KARST MORPHOLOGY FOR FOUNDATION DESIGN

GEO REPORT No. 32

Y.C. Chan & W.K. Pun

GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING DEPARTMENT
HONG KONG

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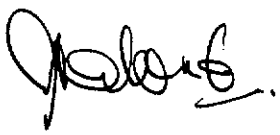
PREFACE

In keeping with our policy of releasing information of general technical interest, we make available some of our internal reports in a series of publications termed the GEO Report series. The reports in this series, of which this is one, are selected from a wide range of reports produced by the staff of the Office and our consultants.

Copies of GEO Reports have previously been made available free of charge in limited numbers. The demand for the reports in this series has increased greatly, necessitating new arrangements for supply. In future a charge will be made to cover the cost of printing.

The Geotechnical Engineering Office also publishes guidance documents and presents the results of research work of general interest in GEO Publications. These publications and the GEO Reports are disseminated through the Government's Information Services Department. Information on how to purchase them is given on the last page of this report.



A. W. Malone
Principal Government Geotechnical Engineer
April 1995

EXPLANATORY NOTE

This GEO Report consists of two Technical Notes on karst morphology for foundation design.

They are presented in two separate sections in this Report. Their titles are as follows:

SECTION 1: KARST MORPHOLOGY OF A SITE IN THE SOUTHERN PART OF YUEN LONG TOWN

Y.C. Chan & W.K. Pun

This report was originally produced in June 1989
as GCO Technical Note No.TN 6/89

FOREWORD

This is the first of a series of reports on the karst morphology interpreted for individual sites in the Designated Area. This facilitates the checking of foundation design submitted by the developer for the development of the site.

The morphology interpretation was done through the MQD and marble mass classification system developed in Mainland West Division of GCO. The system was reported in GCO Technical Note TN 4/89.

The interpretation was made by Mr Y.C. Chan with the assistance of Mr W.K. Pun. The figures were prepared by the Mainland Advisory Service.

M.C. Tang
Acting Chief Geotechnical Engineer/
Mainland West

CONTENTS

1. INTRODUCTION

In January 1989, the GCO studied schemes for classifying marble sites. The study led to the formulation of a marble mass classification system that facilitates the identification of the extent of marble slightly affected or unaffected by dissolution. This provides a tool for the interpretation of karst morphology of sites from drillhole data. Such interpretation would allow foundation to be designed or checked with greater confidence.

This report describes the karst morphology of a site in the southern part of Yuen Long town. The interpretation was made in mid-April, 1989. The foundation design from the developer has subsequently been checked and approved in early May 1989.

2. BASIS OF ANALYSIS

The marble mass classification system utilises the following definitions.

$$\text{MQD} = \text{Average RQD} \times \text{Marble Rock Recovery Ratio (MR)}$$

$$\text{Average RQD} = \sum_{L_1}^{L_2} \frac{r_i \times l_i}{(L_2 - L_1)}$$

$$\text{MR} = \sum_{L_1}^{L_2} \frac{l_i}{(L_2 - L_1)}$$

where l_i is the length of core of RQD value r_i.

L_1 is the top elevation of the section of core being considered.

L_2 is the bottom elevation of the section of core being considered.

$(L_2 - L_1)$ is usually 5 m.

Marble Class	MQD Values (%)	Description
I	75.1 - 100	Very good quality marble mass consisting of rock with widely spaced fractures and unaffected by dissolution.
II	50.1 - 75	Good quality marble mass consisting of rock slightly affected by dissolution or slightly fractured rock essentially unaffected by dissolution.
III	25.1 - 50	Fair quality marble mass consisting of fractured rock or rock moderately affected by dissolution.
IV	10.1 - 25	Poor quality marble mass consisting of very

		fractured rock or rock seriously affected by dissolution.
V	0 - 10	Very poor quality marble mass consisting of rock similar to class IV marble except that cavities can be very large and marble continuous.

Details of the marble mass classification system are described in Chan (1994).

3. COMPUTATION

Appendix A tabulates the MQD values and the marble mass classes compiled from borehole information for the site. The location of the boreholes are shown in Figure 1.

4. KARST MORPHOLOGY

4.1 Vertical Cross-sections

Three vertical cross-sections are shown in Figures 2 to 4. Overhangs of sound rock undermined by zones of dissolution affected rock mass are apparent. The affected rock mass ranges from marginal rock (Class III) to seriously affected rock (Class V).

4.2 Horizontal Cross-sections

Figures 5 to 14 are horizontal cross-sections at different reduced levels. Level -70 to -75 mPD (Figure 14) shows that the site is dissected by a deep surface karst zone extending to below -75 mPD and runs in a east west direction.

Simple 3-D models can be made by plotting the horizontal sections on transparent sheets set at appropriate vertical separations. Such 3-D models are useful for visualising the karst morphology.

4.3 Contour Plan

Figure 15 is a contour plan of the bottom of the surface karst. Overhang areas are shaded.

There are 5 main overhang area. The most prominent overhang is at drillholes BF2, CF1 and BV3 where an igneous sill caps a spur of marble undermined by dissolution.

At drillholes BH3, BC3 and DF6, the overhang is supported by Class III rock with small cavities. The overhang at BH4, BB2 and BB6 is partly supported by Class III & IV rocks. The extent of the overhang is unknown because two of the drillholes are too shallow.

The overhangs at BV7 and AF13 are narrow and consist of Class V rock underlying Class II rock.

AT DF2, there is a zone of Class III rock (5 m thick) at more than 15 m below the bottom of the surface karst. The extent and nature of this zone is not known. However, in view of the moderate size (2.5 m) of the cavity involved and the unfractured nature of the adjacent rock, the cavity is likely to be part of a dissolution joint of limited extent.

5. GEOLOGICAL FACTORS

The karst morphology at the site is affected by the igneous sill. The locations of the sill is shown in Figure 15. The sill is thin, usually less than 15 m thick. It occurs at the rockhead level except at the northwest corner of the site where a part of the sill is 10 m below rockhead. The sill dips south-westward gently. It is possible that the sill originally occurred as a continuous sheet. Subsequent weathering and erosion removed part of the material, exposing the marble except at some isolated spots.

The direct effect of the sill was to reduce infiltration, hence protecting the marble underneath from dissolution. The surface run-off flowed into marble at the margin of the sill promoting dissolution outside the sill. This resulted in the formation of cliffs. If the toe part of the cliff was ponded or covered with soil, lateral dissolution took place to form overhangs. The size of the overhangs depend on the degree of soil cover and ponding, and the cliff height.

As the cliffs and overhangs were formed, the sill weathered and eroded slowly. When the sill was totally removed, infiltration into the marble resumed leading to the flattening of the cliffs and overhangs. It is this series of cliffs, overhangs and partially degraded cliffs which characterise the karst morphology of the site.

Karst formation may also be encouraged by the presence of fracture zones and faults. The drillholes indeed encountered fracture zones with RQD $< 50\%$. The present drillhole information density is however inadequate to identify these small features.

6. ENGINEERING IMPLICATIONS

The location of the proposed building blocks are shown in Figure 1. If this is superimposed on Figure 15, it can be seen that block A sits on an area of high rockhead. There is a 2.5 m cavity at the southeastern corner of the cap. The thick sound rock above the zone (> 15 m) would allow substantial pile load to be transmitted to adjacent compentent rock provided that the deep karst does not exceed 15 m in the narrower extent. This appears to be the case as discussed in Section 4.3. As such, ordinary H-piling with built-in redundancy would provide a satisfactory foundation.

Block B sits on another area of high rockhead, and includes the overhang at boreholes BH3, BC3 and DF6. Reference to Section 1-1 at Figure 2 shows that the overhang is about 8 m wide and consists of Class II rock sitting on 5-15 m of Class III rock. H-piling is unlikely to penetrate the overhang. However, the overhang should be able to take some pile

load because it is narrow, connected to good quality rock and supported by marginally affected rock. It would however be prudent to provide redundant piles at the southeastern corner of the cap and to particularly reinforce the part of the cap above the overhang to take any additional stresses that may be induced by yielding of the overhang.

7. REFERENCE

Chan Y.C. (1994). Classification and Zoning of Marble Sites (GEO Report No. 29). Geotechnical Engineering Office, Hong Kong, 46p.

LIST OF FIGURES

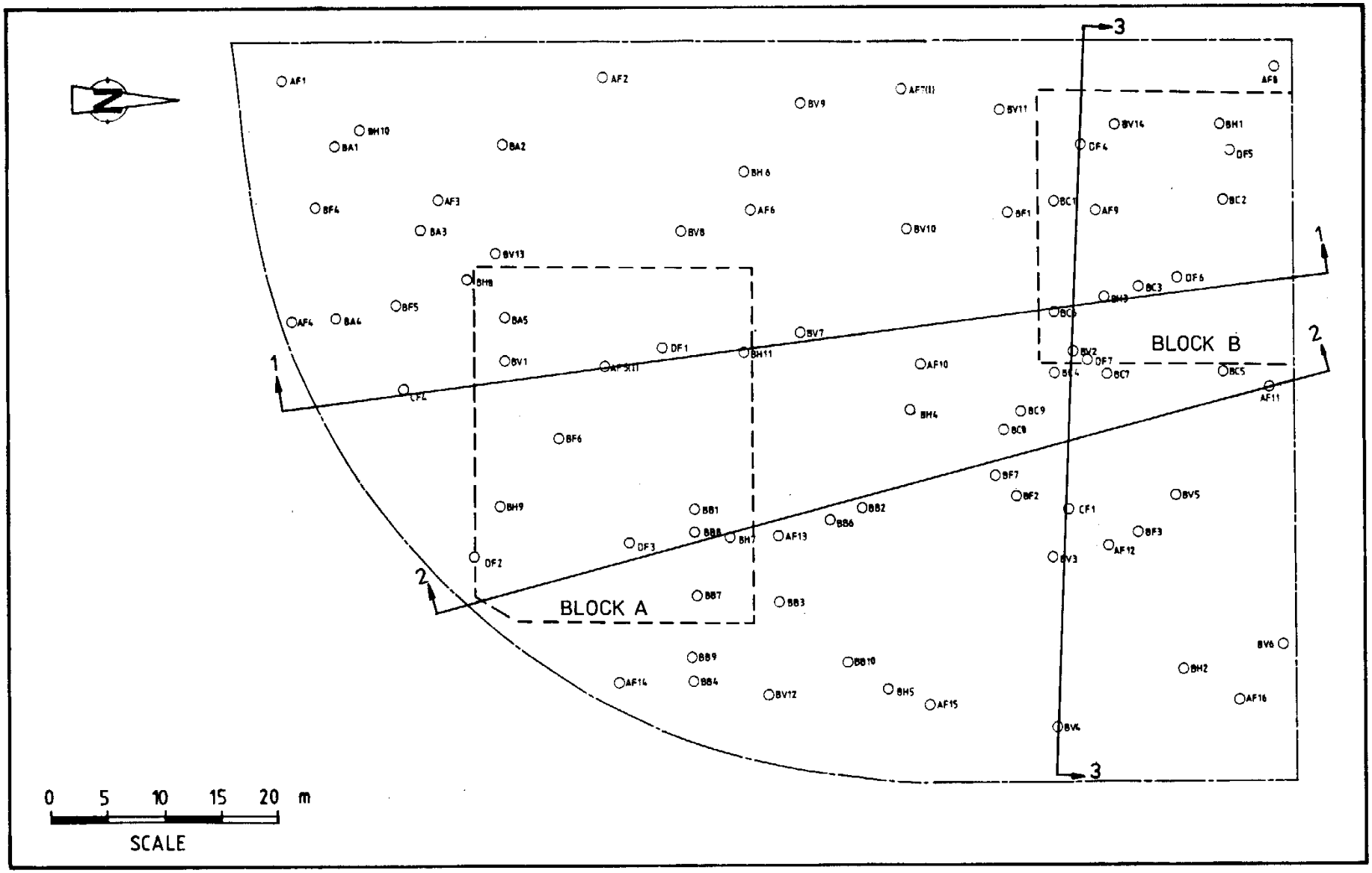


Figure 1 - Site Plan

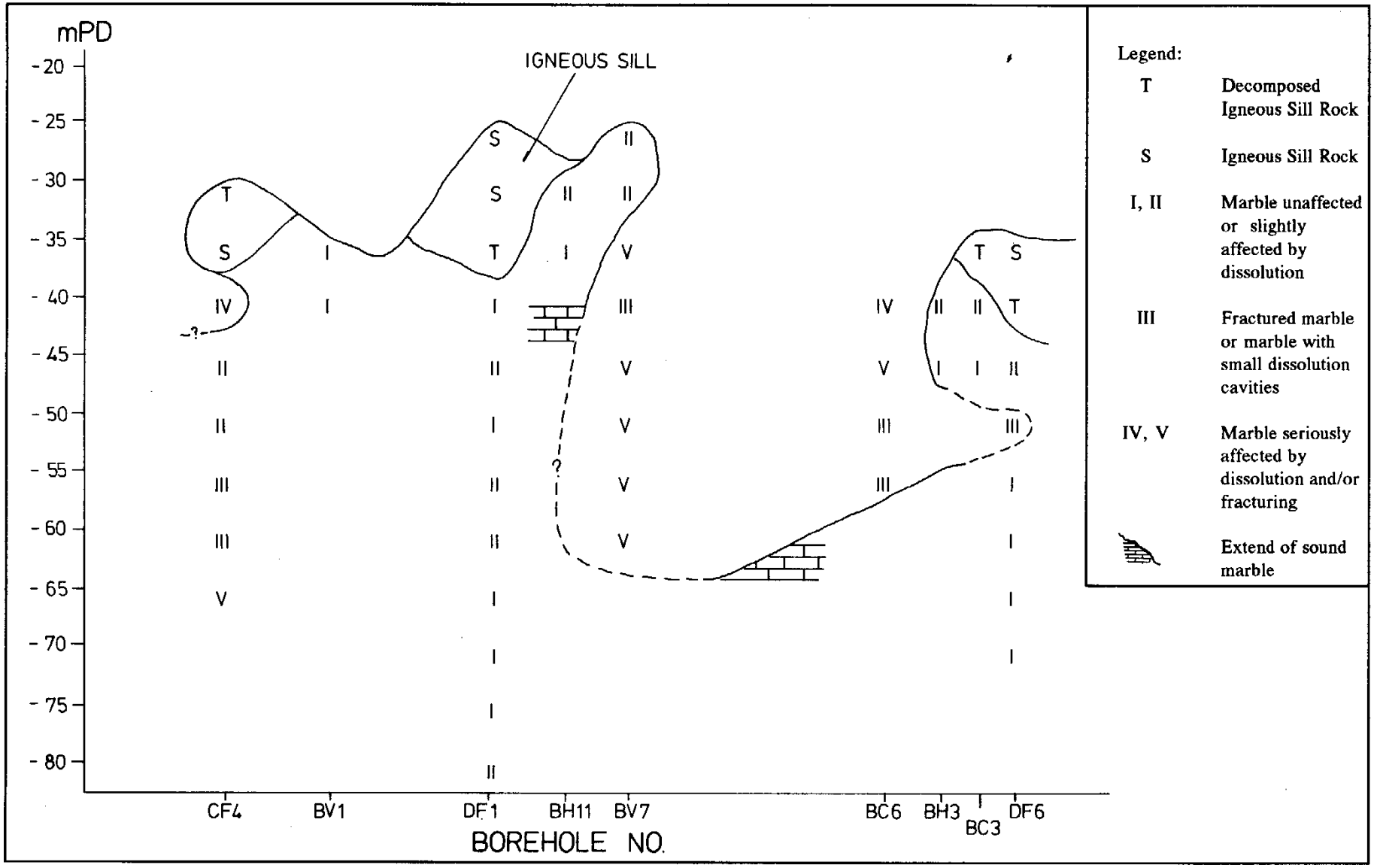
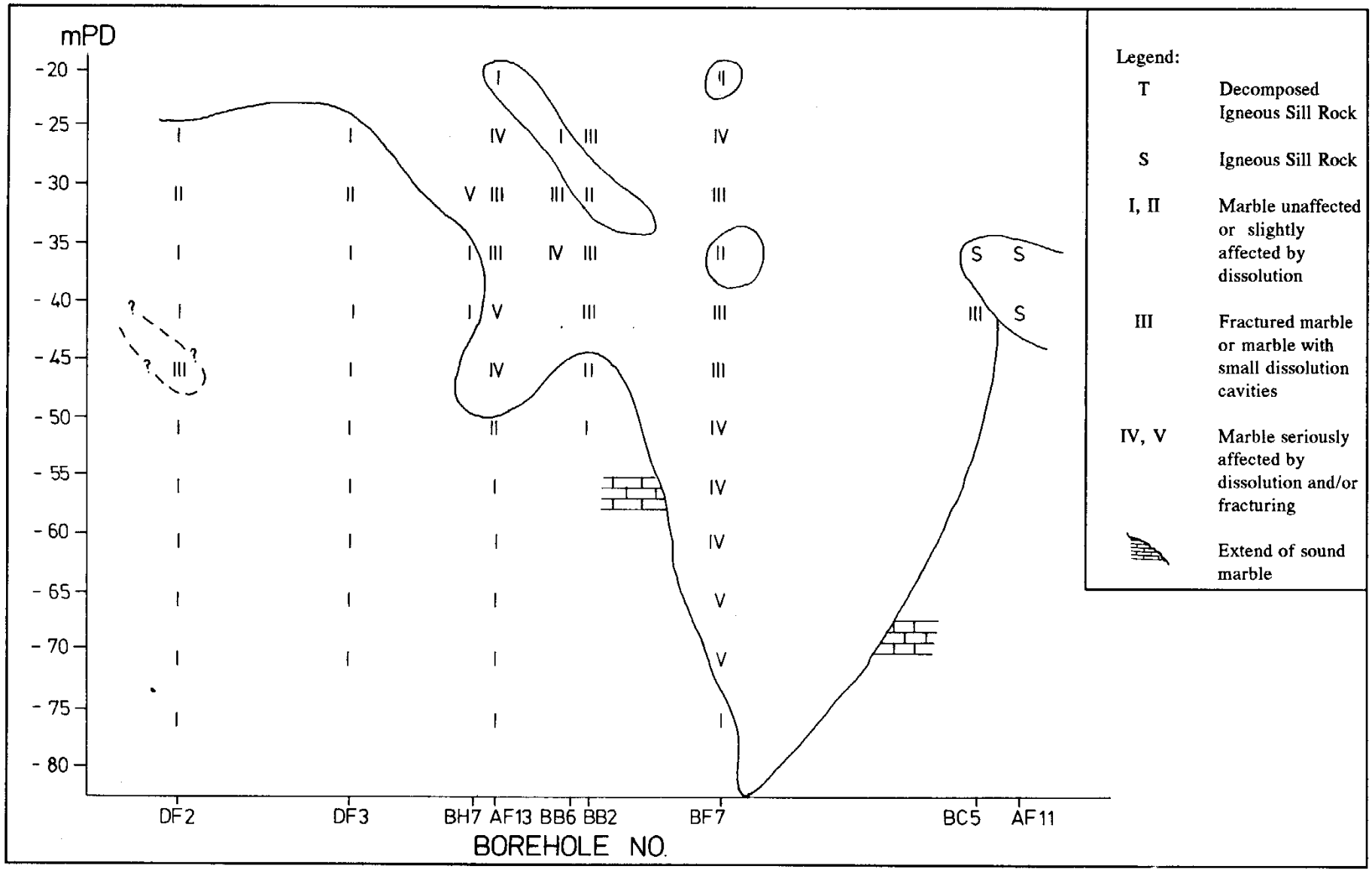


