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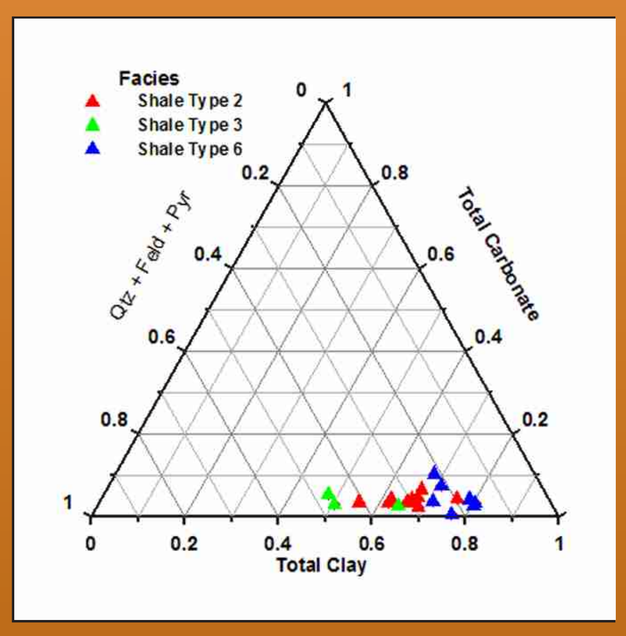
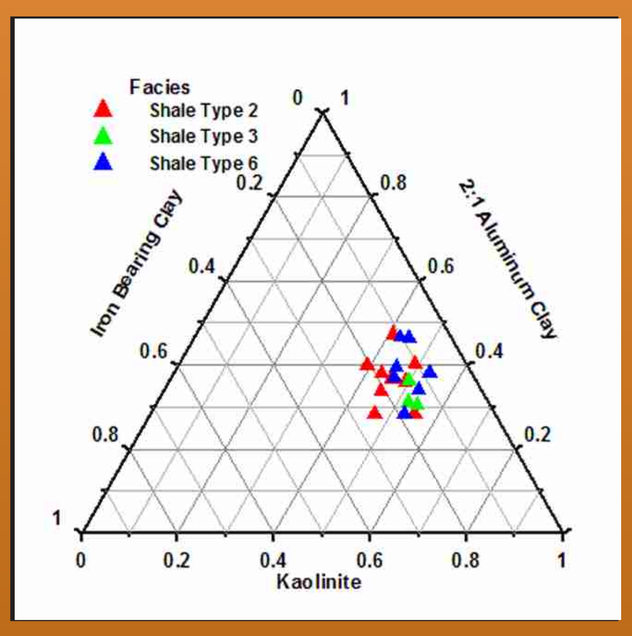
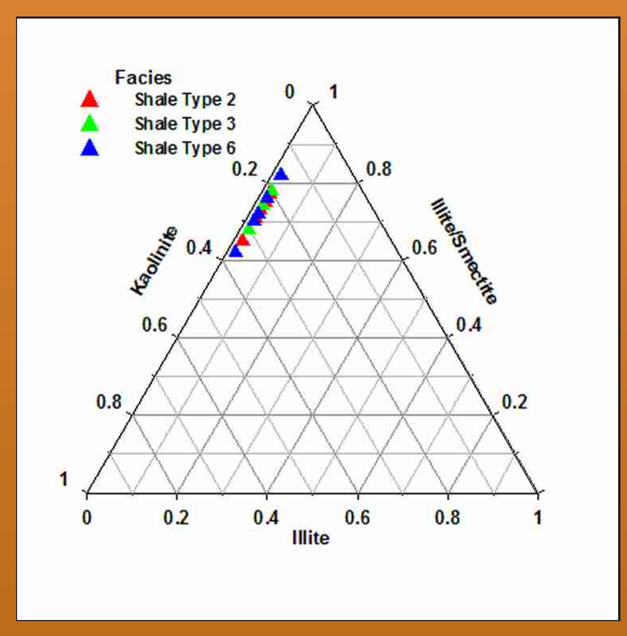
Clay Composition and Log Analysis



This bulk composition plot shows the variation in total clay abundance, quartz + feldspar + pyrite volume and cement (calcite + dolomite + siderite + ankerite) content. Composition varies over significant range.

