nternational Association of Hydrogeologists

Contribution to UNESCO International Hydrogeological Programme IHP in the framework of IHP III budget 5.3

H. Repsold

Well Logging in Groundwater Development









Volume 9 / 1989 International Contributions to Hydrogeology Series Editorial Board G. Castany, E. Groba, E. Romijn

Verlag Heinz Heise



Table of Contents

rable of Contents, cont.

Prefac	Principles of the resistivity methods on notsernedmi largers 90	
1	Introduction	7
2	General remarks	9
2.1	Technical comments	9
2.2	Designations of methods / List of symbols	10
3	The tables Explanations to table 1	13
3.1	Table 1: The most important methods and their possible applications	14
3.2	Table 2: Functions of the methods	16
3.3	Table 3: Grouping of methods according to purpose	18
4	The methods of measurement	19
4.1	Measurement of the natural gamma radiation; Gamma Ray, GR	a 19
4.2	Measurement of rock density; Density, D, FD	25
4.3	Measurement of rock porosity; Neutron, N	29
4.4	Measurement of the sonic velocity in rock; Sonic Log, Akustiklog, SV	31
4.4.8	Assessment of the porosity-sensitive methods	34
4.5	Monitoring a cementation; Cement Bond Log, CBL	835
4.6	Measurement of rock resistivity in multiple point array; Electric Log, ES, EL	36
4.7	Measurement of the electric self potential; Self Potential, SP	40
4.8	Measurement of rock resistivity in focussed data and an endoorga	43
	array; Focussed Electric Log, Laterolog, FEL, LL and array	9
4.9	Measurement of rock conductivity (focussed induction method); and the brue polypoint of all the brue polypoints of all the brue p	47

Table of Contents, cont.

Table of Contents

4.9.8	Principles of the resistivity methods Technical realization of resistivity measurements	49 51
4.9.9	Fields of application of resistivity methods	52
4.10	Measurement of resistivity in the borhole vicinity; Microlog, Microlaterolog, ML, MLL	53
4.11 El	Measurement of the resistivity of the borehole fluid (water or mud); Salinometer, SAL	56
4.12	Measurement of the temperature of the borehole fluid (water or mud); Temperature, TEMP	58
4.13	Measurement of the borehole or casing diameter; Caliper, CAL	60
4.14	Casing collar locator in steel casing; Casing Collar Locator, CCL	63
4.15	Measurement of the vertical fluid flow in the local states of boreholes or wells; Flowmeter, FLOW	65
4.16	Measurement of the borehole deviation from the	74
	vertical; Deviation, DV	4.3
4.17	Measurement of strike and dip of the rock layers; Dipmeter, DIP	76
4.18	Sampling (water or mud); Sampler Tool, SAMP	79
4.19	Optical investigations; Borehole Camera, TV Camera, OPT	81
5.	Quantitative interpretation of borehole logs	83
5.1	Principles of calculating the clay and shale content	84
5.2	Principles of calculating porosity	88
5.3	Determination of pore water salinity	93
5.4	Approaches to hydraulic conductivity about the instant and the	101
6	Some presentations regarding basic principles	106
6.1	Borehole correction and calibration with an	107

Table of Contents

6.2	General information on the muliple point resistivity method in boreholes	111
6.3	FEL measurement principles	116
7	Log Quality Control	122
8	Conversion Tables	125
9	Explanations to the Log Samples	128
10	References	131
	Concluding Remarks	135
	Charts] Annex	137
	Log Samples	145

List of Charts

Chart (1)	Gamma Ray Borehole Correction
Chart (2)	Formation Density Borehole Correction
Chart (3)	Porosity from Formation Density
Chart (4)	Porosity from Neutron
Chart (5)	Porosity from Sonic
Chart (6)	Departure Cuves ES
Chart (7)	Departure Curves FEL
Chart (8) and (9)	Water Resistivity, Salt Content and Temperature
Chart (10)	Minimum Pump Rates FLOW
Chart (11)	Field Calibration FLOW
Chart (12)	Formation Factor-Porosity-Relation