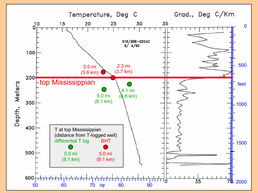
COMBINED BHT AND DIFFERENTIAL TEMPERATURE LOG DATA

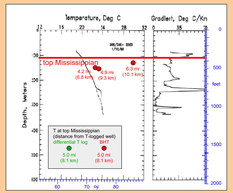
Temperature logs in thermally equilibrated boreholes are in the study area (see Blackwell and Steele (1989), but only two penetrate to Mississippian strata.

These logs are presented at the right. The nearest differential-temperature-log and BHT data are superimposed on these two logs.

Shallow BHT data tends to be higher in temperature than true formation temperature. Whereas other data is closer to true temperature. More thermally logged holes to at least the top of the Mississippian are necessary for better calibration.



USGS & Kansas Geological Survey
#1 Kansas Ordinance Plant
SW sec. 22-T31S-R20E

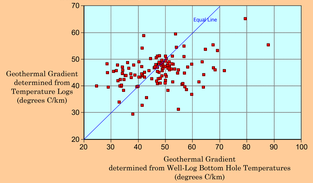


Kansas Geological Survey
#2 Crawford County (RWD #7),
SE SE SE sec. 2-T30S-R24E

Temperature and geothermal-gradient data from both primary data sets are combined in the maps below. If a section has both BHT and differential-temperature measurements, the differential-temperature measurement is preferentially displayed for that section since the BHT data has more scatter than the differential temperature data.

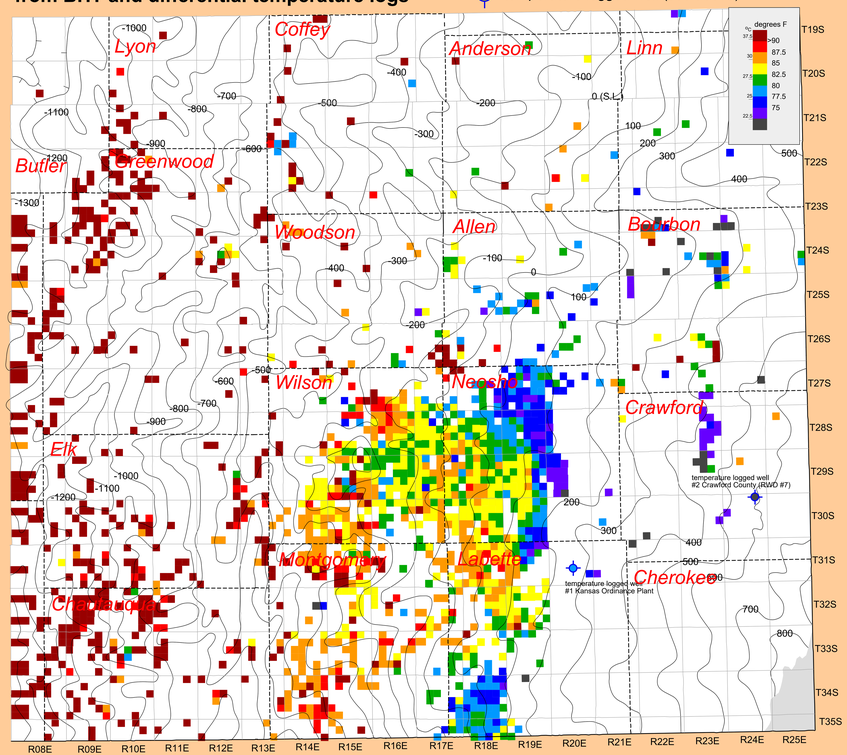
Correlation of the two data sets with respect to geothermal gradients is shown at the right. Although there is agreement around 50 degrees C/km, BHT-derived geothermal gradients may underestimate geothermal gradients relative to differential temperature logs in higher temperature regimes, and underestimate temperature for lower temperature regimes.

In the combined maps, geothermal-gradient highs are evident in northwestern Labette County (T31-32S, R18-19E), southwestern Allen County (T26S, R17E). The N-S linear anomaly in southern Neosho County (T29S, R19E) is also evident.