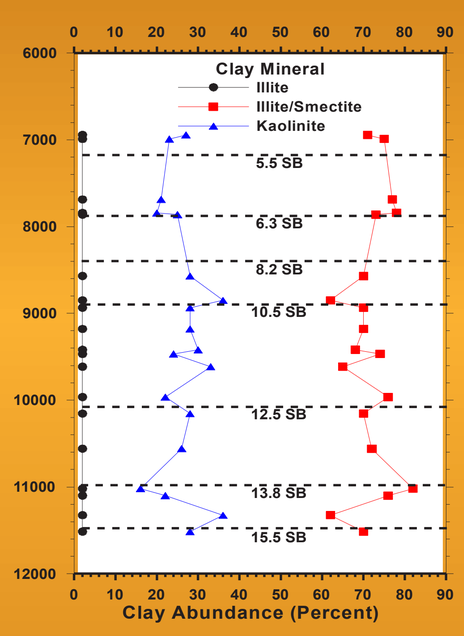


Plotting the compositional variation of the bulk clay types on a ternary graph of kaolinite, 2:1 aluminum clay and 2:1 iron clay + chlorite + trioctahedral 1:1 clay abundance reveals no significant compositional variation. All samples appear to belong to a single family with limited variation.

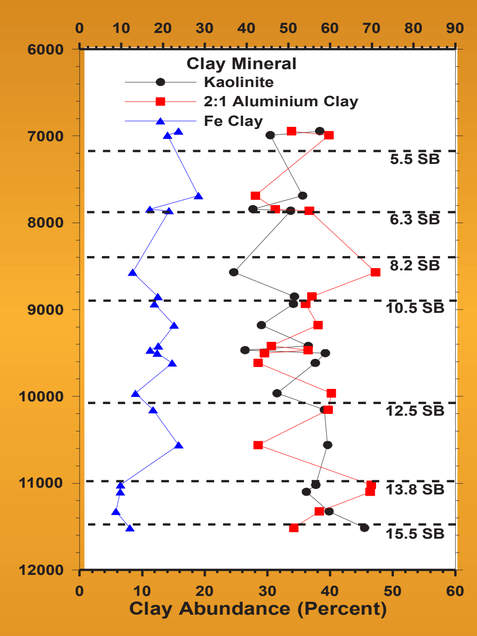


Plotting the compositional variation of the less than two-micron size fraction on a ternary graph as functions of kaolinite, illite, and illite/smectite volume indicates that composition is moderately variable. There appears to be a single compositional group, which is dominated by mixed-layer illite/smectite.

Total clay content varies from 48 to 80 percent (mean 67 %; standard deviation 9 %). Quartz content ranges from 10 to 34 percent (mean 19 %; standard deviation 7 %). The amount of K-feldspar varies from 3 to 11 percent (mean 6 %; standard deviation 2 %). Plagioclase feldspars are less abundant (1 to 4 %) with a mean value of 2 percent and a standard deviation of 0.8 percent. Siderite abundance ranges from 1 to 8 percent (mean 3.5 %; standard deviation 1.9 %). Pyrite, ankerite, and calcite are minor accessory phases in the marine shales. Clay mineralogy data suggest that these samples represent a single compositional group with relatively limited variability.