Figure 2 - Vertical Section 1-1



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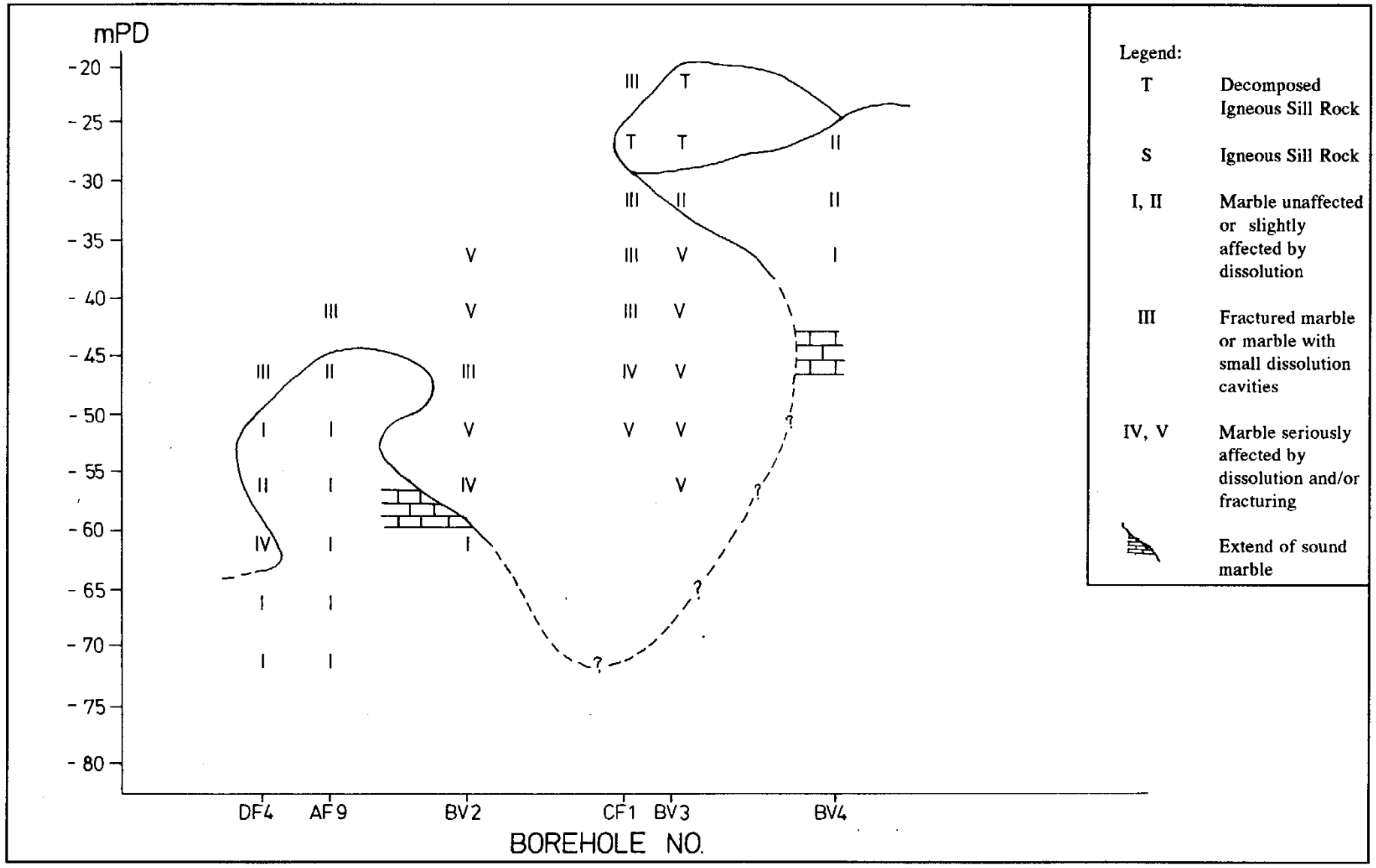


