

Measurements of natural radioactivity of cores from petroleum well bores

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Several methods of well logging are applied to petroleum well bores in order to determine the nature of formations, their physical and chemical properties, hydrocarbon and water content, etc. Although alpha, beta, and gamma radioactivity occur in nature, it is practical to measure only gamma radiation in a well bore. Among many unstable elements found in nature, only ^{238}U and ^{232}Th with their daughter elements and ^{40}K contribute a significant amount of gamma radiation in sedimentary rocks. Clay minerals contain a fairly constant fraction of potassium, of which 0.02% is the radioactive ^{40}K . Due to the nature of clay a small proportion often causes a considerable reduction of porosity and permeability of. The identification of specific radioactive elements in a well bore is very difficult, because of the degradation of energy of gamma rays by Compton scattering. Therefore, measurements of spectra of gamma rays emitted from well bore cores were introduced. Analysis of these spectra allows the determination of the fractional contribution of potassium to the counting rate in the gamma log, and a revaluation of the clay content. Two methods of measurement were applied. A. Ge (Li) detector of a 34 cm³ volume proved to be very selective, but because of its relatively low detection efficiency, rather long times of measurement were required. Subsequently a 76 mm diam. x 76 mm thick NaI (Tl) scintillation detector was applied. Because of its poorer selectivity special methods of analysis¹ were applied.

References

1. J.H.Scott, *Geophysics* 28 (1963) 457; L. Rybach and J.A.S. Adams, *Geochim. Cosmochim. Acta* 33 (1969) 1101.