



**BICRON®**

**THE supplier of  
gamma ray detectors  
to the Logging Service Industry**



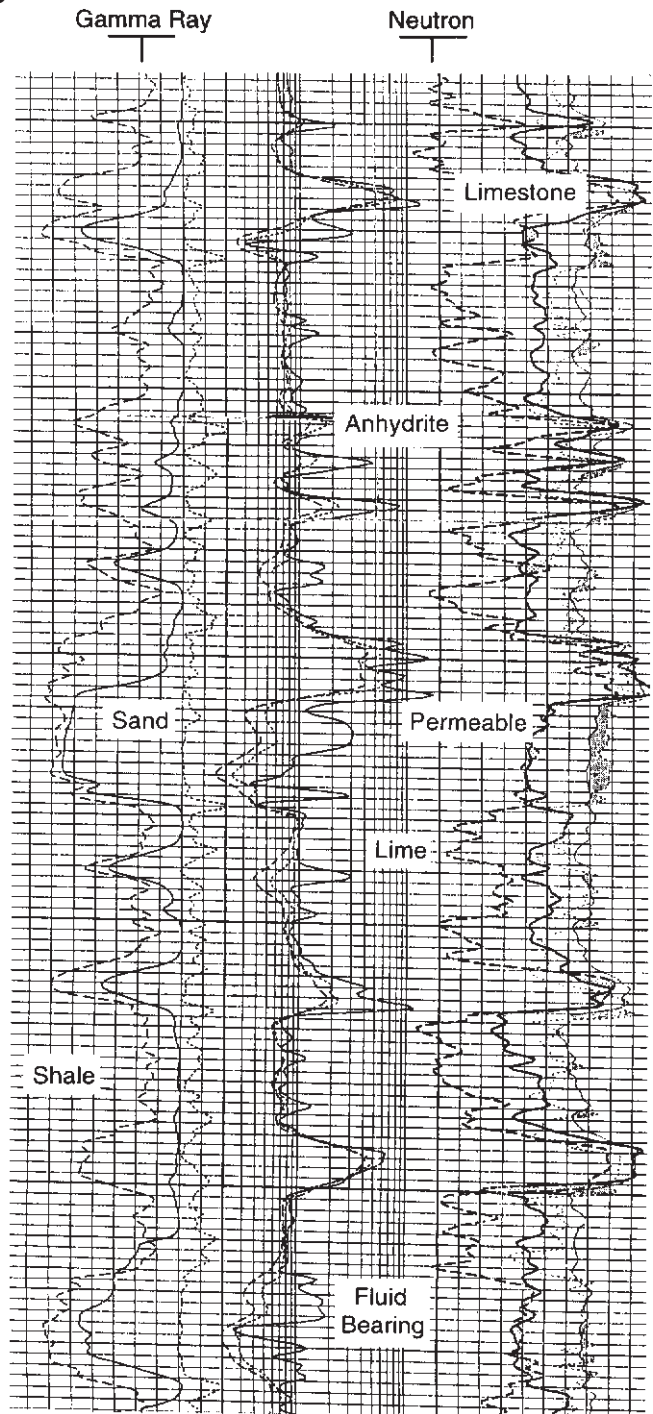
## **Gamma Ray Detection in Well Logging**

All sedimentary rock contains natural radioactivity. A gamma ray (GR) measurement detects the radioactive isotope combinations of potassium, thorium and/or uranium present in both rock and fluid within geological formations. The ability to distinguish between certain geological formations and the change from one formation to another is critical to the petroleum industry.

For over 30 years, BICRON has been the leading supplier of scintillation crystal detectors to the Logging Service Industry. Our detector, as an integral component of a gamma ray logging tool, provides superior performance and survivability under extreme environmental conditions.

The early generation wireline GR tools placed relatively low demands on the scintillation detector. Since the detector was used in a gross counting mode, it was insensitive to the various modes of signal degradation. Recalibration insured that the gross counts were unaffected, as long as deterioration occurred slowly as compared to the logging operation. Catastrophic failure, rather than performance, was the principal detector packaging design consideration.

The extreme operational and survival conditions of Measurement-While-Drilling (MWD) placed increased demands on detector engineering and materials technology. BICRON set the industry standard by providing the required performance and *survivability* to withstand the environmental and transportation/handling conditions of MWD, as well as the performance and *reliability* required by Wireline tools.



*Gamma Ray and Neutron responses to different types of geologic formations*

***Detector Design Considerations***

BICRON is the largest supplier of NaI(Tl) crystals in the world. Our current capacity approaches six tons per month, and our NaI(Tl) detectors are the industry standard for pulse height resolution over all energies. These range from soft X-ray energies through 1-10 MeV to 300 MeV and above.

NaI(Tl) is the most commonly used scintillator for well logging because it offers the best combination of light output, density, handling characteristics and cost. However, BICRON also offers other scintil-

lation materials such as CsI(Na) and BGO. These alternative materials have greater densities and, therefore, improved counting efficiency. Tradeoffs to be considered include cost and scintillation performance differences at operating temperatures.

Standard designs are available in a variety of geometries for both slimline and standard tool diameters. Custom geometries, performance specifications and prototype detectors can be provided.



***BICRON'S Advanced Engineering and Testing Capabilities***

BICRON employs a unique combination of Material Science, Application Physics, and Advanced Engineering professionals to provide the knowledge base and skills required to design radiation detection solutions for both terrestrial and non-terrestrial operational environments. We have both the practical and research experience to design detector system solutions from application specifications. In addition, we bring the requisite testing capabilities for both qualification and acceptance test requirements to fully characterize application specific needs for integrated systems during shock, vibration and temperature extremes. Our capabilities provide the full spectrum of radiation detector design including advanced predictive engineering tools and radiation statistics modeling.

The following is a brief summary of BICRON advanced engineering and testing capabilities:

<b>Engineering Capabilities</b>	<b>Testing/Laboratory Capabilities</b>
CAD/CAE: cosmos/m ProEngineer/Pro Jr. AutoCAD Product Data Management: Optegra Electrical Circuit Design: DSP, ORCAD, Field Programmable Gate Array (FPGA)	Thermal/Vacuum: Test ovens Thermal vacuum chamber Vibration/Shock: Elect.-dyn. shakers (4klb, 8klb) Hydraulic shaker Shock machine Combined environmental temperature chamber Clean Rooms: Class 100k, 10k -- 800 sq. ft. total



**In North America**

**Bicron** • 12345 Kinsman Road • Newbury, Ohio 44065 USA

Telephone: (216) 564-2251 • Telefax: (216) 564-8047

*Bicron FaxBack Information Access System: (800) 892-8708 (U.S. and Canada only)*

**In Europe**

**Crismatec** • 104, Route de Larchant • BP 521 • 77794 Nemours CEDEX • France

Telephone: (33) (1) 64 45 10 10 • Telefax: (33) (1) 64 45 10 01