Figure 4 - Vertical Section 3-3

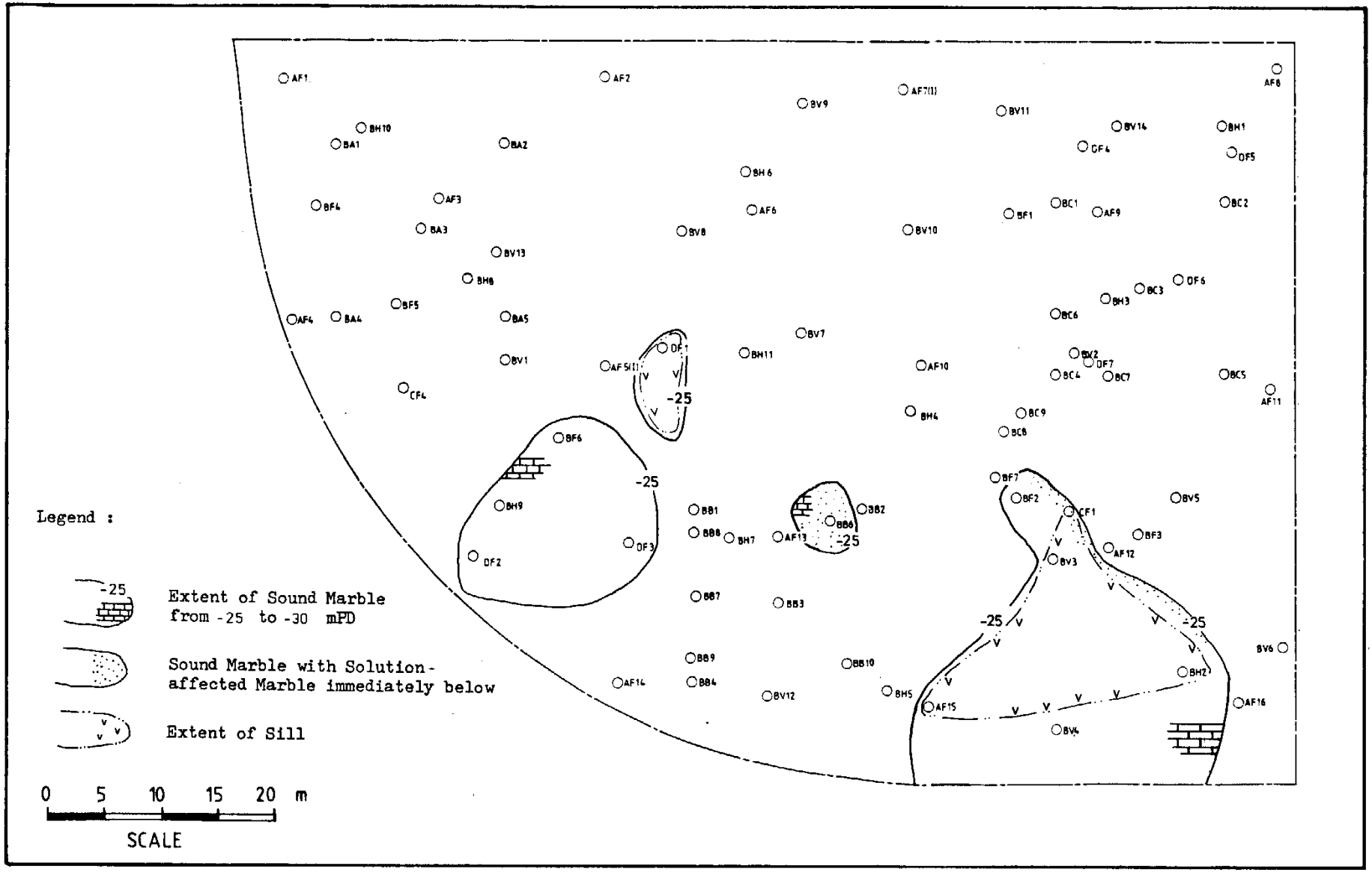


Figure 5 - Extent of Sound Rock at -25 mPD to -30 mPD

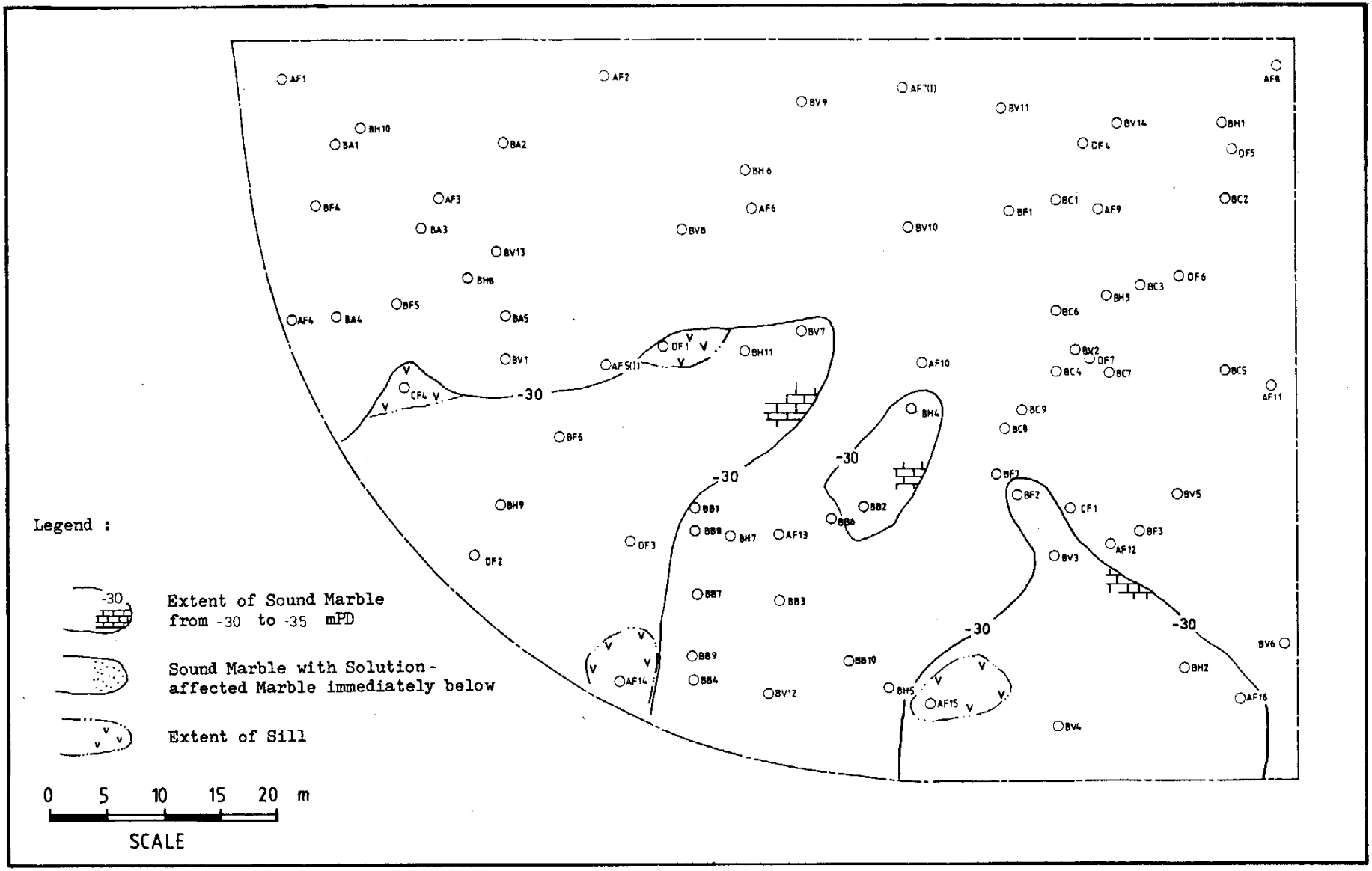


Figure 6 - Extent of Sound Rock at -30 mPD to -35 mPD

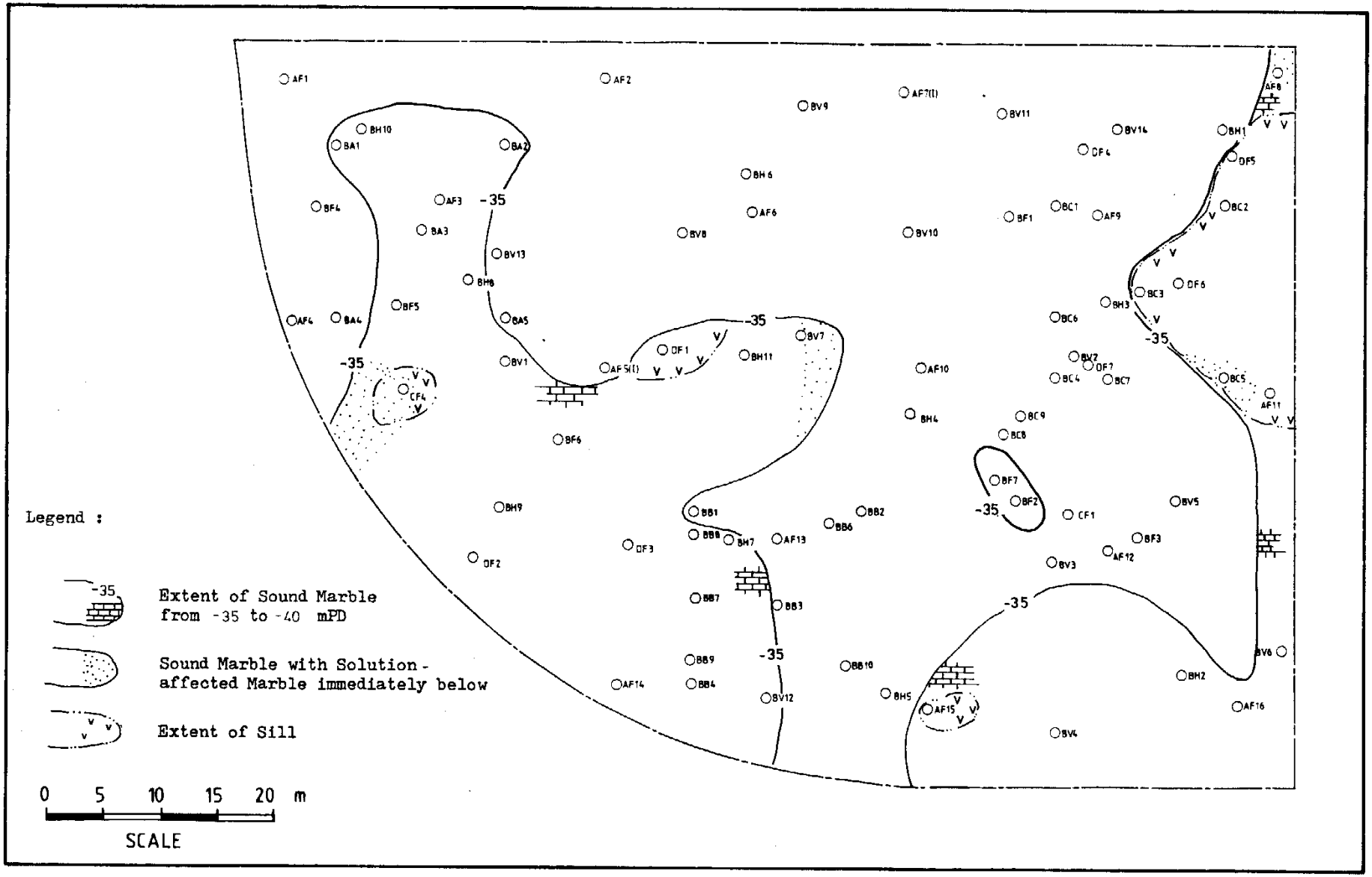


Figure 7 - Extent of Sound Rock at -35 mPD to -40 mPD

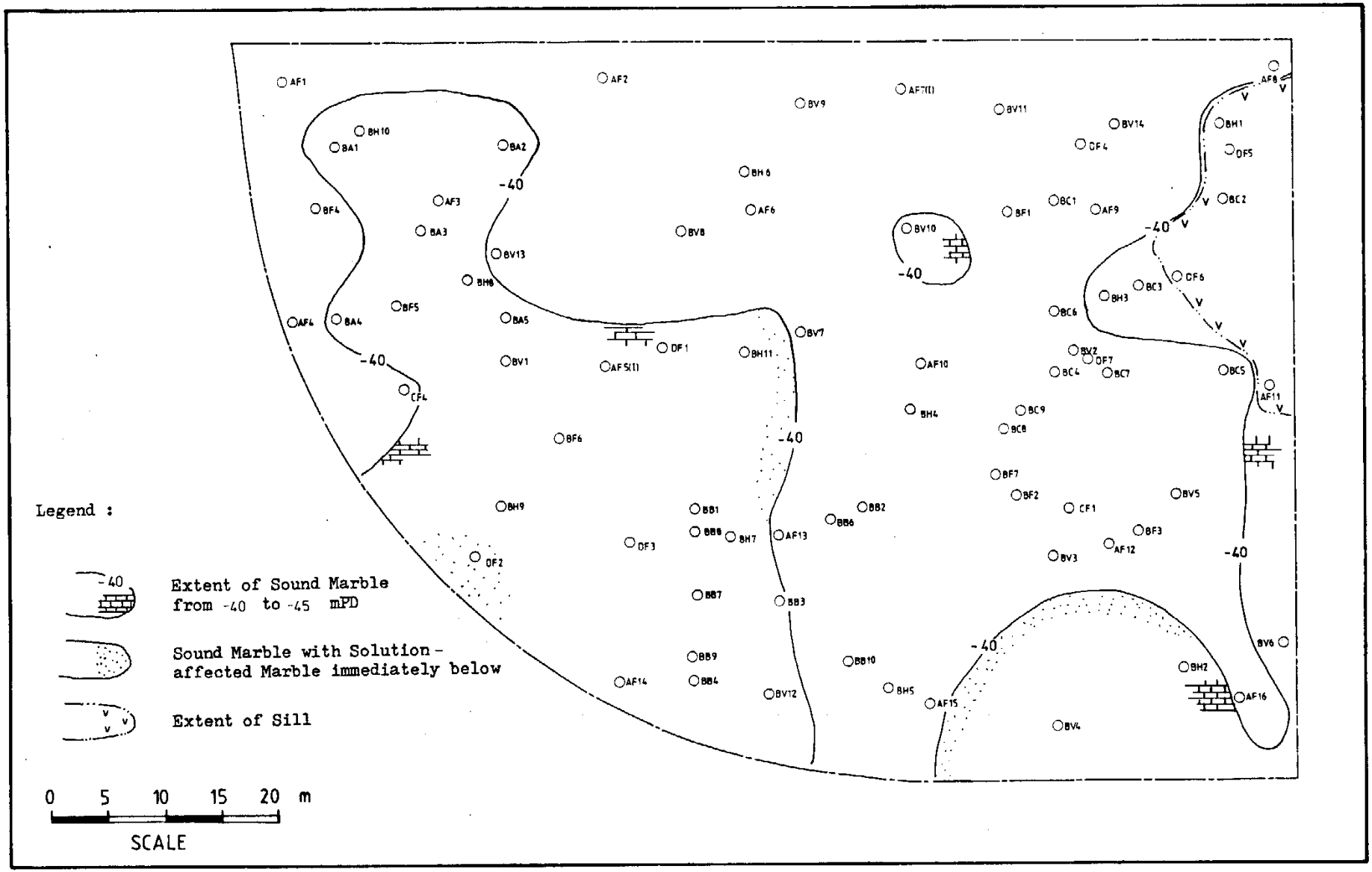


Figure 8 - Extent of Sound Rock at -40 mPD to -45 mPD

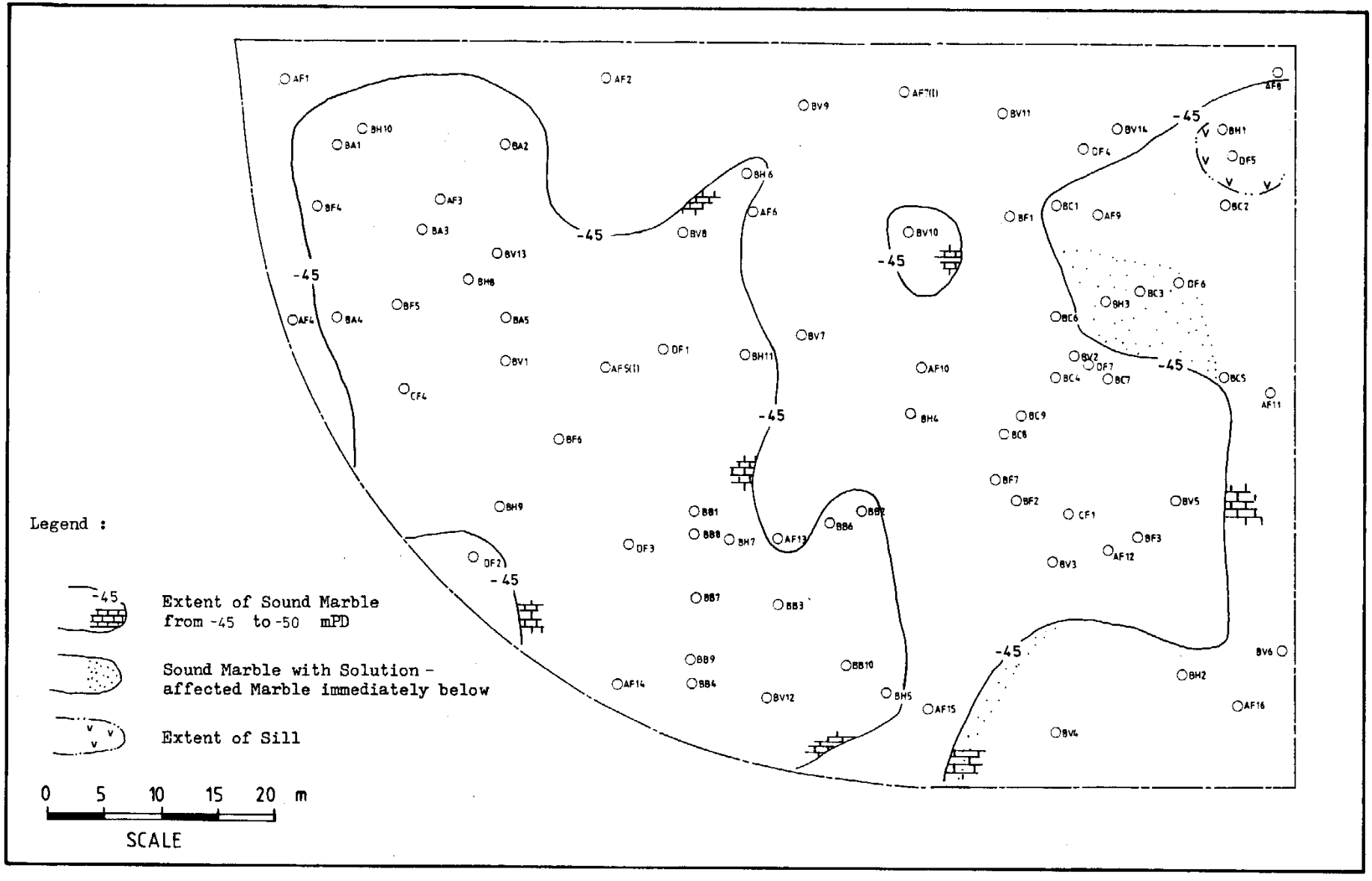
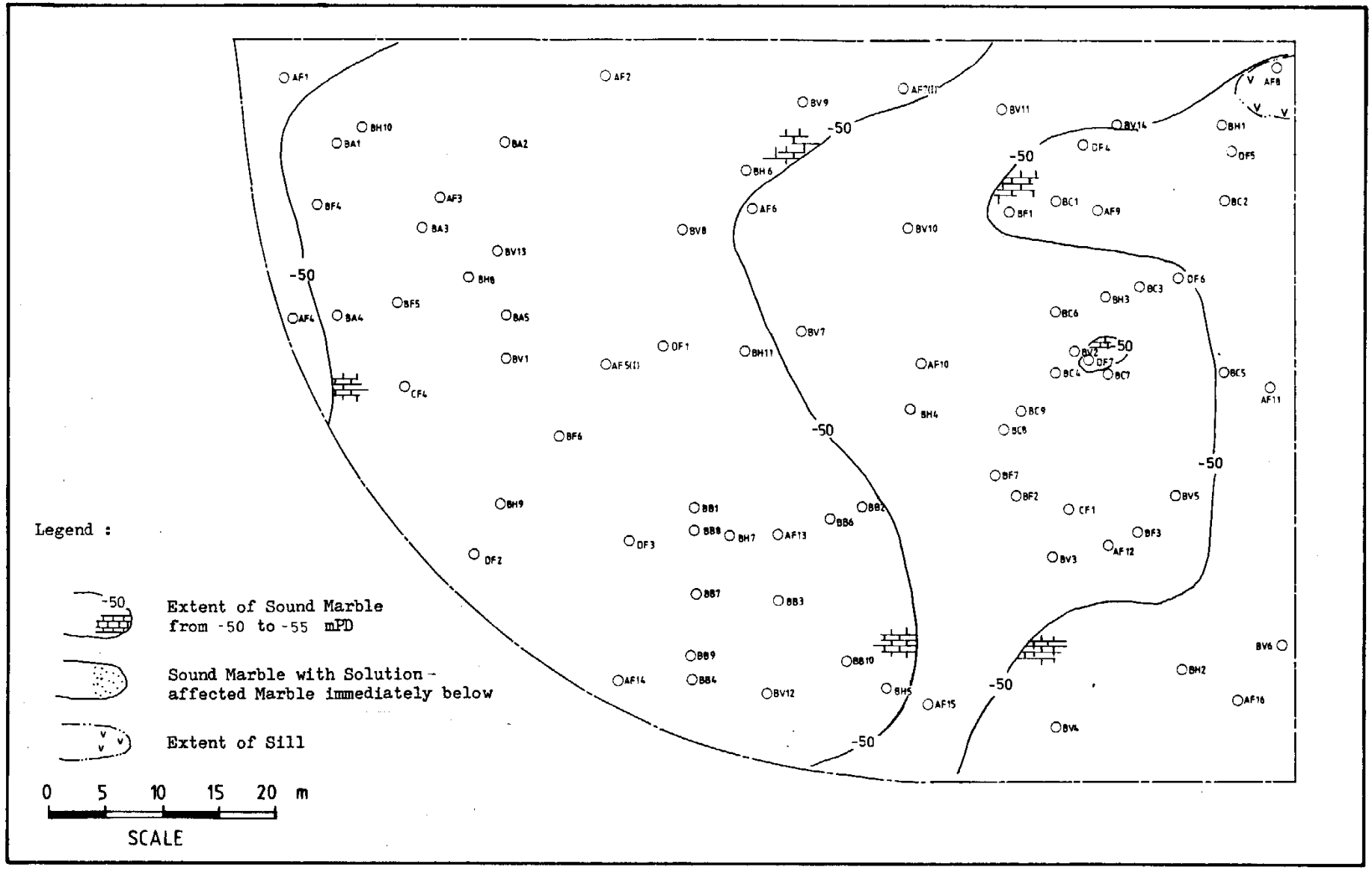