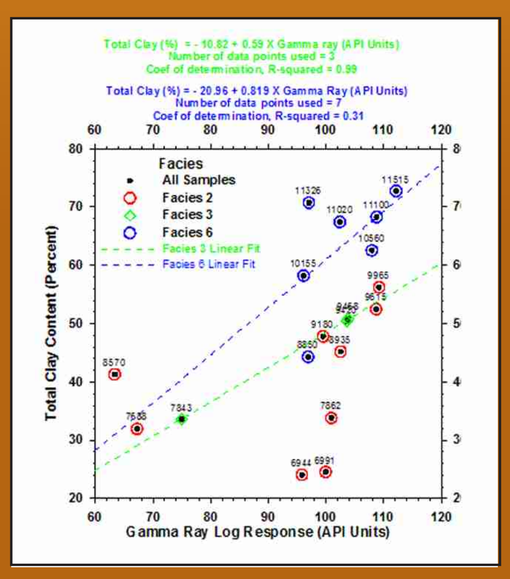


Kaolinite and Ro-ordered illite/smectites are major components of these seals and their abundances appear to compensate for each other. Illite is a minor component of the less than 2 micron fraction of these shale samples.

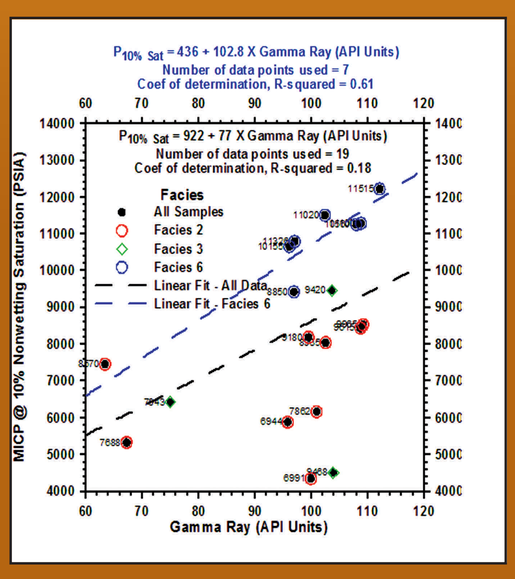


The abundance of Fe-rich clay minerals exhibits an irregular, but decreasing, trend with increasing depth of burial. The abundances of 2:1 aluminum clay and kaolinite vary in a compensatory manner.

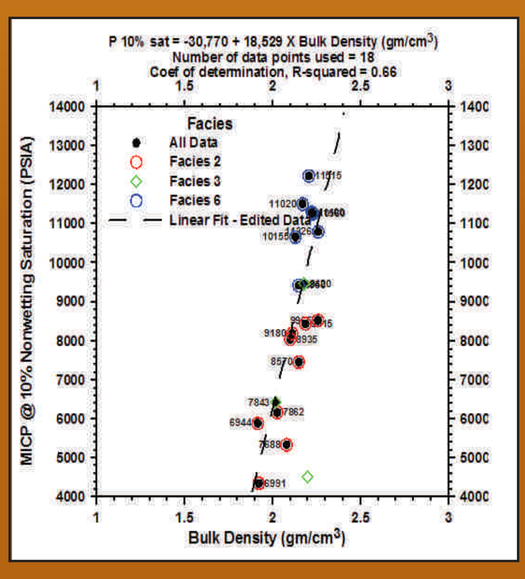
Wire-line log response is used commonly to estimate total clay content, porosity, and V-shale. A cross-plot of total clay and GR log-response shows improved correlation if the data are considered in terms of shale facies. A graph of measured porosity versus neutron density porosity indicates that log responses tend to over estimate porosity in argillaceous rocks by an average of 3 to 5 porosity units. Likewise, log evaluation techniques generally over-estimate V-shale values relative to measured total clay content.



Plotting the total clay content against normalized Gamma ray log response suggests that the two parameters essentially unrelated for facies 2. Facies 3 and facies 6 display moderate to good correlations between the parameters. Samples labeled by measured depth.



Cross plot of GR-log response and critical seal pressure shows a weak correlation for the six shale facies considered simultaneously. However, shale type 6 (blue line) exhibits a moderate to good correlation value.



Graph of critical seal pressure and log-derived bulk density. These data reveal that the two parameters are related moderately. Data labeled by sample depth.