subsurface temperatures. The diagram below works from left to right to show these relationships.



* $Q = c \times dT/dz$ is a simple form of Fourier's Law for heat flow. It is the analog of Darcy's Law for flow of fluids in porous media, of Ohm's Law for electricity, and of Fick's Law for diffusion.

LBR ThermalCond&Geothermal03.odg 10/2011 rev. 10/2015 This documented was inspired by Figure 9.1 of Bjørlykke (2010) *Petroleum Geoscience* (Springer).