Figure 9 - Extent of Sound Rock at -45 mPD to -50 mPD



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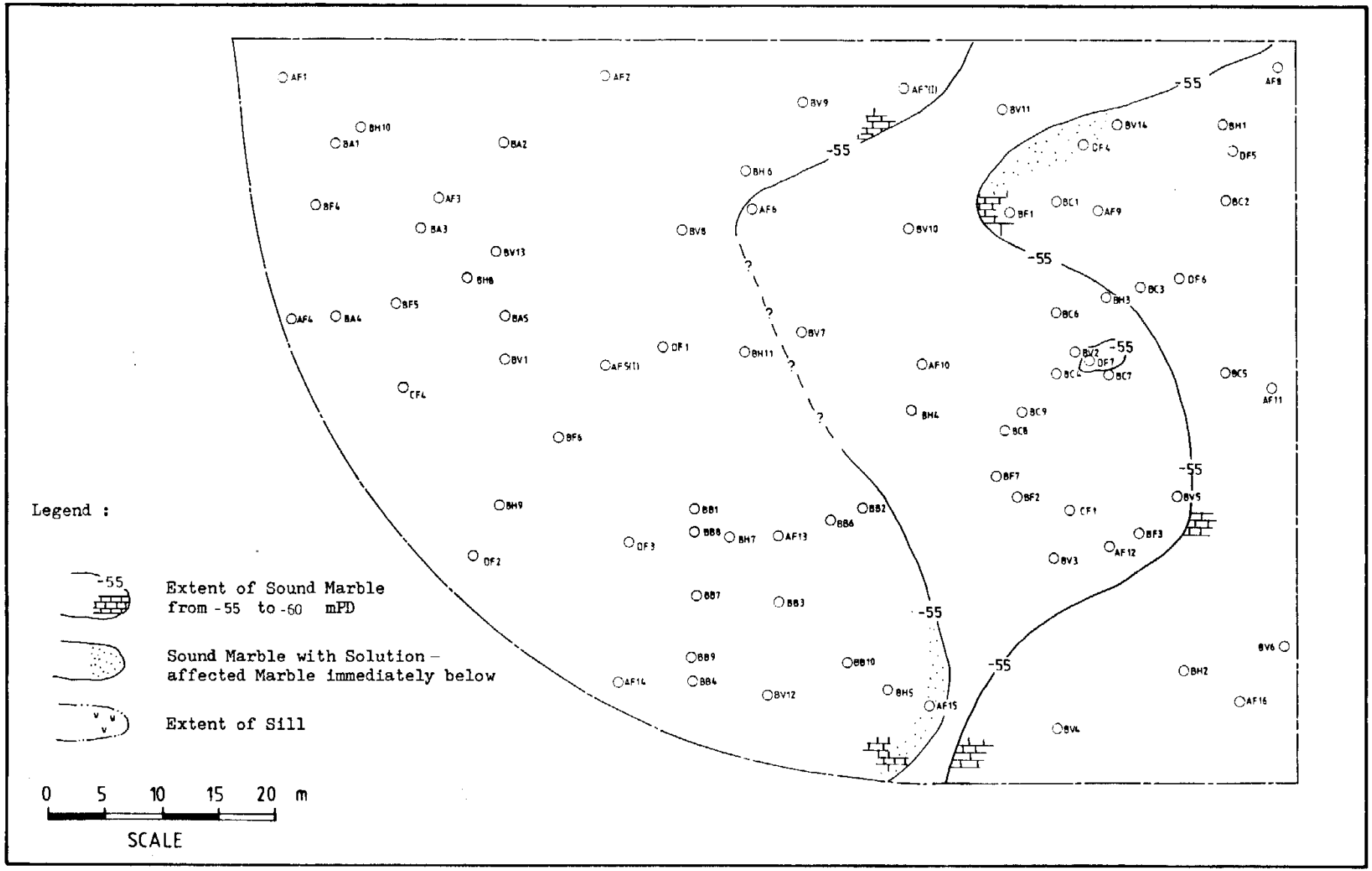


