

Deep Sedimentary Thermal Gradient in the Continental Shelf off Alabama through Louisiana

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ABSTRACT

Sedimentary thermal gradient down to ~7 km below the seafloor has been determined at 12 localities in the section of the Gulf of Mexico continental shelf off Alabama through Louisiana. In obtaining the geothermal gradient at each locality, we compiled bottom-hole temperature data reported from wells in the vicinity and corrected the data for disturbance caused by drill fluid circulation. The so-called Horner plot method was used for the bottom-hole temperature correction. This method requires that bottom-hole temperature be measured twice or more at a fixed depth while the well is shut in for wire-line logging operations. Thermal gradient values in the northeast (*i.e.*, landward) of the Lower Cretaceous shelf margin off Alabama are quite uniform at about 0.028 K/m or 0.015°F/ft. Areas along the outer perimeter of the shelf margin also show similar thermal gradients. Further seaward (southwestward) of the shelf margin off Mississippi and Louisiana, in areas of deep marine deposition and salt diapirs, thermal gradient values tend to be lower and more variable. Lowest gradients (0.018 to 0.021 K/m) are observed in sediments flanking salt domes. At some other localities in the southwestern province, the thermal gradient seems to increase in deep (> ~3 km) sediments. At ~5 km sub-bottom depth, sedimentary temperature fluctuates between 110°C and 160°C in the continental shelf. The temperature variation may have impacted the hydrocarbon maturation history of the region and the bacterial and thermochemical sulfate reduction processes that yield hydrogen sulfide gas.