

C O N T E N T S

PAGE

PART I:	C O L L E C T I O N O F S A M P L E S F O R H Y D R O G E O L O G I C A L G R O U N D W A T E R A S S E S S M E N T	1
1.	INTRODUCTION	3
2.	CRITERIA FOR THE SELECTION OF SAMPLING POINTS	4
2.1	General criteria	4
2.2	Springs and water-carrying galleries	5
2.3	Wells	7
2.4	Groundwater monitoring stations	9
3.	SAMPLING	14
3.1	Sampling points	14
3.1.1	Springs and water-carrying galleries	14
3.1.2	Wells	15
3.1.3	Groundwater monitoring points	16
3.2	Sampling devices	18
3.2.1	Bailers	18
3.2.2	Hand-operated piston samplers	18
3.2.3	Suction pumps	22
3.2.4	Submersible pumps with a vibrating piston	25
3.2.5	Submersible motor pumps	27
3.2.6	Other types of pumps	30
3.3	Practical hints	33
4.	SCOPE OF THE EXAMINATIONS	34
4.1	Analyses for hydrogeological investigations	34
4.2	Drinking water analysis	35

4.3	Analyses of medicinal mineral waters	36
4.4	Analyses for the assessment of anthropogenic changes in groundwater quality	36
4.4.1	Effects of waste deposits	36
4.4.2	Effects of effluents	39
4.4.2.1	Domestic effluents	39
4.4.2.2	Industrial effluents	40
4.4.3	The effects of agricultural and silvicultural land use	40
4.4.4	The effects of polluted surface water	40
4.4.5	The effects of contamination with mineral oil products	41
4.4.6	The effects of contamination with chemicals	41
4.5	Analysis of water for industrial use	42
4.6	Chemical Analysis of groundwater used in construction	42
5.	EXAMINATION, HANDLING AND PREPARATION OF SAMPLES IN SITU	43
5.1	In situ examinations	44
5.2	Pretreatment of the samples in situ	47
5.2.1	Cations and heavy metals	47
5.2.2	Anions	48
5.2.3	Undissociated constituents	49
5.2.4	Gaseous constituents	49
5.2.5	Organic substances	52
5.2.6	Isotopes	54
5.2.7	Redox potential	56
5.3	Sampling for simple bacteriological tests	58
6.	LITERATURE	61

	PAGE
PART II: CHEMICAL ANALYSIS OF GROUNDWATER	67
1. SCOPE OF CHEMICAL GROUNDWATER ANALYSES	69
1.1 Preliminary remarks	69
1.2 Scope of data and measured parameters	69
1.2.1 Institute/laboratory where the ground- water is analysed	70
1.2.2 Sampling point	70
1.2.3 Sampling	71
1.2.4 Qualitative observations	72
1.2.5 Physical measurements	73
1.2.6 General chemical determinations	74
1.2.7 Determination of ions	75
1.2.8 Other determinations	76
1.2.9 Notes	76
1.3 Specimen form "Groundwater analysis"	77
2. REQUIRED ACCURACY OF CHEMICAL GROUND- WATER ANALYSIS	77
2.1 Preliminary remarks	77
2.2 Accuracy requirements, decimals	78
2.2.1 Physical measurements	78
2.2.2 General chemical determinations	79
2.2.3 Cations	79
2.2.4 Anions	82
2.2.5 Ion balance	82
2.2.6 Undissociated substances	82
3. LITERATURE	83
Appendix: Conversion factors	84

## INDEX TO FIGURES AND TABLES

PAGE

Figure 1:	Sampling at the outlet of a cased spring	6
Figure 2:	Sampling tap at a well	8
Figure 3:	Groundwater monitoring point under a surface cover	11
Figure 4:	Groundwater monitoring point above ground level	11
Figure 5:	Groundwater monitoring point with three separate monitoring pipes	12
Figure 6:	Groundwater monitoring point with easily tiltable water level recorder	14
Figure 7:	Measurement of water level and depth	16
Figure 8:	Sampling, using a bailer	19
Figure 9:	RUTTNER bailer	20
Figure 10:	100 ml hand-operated piston sampler with valves	21
Figure 11:	Motor suction pump	22
Figure 12:	Guiding scheme for sampling from groundwater monitoring stations	23
Figure 13:	Foot valve for suction tubes	24
Figure 14:	Submersible pump with a vibrating piston	26
Figure 15:	Submersible motor pump (Side view and performance chart)	28
Figure 16:	Submersible motor pump in portable box with 50 m cable	29
Figure 17:	Submersible motor pump in operation	29
Figure 18:	Reciprocating pump (schematic)	31
Figure 19:	Operating principle of water jet aspirator	32
Figure 20:	Collection of gaseous samples, schematic	51

Figure 21:	Preparation of groundwater samples for radiocarbon determination	56
Figure 22:	Determination of redox potential, using a closed glass bulb	57
Figure 23:	Bottles for bacteriological sampling	58
Table 1:	Technical information on submersible pumps with a vibrating piston	27
Table 2:	Scope of groundwater analyses (simplified version)	37
Table 3:	Determination in situ and maximum permissible storage time for laboratory determinations for groundwater analysis according to DVWK publication 111/1979 [5] and R. WAGNER (1976) [31]	45