Figure 11 - Extent of Sound Rock at -55 mPD to -60 mPD

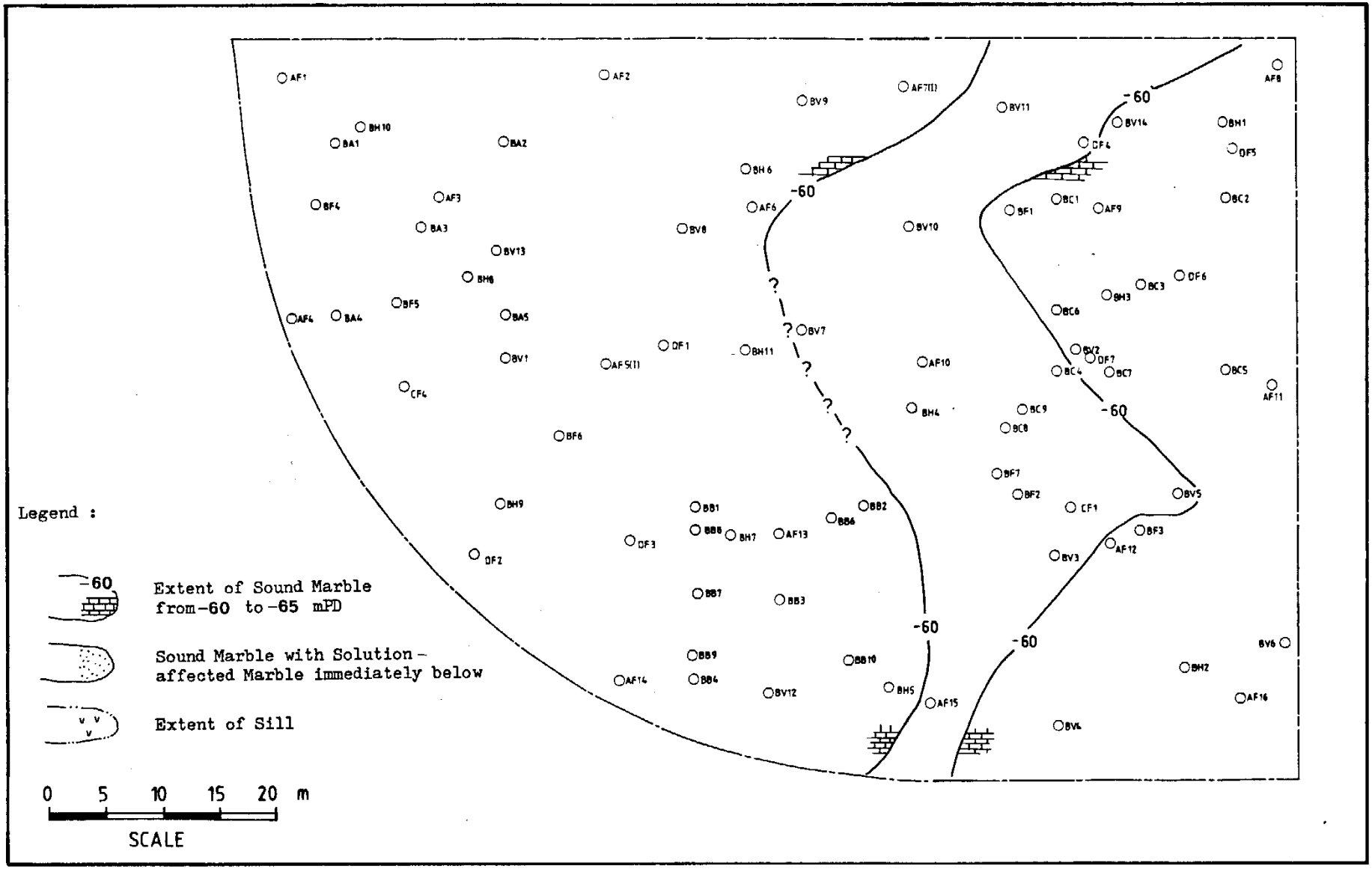


Figure 12 - Extent of Sound Rock at -60 mPD to -65 mPD

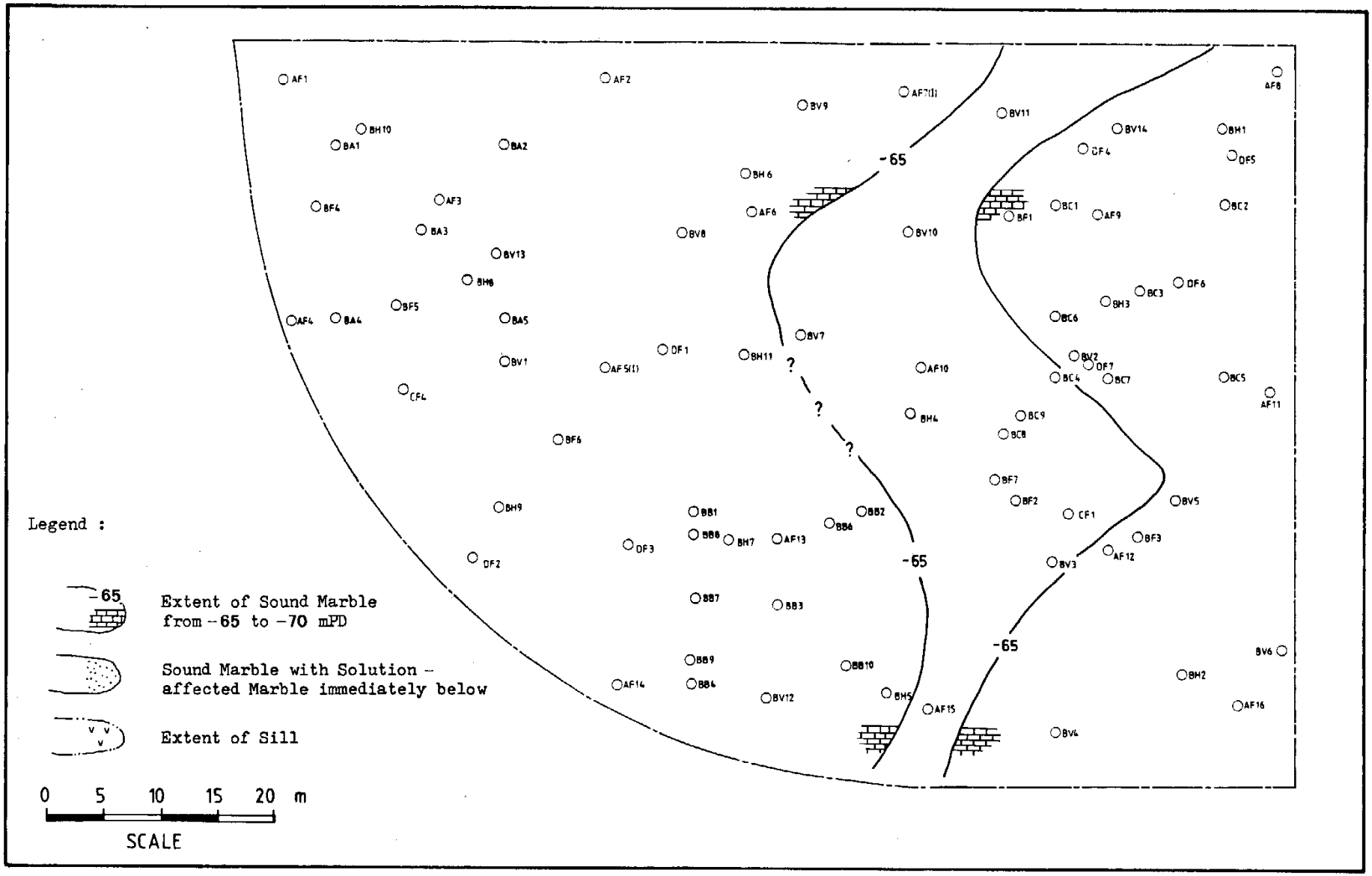


Figure 13 - Extent of Sound Rock at -65 mPD to -70 mPD

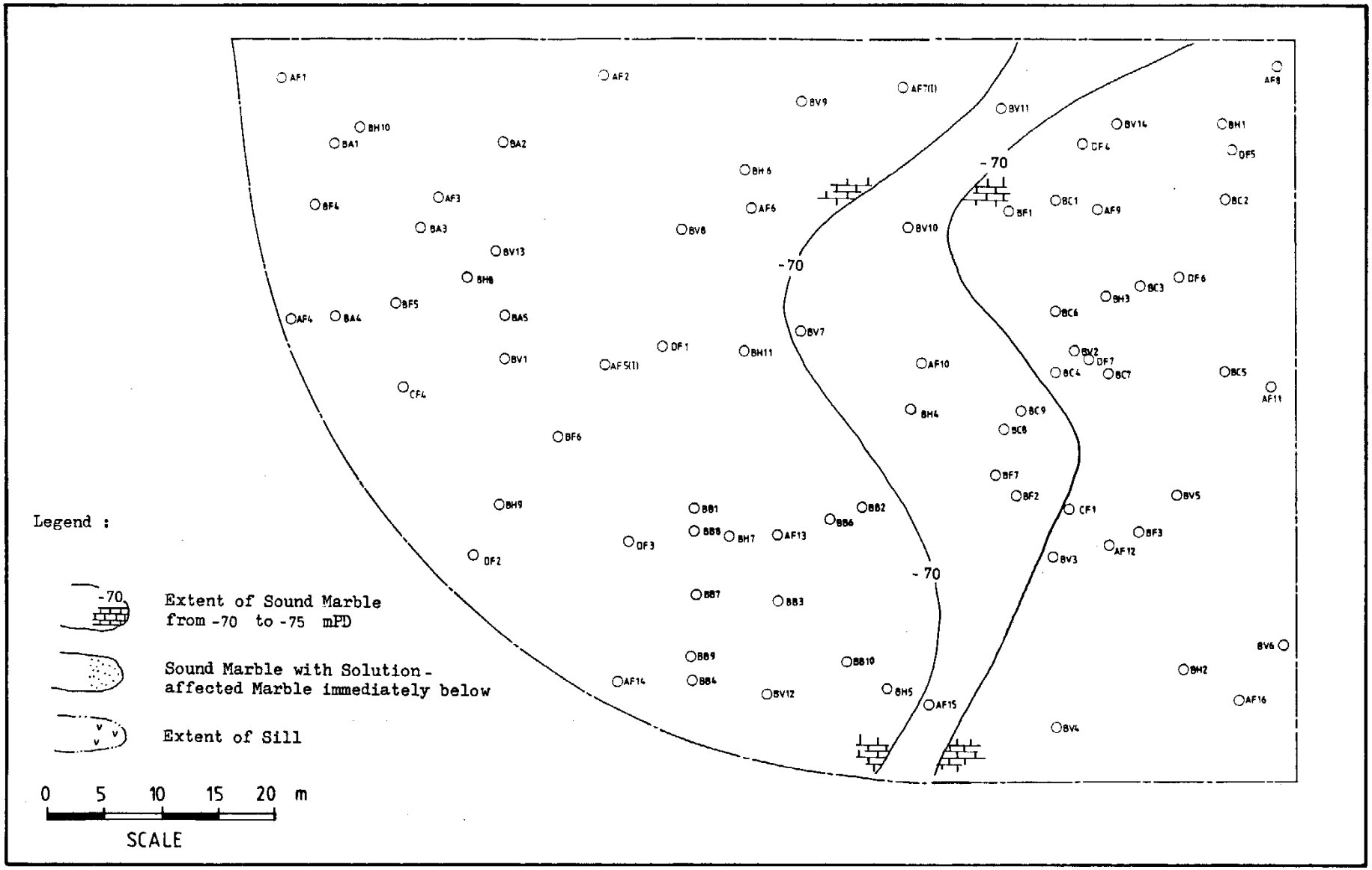


Figure 14 - Extent of Sound Rock at -70 mPD to -75 mPD

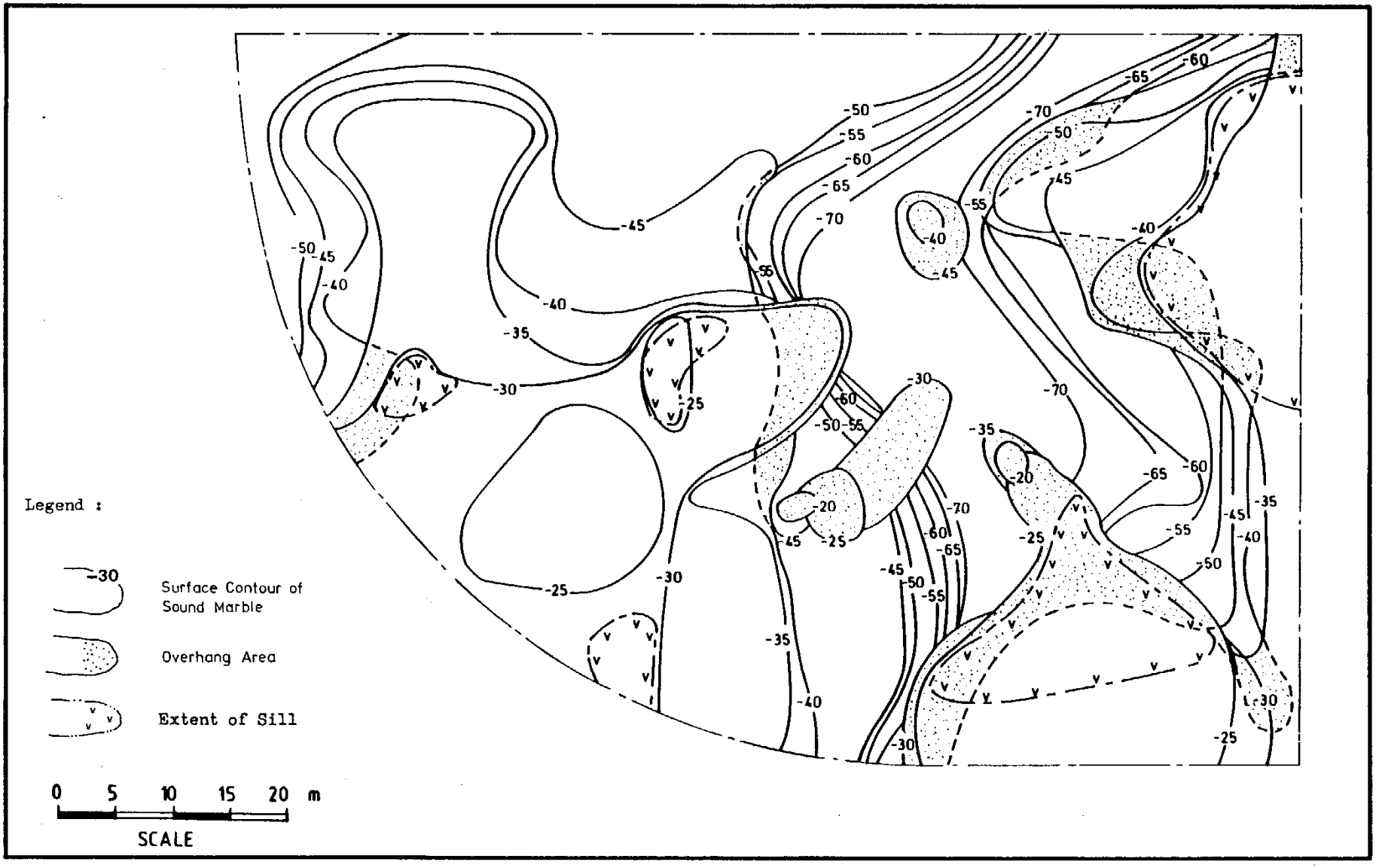


Figure 15 - Contour of Bottom of Surface Karst Zone

APPENDIX A

MQD VALUES AND MARBLE MASS CLASSES

BOREHOLE	SECTION STARTING (mPD)																				
	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BA-1				I	I																
BA-2				I																	
BA-3				I	I																
BA-4				III	I																
BA-5				IV	S	I															
BB-1				III	I																
BB-2		III	II	III	III	III	II	I													
BR-4				I																	
BR-6		T	III	IV																	
BC-1						II	I	T													
BC-2				S	S																
BC-3				T	II	I															
BC-5				S	III																
BC-6					IV	V	III	III													
BY-1				I	I																
BY-2				V	V	III	V	IV	I												
BY-3	T	T	II	V	V	V	V	V													
BY-4		II	II	I																	
BY-5					V	V	V	V	V												
BY-6				I	I																
BY-7		C	II	II	V	III	V	V	V	V											
BY-8						II															
BY-9			III	V	V	IV	II														
BY-10						II	II														
BY-11								IV													
BY-12				I	I																
BY-13				IV	III	S															
BY-14								S													
BH1					S	S															
BH2		S	II	I																	
BH3					II	I															
BH4			I																		
BH5		III	V	V	IV	I															
BH6						I	I														
BH7			V	I	I																
BH8				I	I																
BH9		I	I																		
BH10				I	I																
BH11				II	I																
AF1				IV	V	V	IV	I	I	I											
AF2					I	III	I	I	I	I											
AF3				II	I	I	I	I	I	I	I	I	II	II	III	II	I	I	S	I	I
AF4				IV	III	III	III	I	I	I											
AF5(1)					II	II	I	III	IV	II	I	I									
AF6			IV	V	V	IV	IV	IV	II	I	I										
AF7(1)							II	II	II	I	I	I									
AF8			IV	II	III	V	V	II	I												
AF9					III	II	I	I	I	I	I	I	I	I	I	I	I	I	S	I	I
AF10(1)							IV	II	I	I	I	I	I	I	I						
AF11				S	S	I	I	I	III	III											
AF12							IV	III	II	I	II	I	I								
AF13	I	IV	III	III	V	IV	II	I	I	I	I	I	I	I	I	I	I	I	S		
AF14			S	I	I	I	II	I	I	I	I										
AF15	III	V	S	V	V	V	III	II	IV	IV	V	III	III	III	I						
AF16			II	II	III	I	II	II	III	I											
BF1					IV	IV	I	I	I	I	I										
BF2	III	II	I	I	V	III	V	V	V	V	V	IV	III	I	I	I					
BF3							IV	III	I	I	I										
BF4				V	IV	II	I	I	I	I											
BF5				I	I	I	I	I	I	I											
BF6	I	I	I	II	I	I	I	II	I	I											
PF7	II	IV	III	II	III	III	IV	IV	IV	V	V	I									
CF1	III	V	III	III	III	IV	V														
CF4			V	S	IV	II	II	III	III	V											
PF1		S	S	V	I	II	I	II	II	I	I	I	I	II	I	II					
PF2		I	II	I	I	III	I	I	I	I	I	I									
PF3		I	II	I	I	I	I	I	I	I	I	I									
PF4						III	I	II	IV	I	I										
PF5				V	S	S	I	I	I	I	I	I									
PF6				S	V	II	III	I	I	I	I										
PF7				III	III	III	II	I	I	I	I	I	I								

Marble Mass Class

RANGE OF MQD

I	MQD ≥ 75
II	50 ≤ MQD < 75
III	25 ≤ MQD < 50
IV	10 ≤ MQD < 25
V	MQD < 10
S	OTHER ROCK TYPE (ROCK)
T	OTHER ROCK TYPE (SOIL)

Marble Rock Recovery Ratio

BOREHOLE	SECTION STARTING (mPD)																						
	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120		
BA-1				100.0	100.0																		
BA-2				100.0																			
BA-3				100.0	100.0																		
BA-4				56.0	100.0																		
BA-5				44.9	100.0	100.0																	
BB 1				65.4	100.0																		
BB-2		86.2	87.4	81.0	73.2	95.6	85.8	100.0															
BB-4				100.0																			
BB-6		100.0	74.6	72.6																			
BC-1						100.0	100.0	100.0															
BC-2				100.0	100.0																		
BC-3				100.0	100.0	100.0																	
BC-5				100.0	100.0																		
BC-6					72.5	32.0	88.0	100.0															
BY-1				100.0	100.0																		
BY-2				15.3	33.0	82.0	28.0	66.0	100.0														
BY-3	100.0	60.0	80.0	27.2	0.0	24.0	0.0	0.0															
BY-4		90.5	88.2	100.0																			
BY-5					47.0	0.0	0.0	0.0	0.0														
BY-6				100.0	100.0																		
BY-7			100.0	100.0	29.4	63.0	40.2	0.0	0.0	0.0													
BY-8						95.3																	
BY-9			71.6	33.6	53.0	57.4	100.0																
BY-10					100.0	100.0																	
BY-11								100.0															
BY-12				91.2	100.0																		
BY-13				44.4	88.0	100.0																	
BY-14								100.0															
BH1					100.0	100.0																	
BH2		82.0	100.0	100.0																			
BH3					100.0	100.0																	
BH4			100.0																				
BH5		67.4	6.8	0.0	39.0	100.0																	
BH6						100.0	100.0																
BH7			32.7	96.4	100.0																		
BH8				96.0	100.0																		
BH9		100.0	100.0																				
BH10				100.0	100.0																		
BH11				84.3	100.0																		
AF1				35.7	29.8	29.0	46.4	100.0	100.0	100.0													
AF2					100.0	57.0	100.0	100.0	100.0	100.0													
AF3				93.2	98.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	78.8	85.4	68.2	84.4	95.0	95.4	100.0	100.0	100.0	
AF4				48.4	71.0	85.2	64.0	100.0	100.0	100.0													
AF5(1)					88.6	91.8	97.0	76.2	45.0	76.6	100.0	100.0											
AF6			54.5	17.4	0.0	55.4	68.4	52.2	88.6	100.0	100.0												
AF7(1)							87.5	86.0	100.0	96.0	91.0	100.0											
AF8			37.8	85.0	57.0	31.0	0.0	79.6	100.0														
AF9					72.7	92.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
AF10(1)							81.3	84.0	100.0	100.0	100.0	100.0	95.2	100.0	100.0								
AF11				100.0	100.0	100.0	100.0	100.0	100.0	100.0													
AF12							42.5	62.2	88.0	100.0	78.8	100.0	100.0										
AF13	100.0	65.4	56.4	57.0	38.0	48.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
AF14			100.0	100.0	100.0	93.6	87.0	100.0	100.0	100.0	100.0												
AF15	71.9	46.8	61.2	4.8	84.2	48.2	81.0	84.2	44.0	64.8	33.8	85.8	92.0	93.2	100.0								
AF16			100.0	100.0	84.0	93.4	100.0	100.0	89.6	100.0													
BF1					75.2	75.4	100.0	100.0	100.0	100.0	100.0												
BF2	64.9	79.6	100.0	100.0	33.6	80.6	0.0	23.0	0.0	0.0	0.0	65.2	100.0	91.0	100.0	100.0							
BF3							62.7	100.0	100.0	90.8	88.7												
BF4				11.4	39.0	86.0	100.0	100.0	100.0	100.0													
BF5				94.4	100.0	100.0	100.0	100.0	100.0	100.0													
BF6	100.0	100.0	100.0	86.0	99.0	100.0	100.0	86.4	100.0	100.0													
BF7	87.0	68.6	92.0	91.0	90.0	100.0	93.2	54.6	73.4	30.8	22.0	100.0											
CF1	69.3	8.6	58.0	88.0	76.4	87.4	55.0																
CF4			55.8	78.4	55.0	100.0	79.0	88.0	71.6	0.0													
DF1		82.9	55.8	34.2	100.0	83.0	100.0	100.0	89.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0							
DF2		97.6	85.4	100.0	100.0	58.0	100.0	100.0	100.0	100.0	100.0	100.0											
DF3		100.0	100.0	94.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0											
DF4						100.0	100.0	92.0	54.0	100.0	100.0												
DF5				100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0											
DF6				100.0	44.0	100.0	86.6	100.0	100.0	100.0	100.0												
DF7				79.7	100.0	82.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0										

Marble Quality Designation

BOREHOLE	SECTION STARTING (mPD)																						
	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120		
BA 1				76.1	100.0																		
BA-2				90.2																			
BA-3				84.2	97.9																		
BA-4				27.3	87.4																		
BA-5				14.8	80.8	93.0																	
BB-1				33.5	80.2																		
BB-2		49.0	66.2	43.7	28.4	39.9	56.1	100.0															
BB-4				87.7																			
BB-6		83.8	31.4	14.1																			
BC-1						72.5	96.7	93.9															
BC-2				17.5	33.6																		
BC-3				0.0	64.0	86.9																	
BC-5				30.3	31.2																		
BC-6					14.5	1.5	39.2	25.8															
BY-1				90.3	89.0																		
BY-2				0.1	4.6	27.7	2.8	20.6	75.2														
BY-3	0.0	5.0	51.9	4.4	0.0	5.0	0.0	0.0															
BY-4		53.7	62.2	95.7																			
BY-5					0.0	0.0	0.0	0.0	0.0														
BY-6				92.8	76.1																		
BY-7			59.3	59.9	5.0	26.9	6.4	0.0	0.0	0.0													
BY-8						67.4																	
BY-9			37.4	1.8	8.4	15.2	65.7																
BY-10					56.7	53.8																	
BY-11								17.0															
BY-12				82.1	81.0																		
BY-13				10.6	35.4	89.2																	
BY-14								37.0															
BH1					10.8	73.0																	
BH2		46.5	70.0	90.0																			
BH3					69.0	100.0																	
BH4			99.0																				
BH5		48.9	0.1	0.0	13.7	99.3																	
BH6						93.3	100.0																
BH7			9.6	82.8	100.0																		
BH8				77.5	100.0																		
BH9		96.9	100.0																				
BH10				78.9	99.8																		
BH11				62.7	100.0																		
AF1				10.5	6.6	5.2	19.6	96.8	95.8	100.0													
AF2					93.7	30.1	88.4	91.1	96.6	100.0													
AF3				74.4	91.3	77.2	92.6	92.3	96.0	100.0	95.6	96.8	58.5	72.9	42.4	54.4	83.2	84.4	87.3	92.3	97.0		
AF4				20.1	42.2	50.0	35.7	85.6	88.5	86.0													
AF5[1]					72.4	73.9	85.5	48.1	14.4	52.7	95.0	100.0											
AF6			21.6	0.5	0.0	21.7	19.8	17.9	64.7	89.3	100.0												
AF7[1]							68.4	61.0	74.3	78.4	80.8	100.0											
AF8			11.3	66.2	30.3	1.9	0.0	63.4	97.4														
AF9					34.0	65.4	91.6	99.5	97.0	96.0	83.2	91.7	94.0	94.1	100.0	99.2	93.1	91.8	89.3	98.8	92.0		
AF10[1]							21.0	59.9	95.8	92.5	98.2	98.8	84.9	93.1	92.4								
AF11				25.1	52.8	86.8	88.0	84.8	35.2	28.0													
AF12							12.3	29.3	61.0	85.9	52.7	96.0	83.7										
AF13	80.4	20.9	27.6	27.4	7.2	10.3	60.9	84.3	81.8	100.0	95.9	92.7	89.7	94.5	92.9	95.2	99.2	94.5	92.0	82.5			
AF14			96.2	98.3	99.6	84.8	64.1	95.1	87.7	93.9	100.0												
AF15	30.4	5.3	11.0	0.0	6.7	9.6	37.7	53.3	16.7	14.3	3.4	42.9	37.6	37.4	77.3								
AF16			64.2	55.4	47.2	84.6	71.4	65.4	42.4	82.4													
BF1					23.3	15.4	86.1	100.0	100.0	98.6	97.0												
BF2	33.5	57.7	84.7	95.4	6.9	36.1	0.0	2.1	0.0	0.0	0.0	16.3	38.4	80.7	91.3	88.0							
BF3							14.6	47.3	89.4	77.7	77.7												
BF4				0.3	13.9	65.1	89.9	100.0	100.0	100.0													
BF5				80.9	97.5	100.0	96.7	82.0	93.3	98.1													
BF6	99.8	94.5	94.2	68.7	95.2	96.6	96.7	70.3	100.0	100.0													
BF7	50.5	20.0	26.7	59.4	38.7	27.0	17.6	10.0	15.9	7.0	0.8	90.0											
CF1	30.4	0.6	32.8	45.6	38.0	14.8	8.1																
CF4			6.7	39.6	20.4	74.5	55.2	39.2	37.3	0.0													
DF1		26.8	17.6	8.1	96.9	53.9	79.4	62.5	72.1	99.4	94.4	91.5	85.7	59.1	79.3	67.0							
DF2		94.3	65.0	96.7	91.9	28.9	91.9	81.0	91.6	92.2	98.2	94.0											
DF3		87.8	73.0	78.7	95.8	87.1	95.3	95.2	84.6	97.7	96.4	100.0											
DF4						49.2	99.0	73.0	17.8	98.0	100.0												
DF5				7.9	25.8	30.4	90.4	95.3	94.2	97.1	88.0	97.0											
DF6				38.3	5.9	52.1	45.2	83.6	100.0	98.8	100.0												
DF7				30.2	39.1	34.3	57.0	93.5	95.5	96.0	86.9	93.3	100.0										

SECTION 2: KARST MORPHOLOGY OF A SITE IN THE EASTERN PART OF YUEN LONG TOWN

Y.C. Chan & W.K. Pun

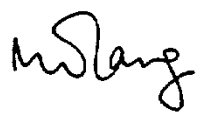
This report was originally produced in August 1989 as
GCO Technical Note No.TN 8/89

FOREWORD

This is the second of a series of reports on the karst morphology interpreted for individual sites in the Designated Area. This facilitates the checking of foundation design submitted by the developer for the development of the site.

