

# Micro-Spherically Focused Log (MSFL™) and Microlog (ML)

The MSFL tool is a pad-type miniature version of the SFL (Spherically Focused Log) that was developed to eliminate borehole effects and achieve superior shallow investigation. The MSFL tool is a stand-alone logging tool that is wired to be placed anywhere in the logging tool string. Included in the MSFL tool string is a ML log that makes two resistivity measurements, a 2-in. normal and a 1.5-in. lateral. A caliper measurement of the borehole is also provided along with the MSFL tool log.

## MSFL and ML Tool Features

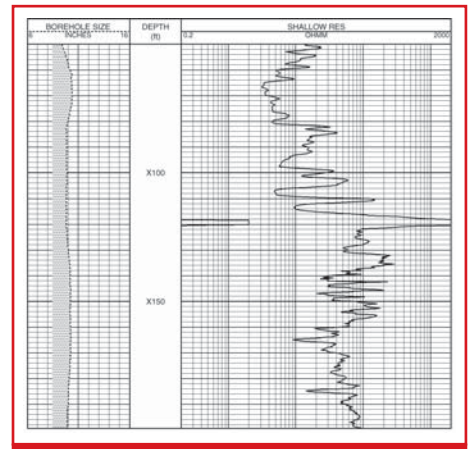
The MSFL and ML tools contain the following features:

- The MSFL tool measures voltages that represent five analog parameters:
  - MSFL tool survey current (IA)
  - MSFL tool survey voltage (VE)
  - Caliper potentiometer voltage (CALP)
  - Microlog lateral (MINV)
  - Microlog normal (MNOR)
- The MSFL tool measurement involves only the first few inches of the formation immediately adjacent to the borehole, the flushed zone ( $R_{xo}$ ), in which drilling fluid has displaced all formation fluids. Electrodes for the MSFL are imbedded in a insulating pad mounted on a powered caliper arm
- The Microlog has three electrodes spaced 1-in. apart and positioned vertically on an insulated pad. The microlog senses the presence or absence of mudcake. The measured voltage at the 2-in. button and the differential voltage between the 1-in. and 2-in. buttons are linearly related to the formation resistivity. When mudcake forms adjacent to permeable formations, mud invasion causes negative separation in high porosity sands between the 1.5-in. lateral and the 2-in. normal

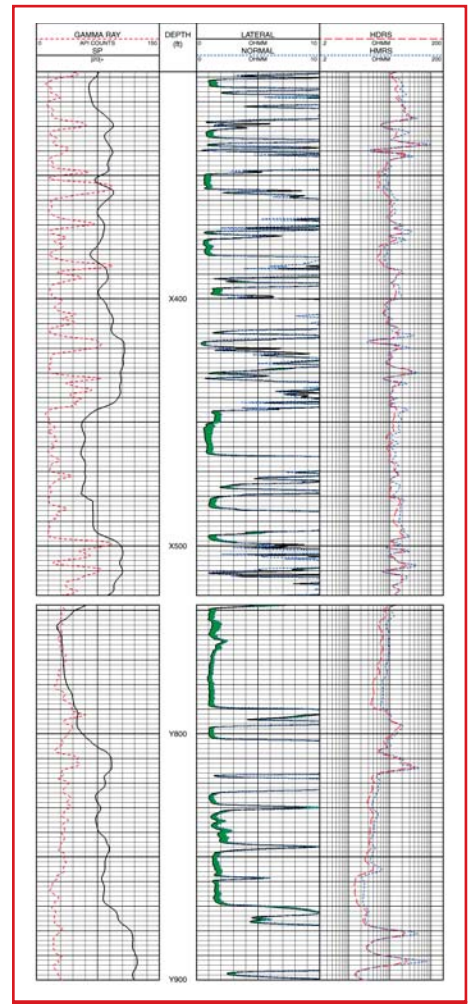
## MSFL™ and ML Tool Benefits

The MSFL and ML tools offer the following benefits:

- The MSFL tool provides a measurement of the flushed zone resistivity ( $R_{xo}$ ) with low mudcake correction. The  $R_{xo}$  is used in the computation of moved out hydrocarbons
- The Microlog provides qualitative estimate of permeability. Permeable zones allow mud filtrate to invade the formation, which results in mudcake buildup. Zones that are not permeable do not allow mud filtrate to invade the formation. Such zones have no mud cake. The permeability estimates help in making well completion decisions



Standard MSFL log example from a sequence of high resistivity carbonate formation and limy shales.



Field example of Microlog.

<b>Micro-Spherically Focused Log (MSFL™) and Microlog (ML) Specifications</b>										
<b>Tool</b>	<b>Length</b>		<b>Diameter</b>		<b>Maximum Pressure</b>		<b>Maximum Temperature</b>		<b>Weight</b>	
	(ft)	(m)	(in)	(mm)	(psi)	(Mpa)	(°F)	(°C)	(lb)	(kg)
<b>MSFL™</b>	<b>10.2</b>	<b>3.1</b>	<b>5</b>	<b>127</b>	<b>20,000</b>	<b>137.9</b>	<b>350</b>	<b>176.7</b>	<b>214</b>	<b>96.4</b>
<b>ML with HFDT™ Assembly<sup>1</sup></b>	<b>27.5</b>	<b>8.4</b>	<b>5</b>	<b>127</b>	<b>20,000</b>	<b>137.9</b>	<b>350</b>	<b>176.7</b>	<b>720</b>	<b>326.6</b>
<b>ML with SDLT™ Assembly<sup>2</sup></b>	<b>18.6</b>	<b>5.7</b>	<b>4.5</b>	<b>114.3</b>	<b>20,000</b>	<b>137.9</b>	<b>350</b>	<b>176.7</b>	<b>475</b>	<b>215.5</b>

<sup>1</sup> Weight, length, and diameter apply to the HFDT/Microlog assembly.

<sup>2</sup> Weight, length, and diameter apply to the SDLT/Microlog assembly.