INTRODUCTION TO BOREHOLE GRAVITY

Alan T. Herring, EDCON
February, 1990

SUMMARY

The borehole gravity meter (BHGM) can be described simply as a deep-investigating, density logging tool. Applications range beyond this simple description to include detection of oil and gas-filled porosity, detection and definition remote structures (e.g. salt domes, faults, reefs, etc.) and non-Newtonian gravity experimentation.

One of the great advantages of the BHGM as a density logging tool is that it is practically unaffected by near-hole influences which are the scourge of nuclear tools: casing, poor cement bonding, rugosity, washouts, and fluid invasion. Another advantage is the fundamental simplicity of the relationships between gravity, mass, rock volume and density. Complex geology can be easily modeled so that the response of a range of hypothetical models can be studied and understood before undertaking a survey.

What is actually measured is referred to as BHGM *apparent density* which is a simple function of the measured vertical gradient of gravity. To obtain an *apparent density* measurement, gravity is measured at two depths. The accuracy of the computed density depends on the accuracy of both measured differences: gravity and depth. Operationally, BHGM surveys resemble VSP (vertical seismic profiling) surveys. The BHGM is stopped at each planned survey level and a five-to-ten-minute reading is taken. The blocky appearance of the log reflects the station interval, Figure 1.

The log is not continuous. BHGM measurements are taken at discrete depths usually at intervals of 10 to 50 feet, depending on the vertical and density resolution required. While the BHGM has remarkable resolution in the measurement of density over intervals of 10 feet or more (less than 0.01 g/cm^3), surveys requiring closer vertical resolution must sacrifice density resolution.