The morphology interpretation was done through the MQD and marble mass classification system developed in Mainland West Division of GCO. The system was reported in GCO Technical Note TN 4/89.

The interpretation was made by Mr Y.C. Chan with the assistance of Mr W.K. Pun. The figures were prepared in the Mainland West Division.



M.C. Tang
Acting Chief Geotechnical Engineer/
Mainland West

CONTENTS

1. INTRODUCTION

In January 1989, the GCO studied schemes for classifying marble sites. The study led to the formulation of a marble mass classification system that facilitates the identification of the extent of marble slightly affected or unaffected by dissolution. This provides a tool for the interpretation of karst morphology of sites from drillhole data. Such interpretation would allow foundation to be designed or checked with greater confidence.

This report describes the karst morphology of a site in the eastern part of Yuen Long town. The interpretation was made in late April, 1989 and was used in the subsequent checking of the foundation designs from the developer.

2. BASIS OF ANALYSIS

The marble mass classification system utilises the following definitions.

$$\text{MQD} = \text{Average RQD} \times \text{Marble Rock Recovery Ratio (MR)}$$

$$\text{Average RQD} = \sum_{L_1}^{L_2} \frac{r_i \times l_i}{(L_2 - L_1)}$$

$$\text{MR} = \sum_{L_1}^{L_2} \frac{l_i}{(L_2 - L_1)}$$

where l_i is the length of core of RQD value r_i.

L_1 is the top elevation of the section of core being considered.

L_2 is the bottom elevation of the section of core being considered.

$(L_2 - L_1)$ is usually 5 m.

Marble Class	MQD Values (%)	Description
I	75.1 - 100	Very good quality marble mass consisting of rock with widely spaced fractures and unaffected by dissolution.
II	50.1 - 75	Good quality marble mass consisting of rock slightly affected by dissolution or slightly fractured rock essentially unaffected by dissolution.
III	25.1 - 50	Fair quality marble mass consisting of fractured rock or rock moderately affected by dissolution.
IV	10.1 - 25	Poor quality marble mass consisting of very

		fractured rock or rock seriously affected by dissolution.
V	0 - 10	Very poor quality marble mass consisting of rock similar to class IV marble except that cavities can be very large and marble continuous.

Details of the marble mass classification system are described in Chan (1994).

3. GROUND INVESTIGATION

A total of some 500 drillholes have been sunk at the site to clarify the geology. Figure 1 shows the location of the boreholes.

About 150 boreholes are being drilled by the developer to 20 to 50 m below rockhead to prove founding levels of the large diameter bored piles. This information is not available yet for incorporation into this report.

4. MQD AND MARBLE MASS GRADING

Appendices A and B tabulate the MQD values and the marble mass classes compiled from borehole information for the site. Figure 2 is a statistics of the marble rock recovery ratios and cavity sizes with marble mass classes.

5. GEOLOGY

5.1 Rock Types

Three main rock types are found in the site, namely, marble, metamorphosed granodiorite and basalt dyke. The marble is mostly greyish white to white. The metamorphosed granodiorite is highly weathered and is underlain by marble. The basalt dyke is highly weathered for the top 5-10 m. It runs NNE across the northwestern corner of the site and is 5-10 m wide. Figure 1 shows the rock distribution.

Some weathered mudstone and siltstone have also been logged immediately under the weathered granodiorite e.g. at BH301 and 304. They are however limited in extent and are treated as part of the granodiorite body in the karst morphology appraisal.

5.2 Superficial Deposits

The site is covered by about 4 m of random fill. Under the fill is alluvium of sand/silt interbeds. Below these and above the marble rockhead is a layer of firm dark brown silty clay with rock fragments. This was logged as 'Terra Rosa' or completely decomposed

marble. Both terms implies the same material, i.e. a laterite of non-carbonate residual after dissolution of the marble. This layer varies in thickness from zero to 20 metres but generally exceeds 10 metres. The current view of the Resident Consultant Geologist engaged by GCO is that completely decomposed marble can only be very thin in the Designated Area. The mottled material is a debris flow deposit. This debris deposit was washed to cover the surface karst and filled most underground channels.

In this respect, the Terra Rosa logged at the northwestern corner of the site is particularly worthnoting because it lies between the decomposed granodiorite and the karstic marble. The 5 to 10 m of "Terra Rosa" would have to be formed by dissolution of over 100 metres of dirty marble. Because of the non-uniform rate of dissolution, the capping granodiorite would certainly disintegrate in the course of subsidence to compensate the void left by dissolution. This material is more likely to be debris deposit washed in to fill underground channels at the marble granodiorite interface.

6. SECTIONS

6.1 Vertical Sections

Figures 5 to 11 show 7 longitudinal sections. Figures 12 to 22 contain twenty two cross-sections running N-S across the site. The location of the sections are shown in Figure 3 and the legend for the Figures are shown in Figure 4. Depressions (e.g. Section 7-7, 18-18), overhangs (e.g. Section 2-2, 3-3, 8-8), slots (e.g. Section 15-15, 16-16) and underground channels (e.g. Section 4-4, 5-5) are easily discernible.

Figures 23 to 25 are 5 cross-sections (Sections 23-23 to 27-27) drawn to examine the extent of an underground channel at the northwestern corner of the site. The locations of the cross-sections are shown in Figure 3. As information regarding the overburden materials is absent for a number of boreholes, some of the sections are rather interpretative. However, an underground channel in that area is still the best hypothesis to explain all observations including the Terra Rosa and karst features in certain part of the marble.

6.2 Horizontal Sections

Drg GCSP 25/1 contains eleven horizontal sections showing the extent of sound marble (class I, II), granodiorite and basalt dyke. Each section represents 5 m of materials and is designated by the top elevation of the section e.g. Section -15 mPD is for the rock distribution from -15 mPD to -20 mPD. The horizontal sections are useful for identifying alignment of cavities and overhang areas.

Simple 3-D models can be made by piling together polystyrene sheets cut to the shape of the horizontal sections. Such a model is useful to visualize the foundation problems on site.

7. KARST HYDROGEOLOGY AND MORPHOLOGY

7.1 Hydrogeological Regime

Hydrogeologically, the site can be divided into three compartments, i.e. the east, the middle and the west compartment. Their extents can best be seen at Figure 26.

Within each compartment, surface water drained down to the general water table through drainage systems. A drainage system is a group of interconnected cavities and channels conducting the downward flow from a general catchment area at the ground surface. Whilst drainage systems in two compartments are not connected, drainage systems within a single compartment may be linked together by underground channels. The boundary of the drainage systems are fixed according to the channel and cavity characteristics and is unavoidably arbitrary at times.

The extent of the drainage systems are also shown in Figure 26.

7.2 The East Compartment

The east compartment occupies over half of the site, it is separated from the middle compartment by the ridge line 9A-13D-11F (Section -20 mPD, Drg. GCSP 25/1). The compartment is completely isolated below -25 mPD. Water in this compartment drained down to the water table in the past through three main underground drainage systems, i.e. East 1, East 2 and East 3.

System East 1 possessed the largest catchment (see Section -30 mPD). The downflow channel was composed of elongated branches. The orientation and combination of the branches varied at different levels resulting in a large area of overhangs of limited thickness but large lateral extent. Water in this system finally flowed to the water table at the locations of BH 143 (-65 mPD) and BH 123 (-60 mPD). There were a number of shallower drain points at BH 619 (-50 mPD), BH 915 (-45 mPD), BH 126 (-40 mPD) and BH 203 (-35 mPD).

Drainage system East 2 consisted mainly of a channel that started at 1D - 2F and ran westward and downward towards 6E. Part of the system drained to system East 1 through a channel at -55 mPD along 6D - 8D. The rest drained out of the east boundary of the site at location 1E.

Drainage system East 3 received limited water from a narrow shaft at location 3C (borehole BH 825), and from the north boundary of system East 2. The system consists of a dome-shaped vertical cavity that extended from -50 mPD to -70 mPD. The shape of the cavity is shown in Sections 3-3, 4-4 in Figure 13 and Section C-C in Figure 7.

Apart from the main karst drainage networks, there are a number of slots. The best defined is at BH 324, (location 3A at Section -30 mPD). The slot is narrow in extent and dips approximately 45° to NNW.

At 11C in Section -15 mPD (Drg GCSP 25/1), there is one shallow overhang which is larger than those commonly observed in Yuen Long.

7.3 The Middle Compartment

The middle compartment is separated from the west compartment by the basalt dyke. The separation is complete below -35 mPD. Water in this compartment drained down along drainage systems which were small when compared with those in the other two compartments. Only three of these extended down to -45 mPD (Drg GCSP 25/1). We may call these systems Middle 1 (17C at section -45 mPD), Middle 2 (12A) and Middle 3 (14F).

System Middle 1 was the largest of the three systems and consisted of shallow channels trending NW and NE. Water drained downward mainly at 17C (BH 707). There were a number of secondary drain points at 17D (AH 88), 16D (BH 1009), 15E (AH 109) and 15C (BH 710). System Middle 2 ran parallel to the dyke with a SSE trending branch near ground surface. Water in this system drained at 12A (drillhole AH 10). For both systems Middle 1 and Middle 2, the channels taper downward without twisting laterally so that the overhangs are small. Lateral underground channels had not been found. They may either be absent in this compartment or too small to be identified at the present borehole spacing of about 8 metres.

Only the north extreme part of system Middle 3 lies within the site. Its effect on the site is unlikely to be large.

7.4 The West Compartment

Geologically, the west compartment is different from the other two. It consists of an irregular wedge of decomposed granodiorite resting against greyish white marble. The maximum thickness of granodiorite is over 45 m. It is absent at the eastern part of the compartment where marble outcrops.

The compartment was dominated by the underground drainage system West 1 (22A-21C-18B, Section -50 mPD, Drg GCSP 25/1). The system consisted of an underground channel at the decomposed granodiorite and marble interface. It received water from three inlets. Two of them (18B and 20D at Section -35 mPD) started at the granodiorite/marble outcrop boundary. The third one was outside the northwestern corner of the site (22A at Section -50 mPD) and might have been similar in nature to the other two inlets. Water in this system drained to 22B (BH 501).

There is one other minor drainage system, West 2, which does not reach -45 mPD (16B at Section -35 mPD). It is elongated and dips laterally eastward. This leads to a part of the rock mass at -30 mPD to -35 mPD being undermined.

7.5 Overview

At the bottom right corner of Drg GCSP 25/1 is a contour plan of the surface of sound marble, basalt and granodiorite. The extent of the underground drainage systems are shown in Figure 26.

8. MORPHOGENETICS

8.1 Lineaments

Some of the cavities and zones of dissolution affected rock in this site appear to be aligned. Drg GCSP 25/1 shows the alignments at 12A-1D, 11A-18E, 6A-8F, 19C-13F, and 4C-15F. There is also one set with orientation changing gradually from 18C-3G at -20 mPD to 17C-1E at -55 mPD. This represents a slightly curved plane dipping steeply to the NNE. It can be seen from Drg GCSP 25/1 that cavities and zones of affected rock are more numerous at the intersection of these lineaments. The depth of dissolution also depends on the number of the lineaments intersection at its vicinity.

These lineaments are likely to be the position of fractured zones or continuous joint planes. The initial rock mass is more jointed at the intersection of the planes and is hence more favourable to dissolution (Chan, 1994).

It is hence not surprising for drainage system East 1 to be most complex and extensive because it is criss-crossed by 4 of the planes.

8.2 Basalt Dyke

The basalt dyke possesses lower permeability than marble. It forms a barrier to any lateral flow in the marble mass. There was hence concentrated downward flow at the dyke/marble interface. As a result, the deeper drainage shafts in the Middle Compartment are mostly found adjacent to the dyke.

8.3 Granodiorite

As discussed in Chan (1994) and Section 1 of this Report: Karst Morphology of a Site in the Southern Part of Yuen Long Town, water tends to collect on the granodiorite surface as surface streams. This leads to concentrated dissolution when the stream discharged onto marble. In this site, this resulted in the swallow holes at 19B (BH 405) and 20D (BH 903).

9. FOUNDATION IMPLICATIONS

Development of tall buildings on the site should avoid the overhang or undermined areas. Piles should penetrate thin overhangs. Depending on the pile loading, some of the piles may rest on the roofs of underground chambers. Part of the drainage systems are lined by steep rock cliffs. Piles immediately on top of the cliffs should be carried down to lower level to avoid failing the rock cliff.

Experience gained from the foundation designs for this site will be described in a separate Technical Note.

10. SUMMARY

The karst morphology of the site has been examined to facilitate the checking of foundation designs for the site.

The main karst features on the site are drainage systems that conveyed surface water down to the groundwater table in the past. The systems consist of swallow holes, shafts, and underground channels.

The cavities and dissolutions zones are found along lineaments. The degree and depth of dissolution depends on the number of lineaments intersecting in the vicinity of an area.

11. REFERENCES

Chan Y.C. (1994). Classififcation and Zoning of Marble Sites (GEO Report No. 29). Geotechnical Engineering Office, Hong Kong, 49p.

