Elemental spectroscopy measurements and tool specifications

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Elemental Spectroscopy Tools				Elements detected																										
Acquisition Company	*Tool Names (New to Old)*	*Neutron source*	*Detector*	*K: Potassium*	*U: Uranium*	*Th: Thorium*	*Al: Aluminum*	*Ba: Barium*	*C: Carbon*	*Ca: Calcium*	*Cl: Chlorine*	*Cu: Copper*	*Fe: Iron*	*Gd: Gadolinium*	*H: Hydrogen*	*K: Potassium*	*Mg: Magnesium*	*Mn: Manganese*	*Na: Sodium*	*Ni: Nickel*	*O: Oxygen*	*S: Sulfur*	*Si: Silicon*	*Ti: Titanium*	*spectrum/ processing*	*Depth of investigation*	*Vertical Resolution*
BakerAtlas	FLeX	pulsed neutron	bismuth germanate BGO	■	■	■	■			▒	■		▒	▒	■	■	■	▒				▒	▒	▒	capture	21 in.	
							▒		▒	■			■				▒				■	■	▒	■	inelastic	8.5 in.	
Halliburton	GEM	AmBe	bismuth germanate BGO	■	■	■	■		■	■	■		■	■	■	■	■	■			■	■	■	■	capture	6 in.	18 in.
							▒			▒			▒	▒		▒	▒	▒				▒	▒	▒	oxides closure		
Schlumberger	LithoScanner	pulsed neutron	lanthanum bromide $LaBr_3$	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■		■	■	■	capture		18 in
							■	■	■	■			■				■				■	■	■		inelastic		18 in
Schlumberger	ECS	AmBe	bismuth germanate BGO	■	■	■	■			■			■	■								■	■	■	capture	9 in	18 in
Schlumberger	GST	pulsed neutron	sodium iodide NaI	■	■	■				■	■		■	■	■							■	■	■	capture		
				natural GR			Tool outputs: ■ Processing results: ▒																								
							neutron spectroscopy																								

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Comments:

This table provides some general information about elemental spectroscopy tools; the source and detector types, the types of spectra captured, and volumes of investigation. It also specifies the elements that each tool measures.

Often, as indicated by the cell colors, some elements are derived from measurements of other elements. In all cases, the measurements from the tools are processed by specific software. The ability of the tools to measure specific elements, and the related processing, can be expected to change with time, as tool technology and the understanding of the measurements improves. This is especially true of the latest generation of the tools, since this generation is relatively new.

Some references that may be of help in understanding the measurements are:

Ellis, Darwin, Jim Grau, Jeffrey Schweitzer, Russel Hertzog, 1987, Basics of nuclear logging; The Technical Review, v.35, n.3, July: Schlumberger Educational Services, Houston, Texas.

A good basic review of all nuclear phenomena used in logging. Out of date in terms of the spectroscopy tools, but the underlying physics is current.

Aboud, Manuel + 11 co-authors, 2014, High-definition spectroscopy – determining mineralogic complexity; Oilfield Review, v.26, n.1, Spring: Schlumberger.

Aside from the expected Schlumberger bias, a good paper for how current tools (from any company) work, and how the data is generally processed. Some overlap with Ellis et al, 1987, about nuclear interactions, some new information.

MacDonald, Robert M. + 4 co-authors, 2011, Comparison of elemental and mineral abundances from core and three modern neutron induced elemental spectroscopy tools; 52nd Annual Logging Symposium: Society of Petrophysicists and Well Log Analysts, Houston, Texas.

A comparison of BakerAtlas FLeX, Halliburton GEM, and Schlumberger ECS, in a log-off situation. Read for understanding of how the tools and processing can deliver different results in the same environment.

Contact the specific logging company for current information about their tools and processing.

This document is intended to be updated periodically as necessary to include new and corrected information.

Questions and comments about this document are welcomed and encouraged. Please contact Dan Krygowski at The Discovery Group; DanKrygowski@Discovery-Group.com.