Pore Pressure

An accurate prediction of pore or formation pressures is needed to properly design the mud program to keep a well under control. Pore pressures and fracture pressures are used in the casing design.

Normal pressure gradients are in the range of water.
Examples
- Permian Basin: .433 psi/ft
- Rocky Mountains: .438 psi/ft
- Gulf Coast: .456 psi/ft
- West Africa: .442 psi/ft

Abnormal Pressures
Abnormal high pressures are caused by compaction effect, diagenetic effect, and differential density effect. The most common effect is the compaction effect. In this the grains of the formation do not support all of the overburden stresses.


Before drilling
1) Available data from other wells
2) Geophysical Data

While Drilling
1) Drilling rate
   Drilling rate tends to decrease with depth, a change in this could indicate a transition zone going into a high pressure zone. First will be a slowing of the ROP, drilling the sealing rock and then an increase in the ROP. This is caused by the decrease in the difference in the pressure in the well bore and pore pressure. Also a sign of a less dense sub compacted rock, higher porosity.

2) Increasing torque
When the overpressured zone is a shale that is slough because of its higher pore pressure the torque will in increase.

3) Mud log analysis
   An increase in the hydrocarbons in the mud can indicate that gas is coming into the wellbore. Also the mud log is plotted with lithology it is used in correlating with the surrounding wells.

4) Cutting analysis
   Can be used to find the bulk density of the formations, but mainly as a correlation tool.

5) Measurement while drilling
   The density log can indicate drilling into transition zone.
   Conductivity logs

6) Drilling fluid analysis
   Changes in salinity, temperature and density

Formation Fracture Pressure
   The pressure that the formation breaks or fractures. The main factors are the rock strength, stresses and pore pressure. The formations to look out for are ones with weak rork and/or low pore pressure (depleted reservoirs). Because of the stress component the frac pressure increases with depth. The minimum stress of the formations are assumed to be horizontal with maximum stress caused by the overburden.

Predicting
   Again use the information from surrounding wells.
   Step rate or leak off tests are used to calculate the frac pressure.