LIST OF FIGURES

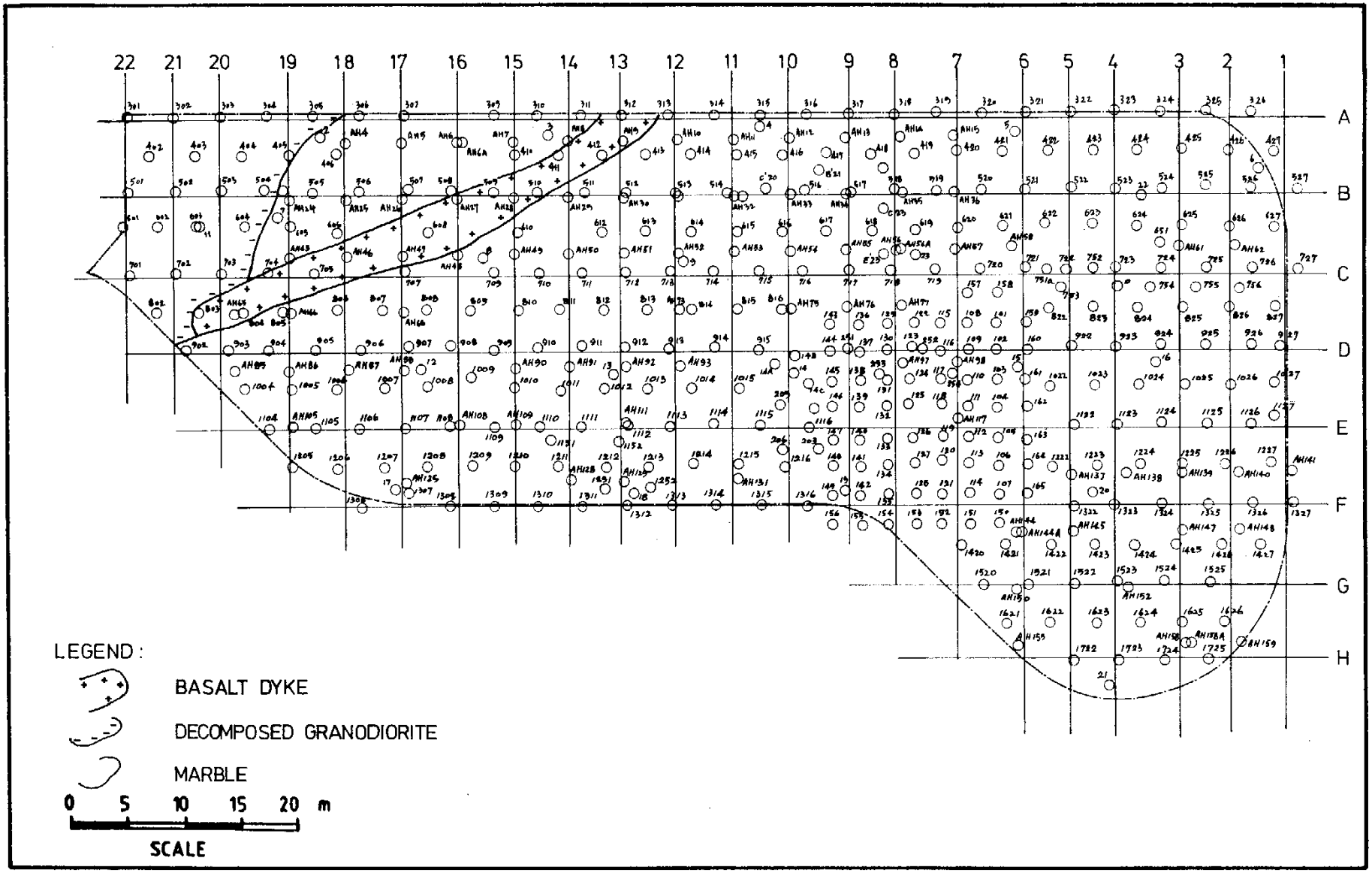


Figure 1 - Location of Ground Investigation Boreholes

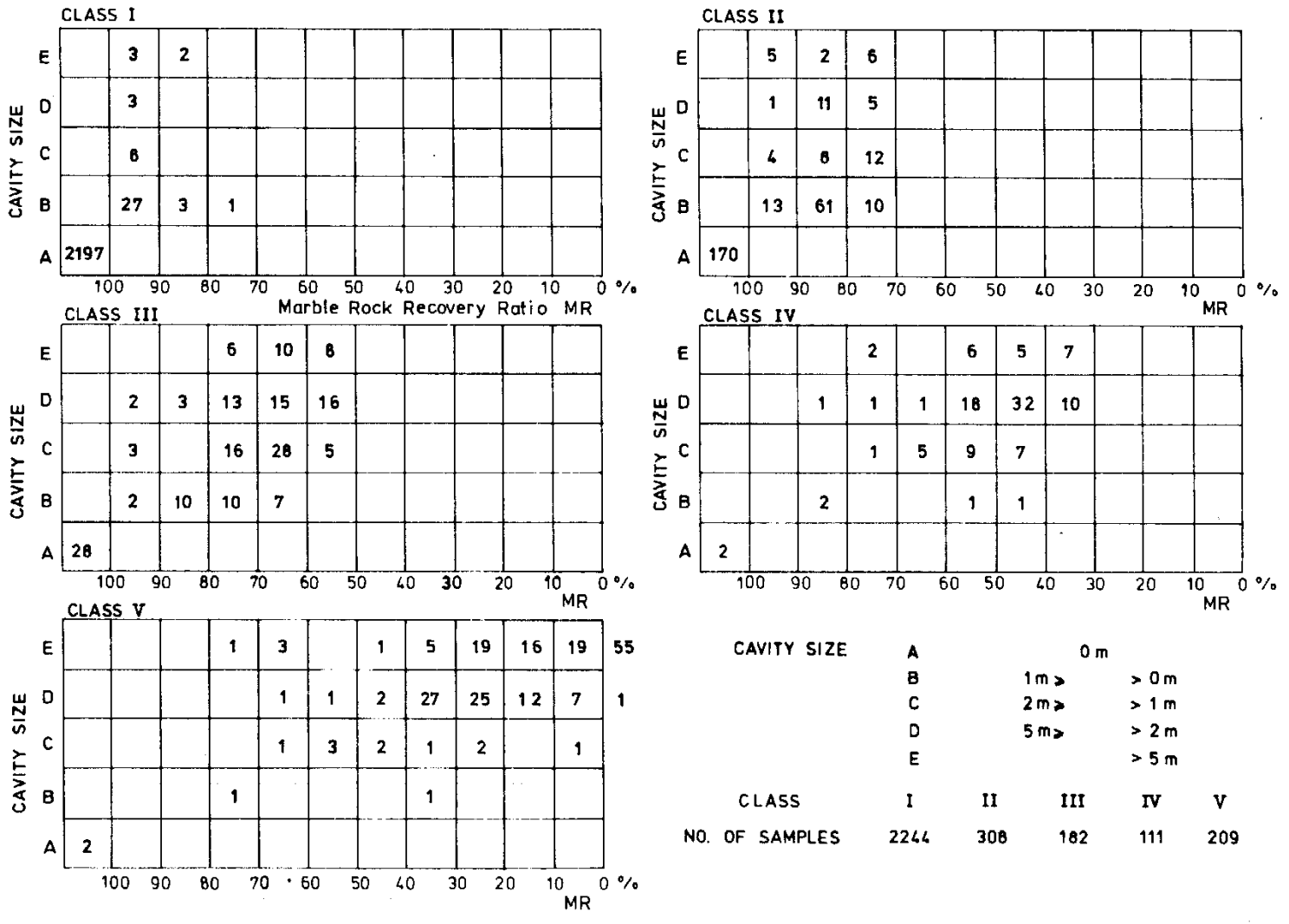


Figure 2 - Cavity Size Distribution with Marble Mass Classes

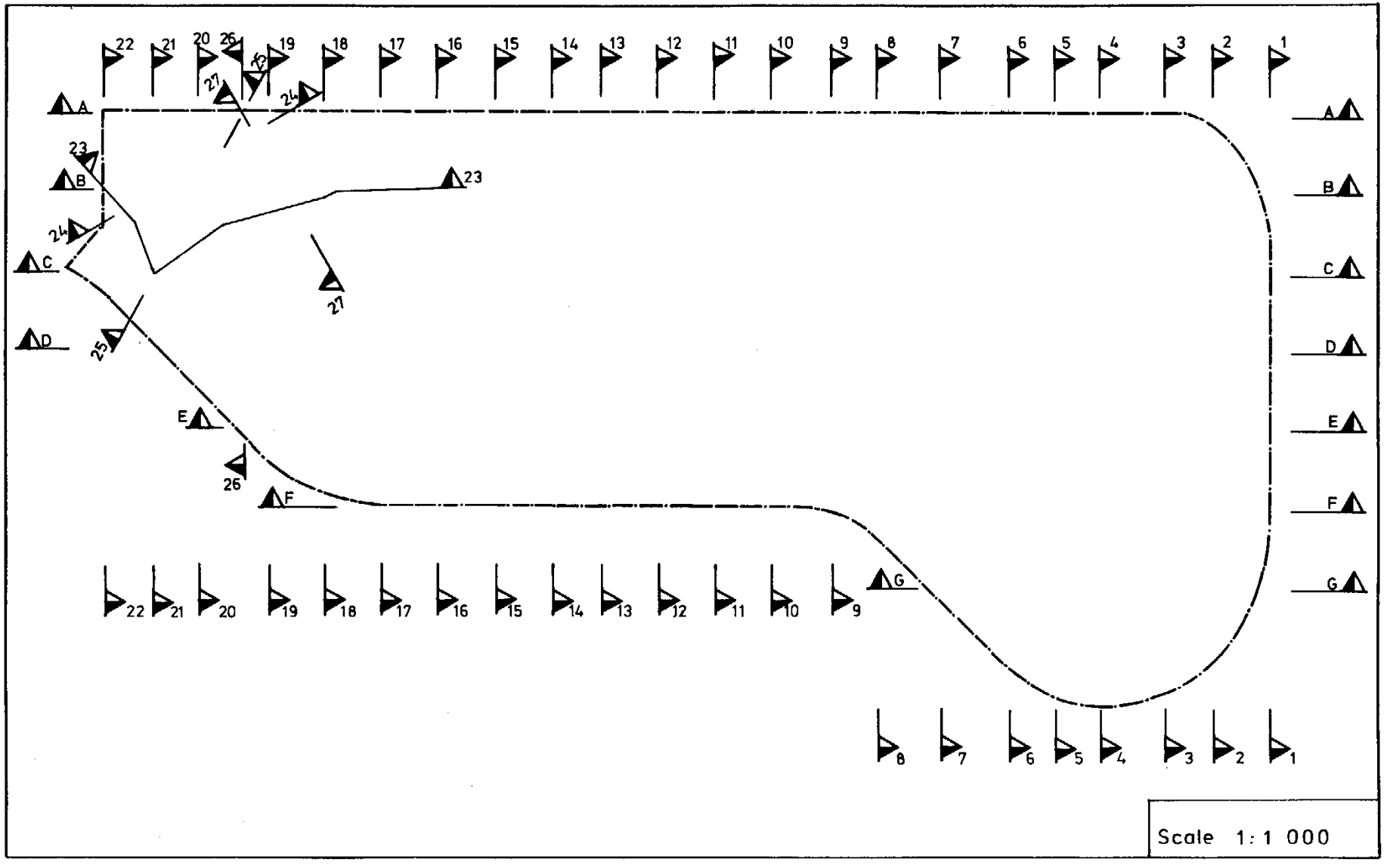


Figure 3 - Location of Sections

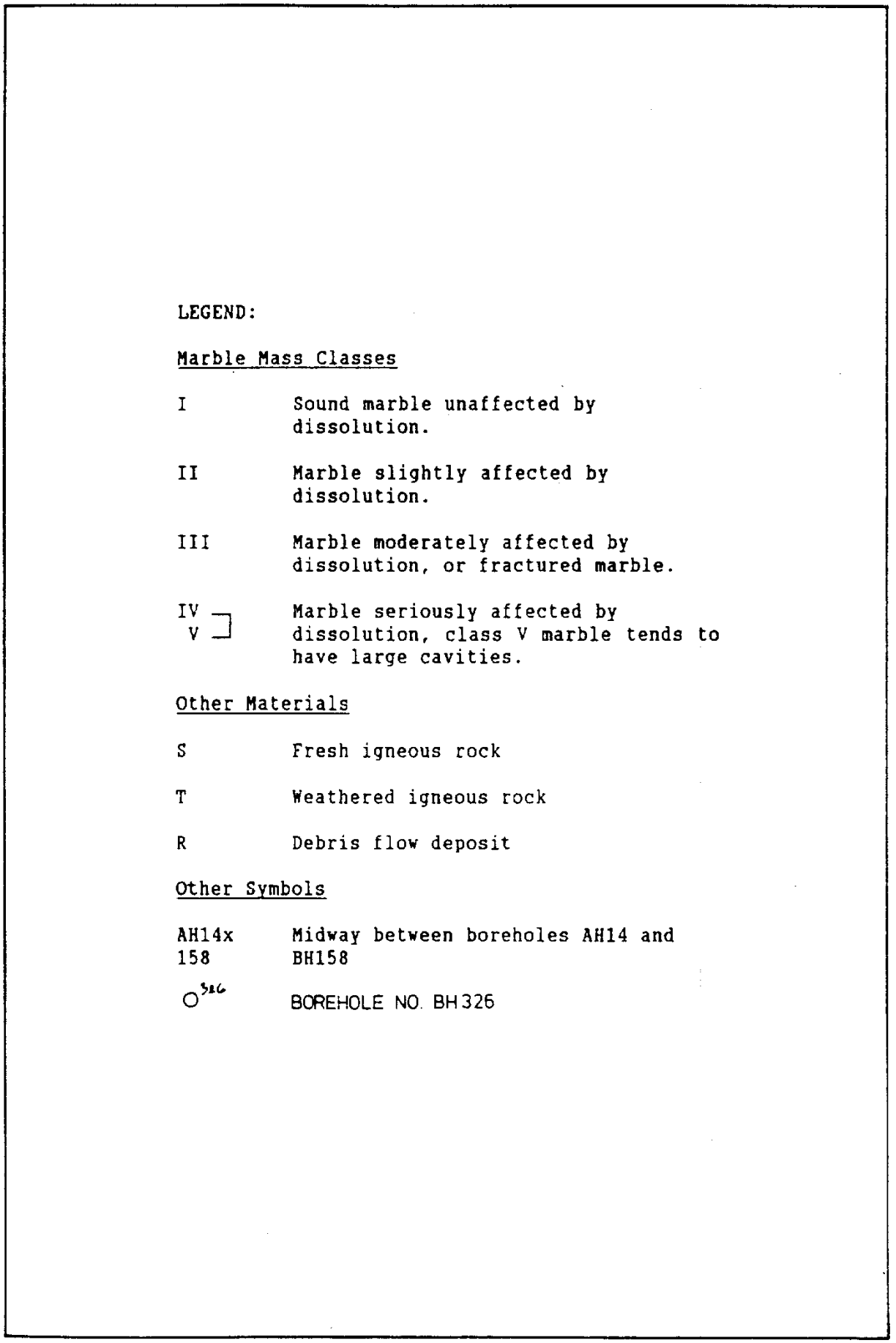


Figure 4 - Legend for Figure 5 to Figure 25

