GEOTHERMAL GRADIENT

A geothermal gradient of 1.75°F per 100 feet or 31.9°C per 1000 meters best represents the temperature regime present during Late Cretaceous to Present. This value best matches the vitrinite reflectance data for wells in the Bass Basin.

Present day corrected geothermal gradients average slightly higher than the interpreted historical geothermal gradient of 1.95°F per 100 feet, 33.0°C per 1000 meters, as presented in Table 2 and Enclosure 37. The uncorrected temperature data for each of the 22 basin wells and the five out-of-basin wells are presented on Table 3 with the interval of time passing since drilling mud circulation at temperature recording. Six of the wells have sufficient data to investigate theoretical increases in bottomhole temperatures through Horner plots (Enclosure 38). The Horner plots indicate that even wells with bottomhole temperatures measured 33 hours after drilling mud circulation stopped have not reached an equilibrium temperature with the surrounding formation. The average increase in bottomhole temperature for the wells, excluding Pelican-5, is 10.7 percent. Based on the limited Horner plot data it was decided that a reasonable correction of the bottomhole temperatures of the remaining wells would be a 10 percent increase for wells with post circulation times of 20 hours or less and a 5 percent increase for wells with post circulation times greater than 20 hours. These corrections are presented on Table II. The geographical distribution of the present day corrected and uncorrected geothermal gradient is illustrated on Enclosure 37. It appears that the juxtaposition of wells with very low geothermal gradients, i.e., Pelican-2, to wells with very high geothermal gradients, i.e., Pelican-5, is possibly an artifact of the measurements rather than a reflection of a real variation in the gradient. This is supported also by the sporadic nature of the high and low extremes of the gradients and the lack of a real geographic variation. It was thought, therefore, that an average geothermal gradient could represent the gradient for the basin wide area.

Before pursuing thermal history modeling with a basin average geothermal gradient, theoretical vitrinite reflectance for varying geothermal gradients was compared to the measured vitrinite reflectance data.

The vitrinite reflectance data available for wells in the Bass Basin are illustrated on Enclosure 39. Eight well have enough measured vitrinite data with extensive depth coverage to be candidates for a comparison of theoretical and measured vitrinite data. This comparison is designed to evaluate the validity of an area-wide, time-constant geothermal gradient.

The eight wells with extensive vitrinite data are the Koorkah-1, Pelican-5, Poonboon-1, Bass-3, Cormorant-1, Tilana-1, Yolla-1 and Durroon-1. The measured vitrinite data and theoretical vitrinite values at varying geothermal gradients are displayed on Enclosures 40 through 47. Theoretical vitrinite values from two differing thermal history maturation models were compared to the measured vitrinite values. These two models are the Bandurski variation on the Tissot-Espitalie'