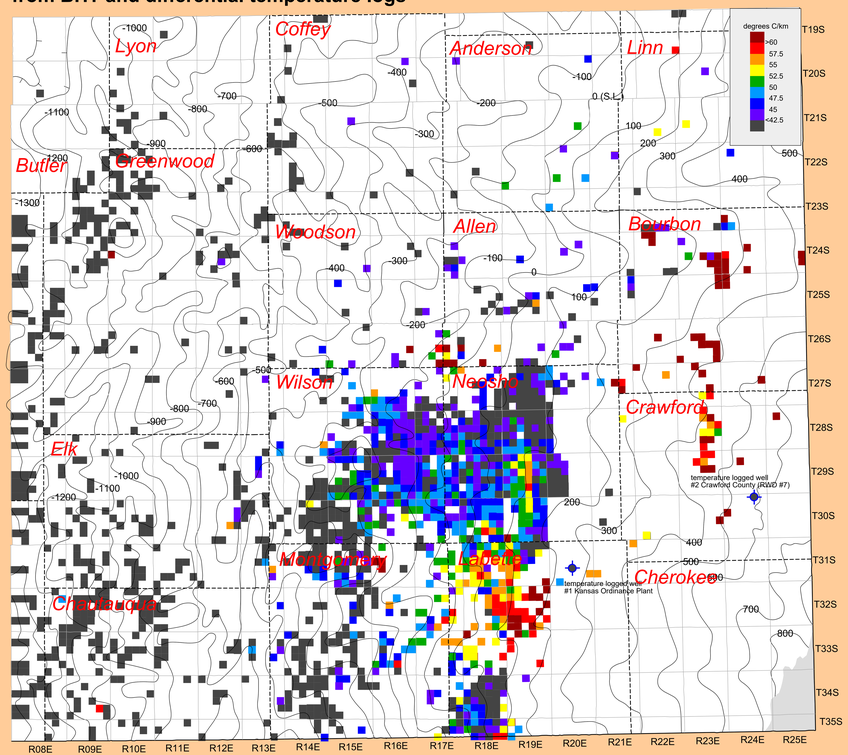


TEMPERATURE at TOP MISSISSIPPIAN from BHT and differential temperature logs

temperature logged well (see above)

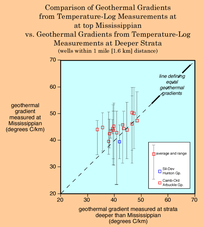


GEOTHERMAL GRADIENT at TOP MISSISSIPPIAN from BHT and differential temperature logs

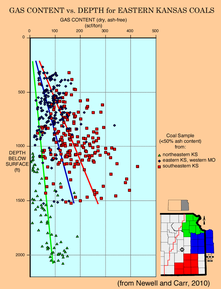


INTERPRETATION and CONCLUSIONS

Regions of higher geothermal gradients in eastern Kansas are likely caused by higher heat flow from the basement or lateral movement of hotter basinal waters on to the shallower flanks of the basin. However, this latter process is unlikely because high temperatures along the axis of the basin are separated from high temperature areas along the basin flanks by regions of lower temperature. Upward movement of heat by thermal conduction is more likely. Geothermal gradients for strata deeper than the top Mississippian are also locally elevated like the Mississippian gradients (see diagram at right) implying that heat movement is dominantly vertical and not due to lateral water movement. Blackwell and Steele (1989) suggest that radioactive plutons in Precambrian basement may be the source of the localized heat.

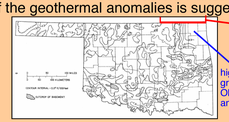


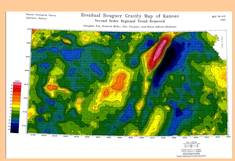
Coals in the Cherokee Basin have more adsorbed gas content than similarly buried coals farther north in Kansas on the Bourbon Arch and Forest City Basin (see diagram at right). The higher rank associated with the higher gas content (high-vol A bituminous vs. high-vol C bituminous in NE Kansas) may be due to the higher heat flow and geothermal gradient in southeastern Kansas. A study of gas content vs. temperature is thus suggested.

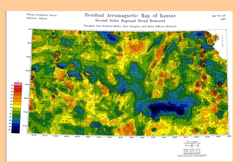


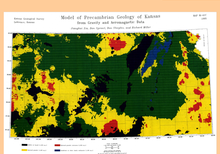
(from Newell and Carr, 2010)

Studies of subsurface temperatures in Oklahoma indicates that northeastern Oklahoma has elevated geothermal gradients contiguous with that of southeastern Kansas. A common origin of the geothermal anomalies is suggested.









Deep wells reaching basement in eastern Kansas are very sparse, so aeromagnetic and gravity maps are the main source of information on basement lithology. A NW-trending magnetic anomaly in northern Labette County is coincident with the geothermal high present in that region and may be the expression of a radioactive pluton that is supplying the heat for this anomaly.

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