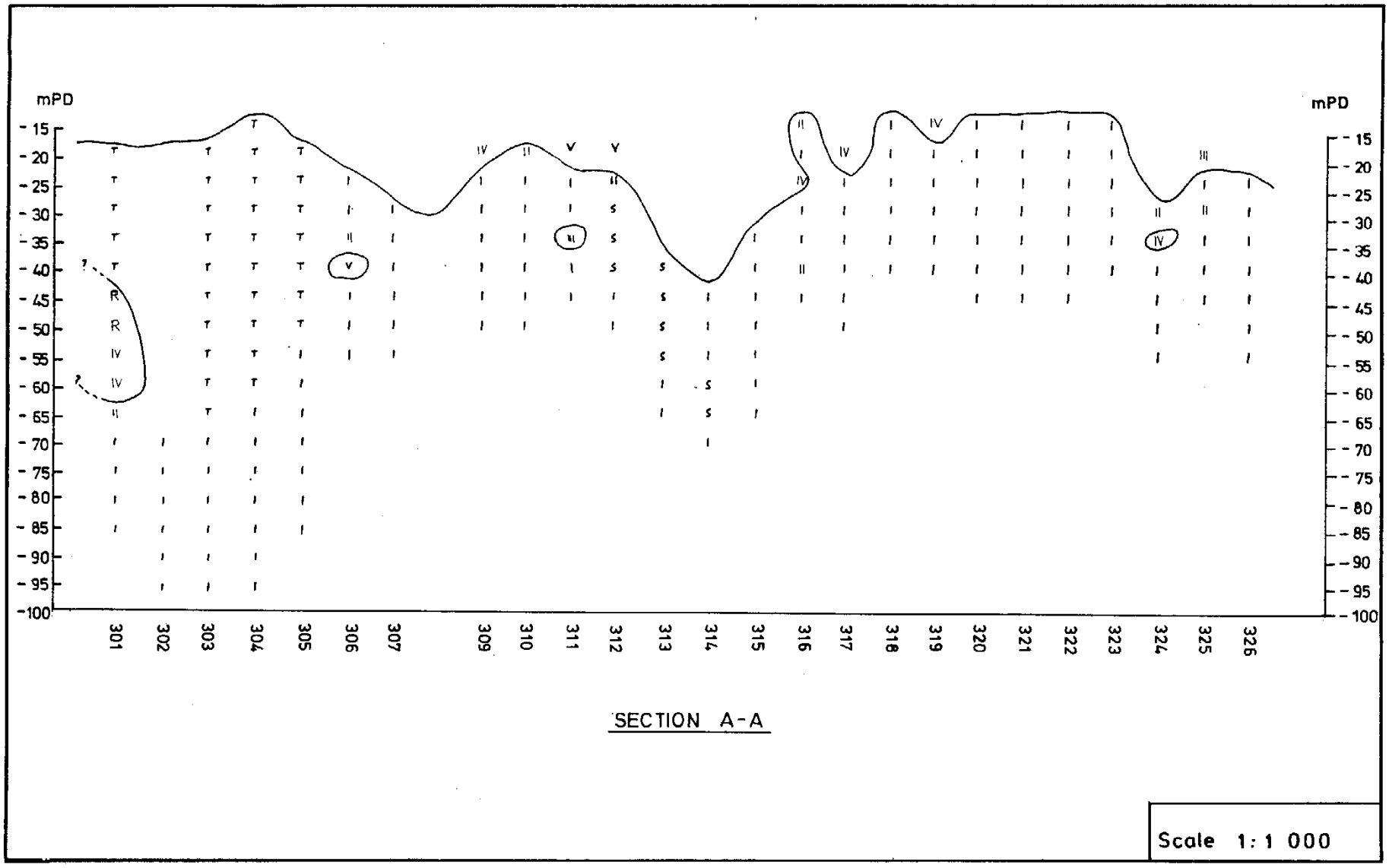


Figure 5 - Longitudinal Section A - A

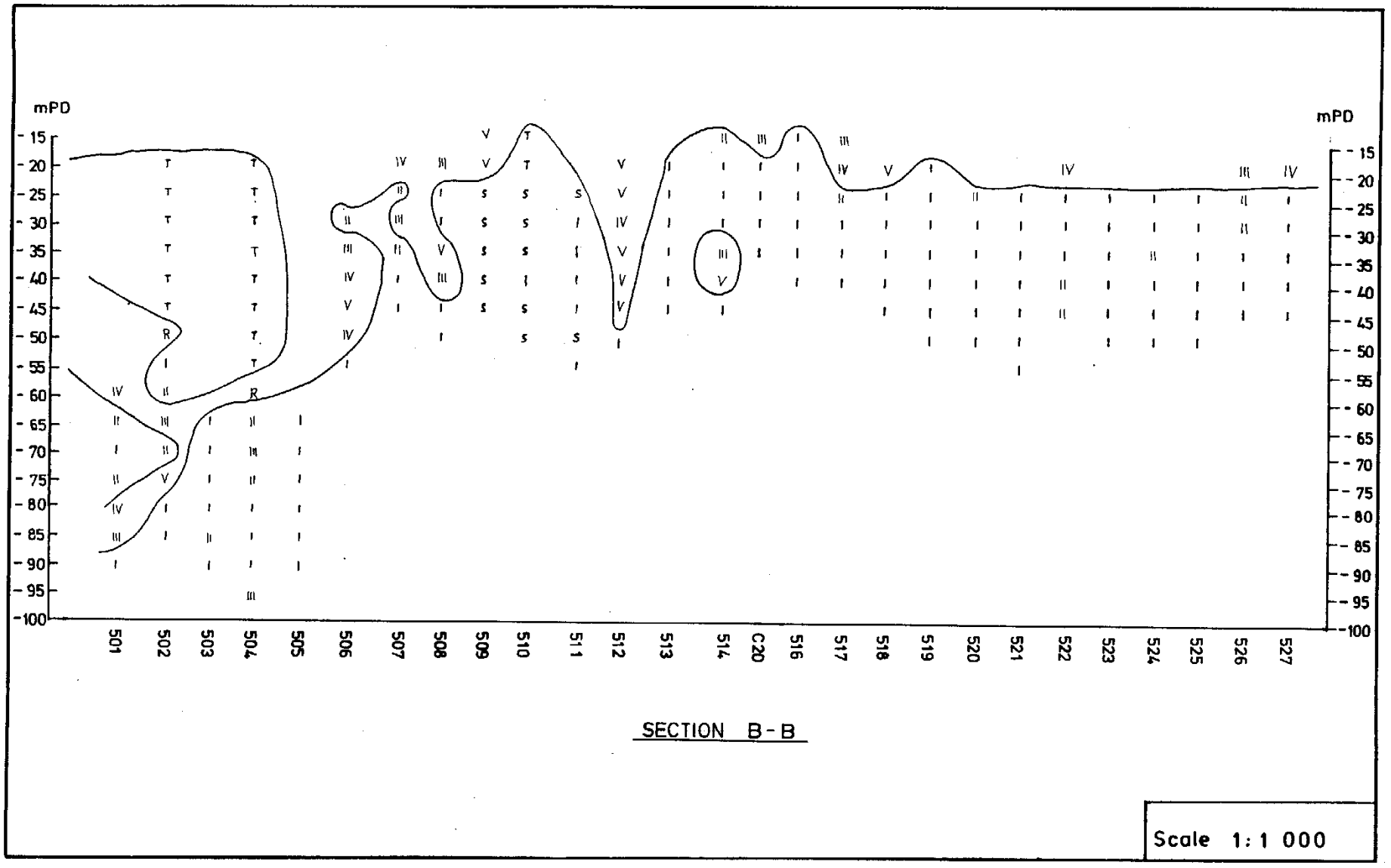


Figure 6 - Longitudinal Section B - B

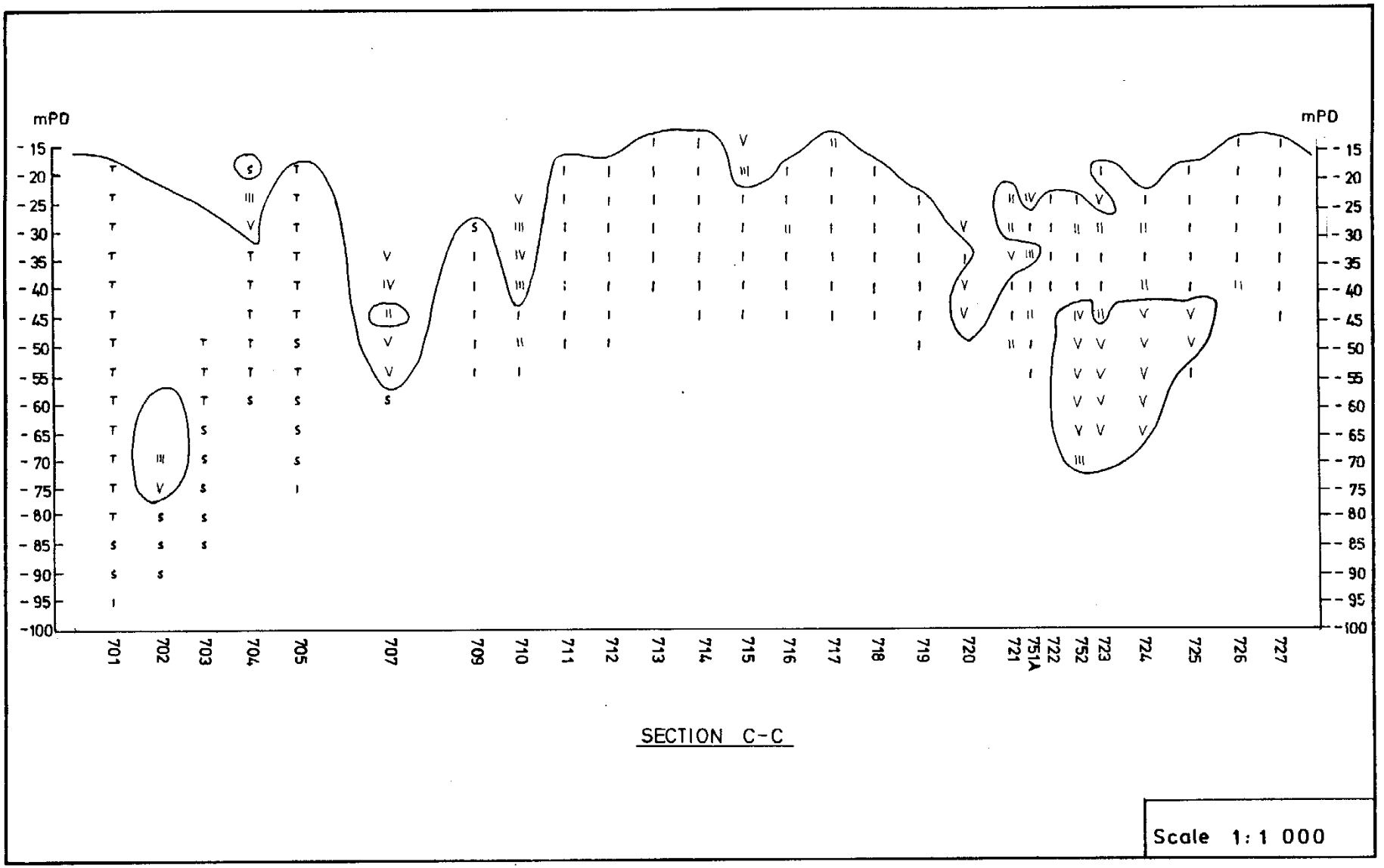


Figure 7 - Longitudinal Section C - C

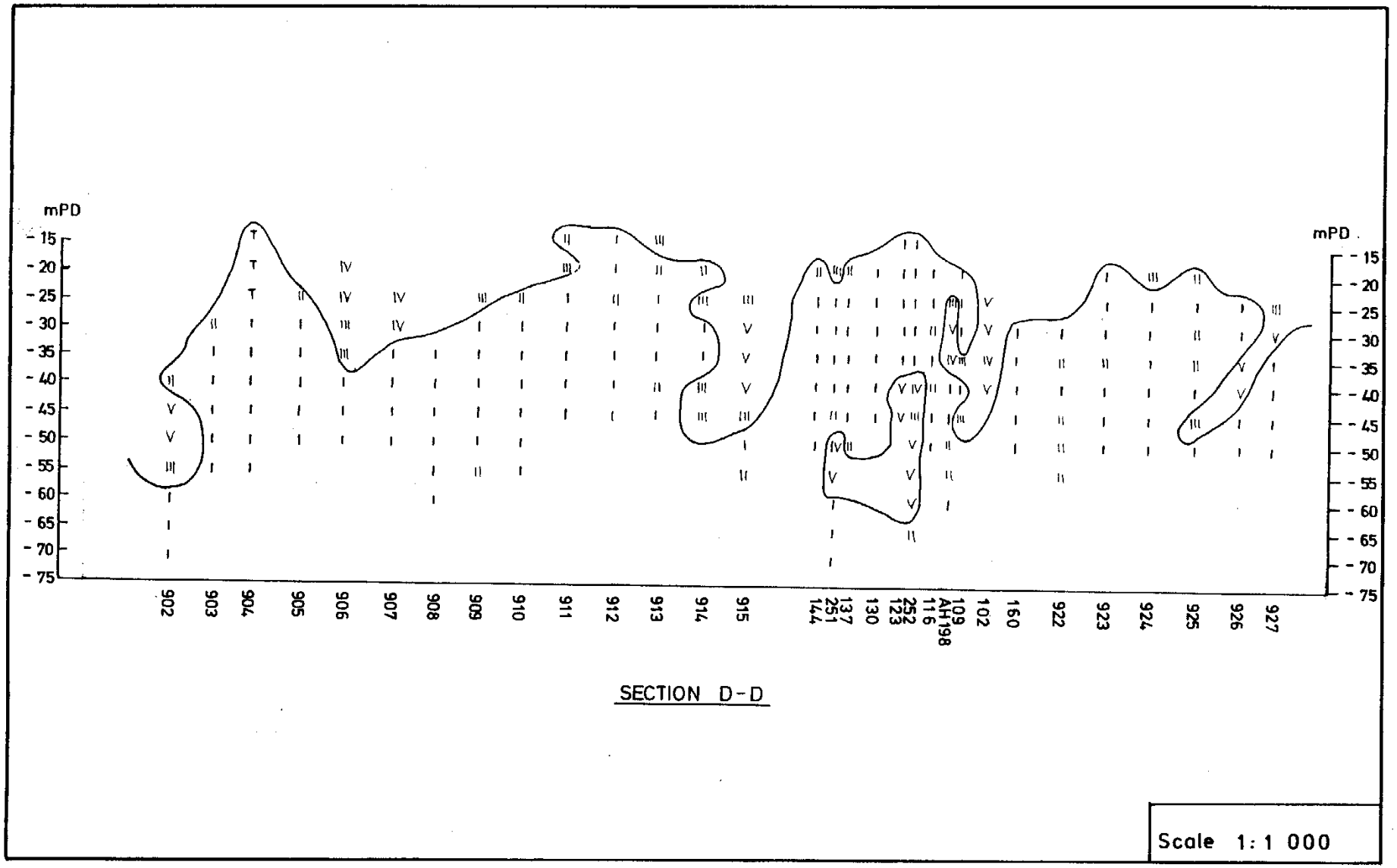


Figure 8 - Longitudinal Section D - D

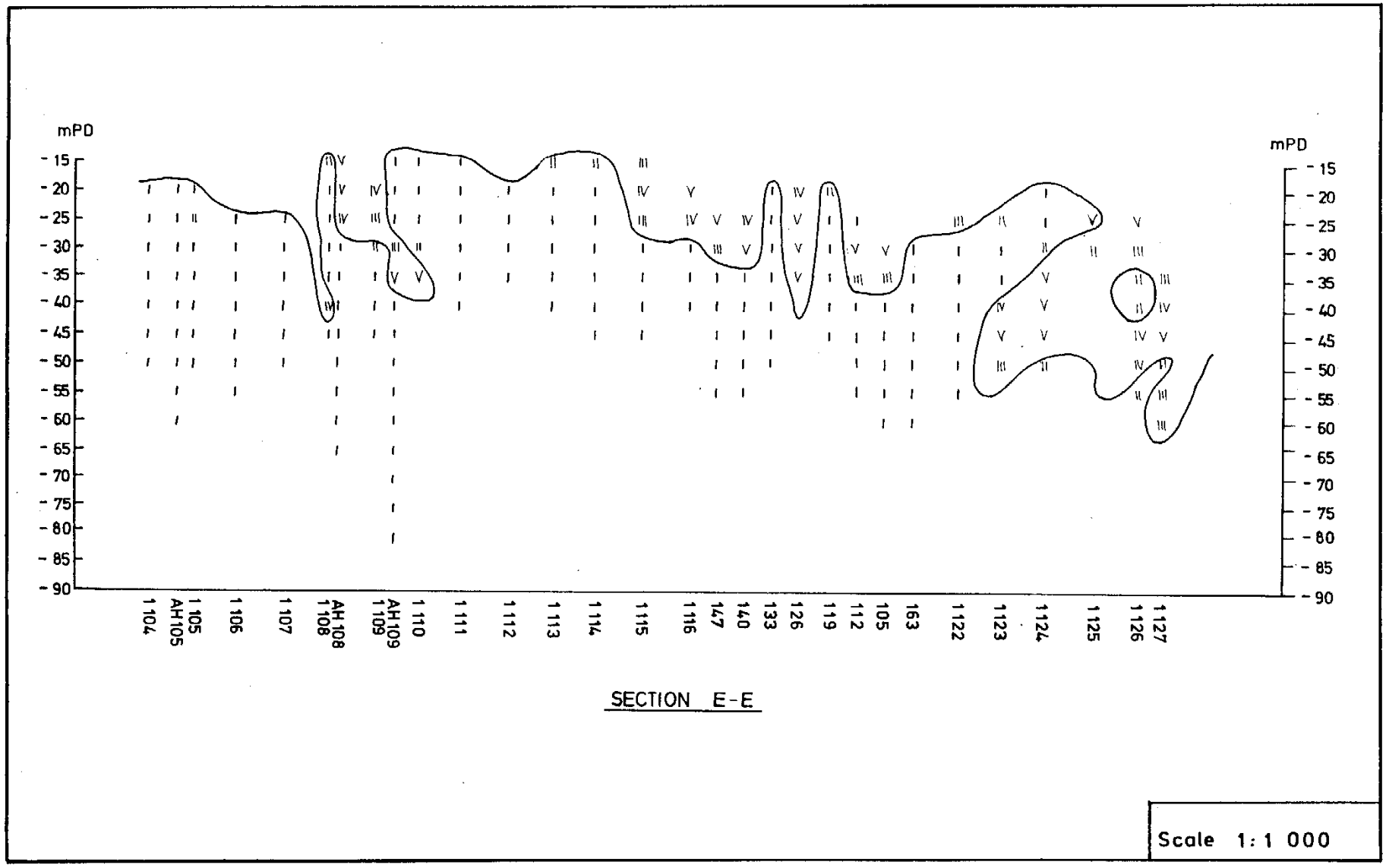


Figure 9 - Longitudinal Section E - E

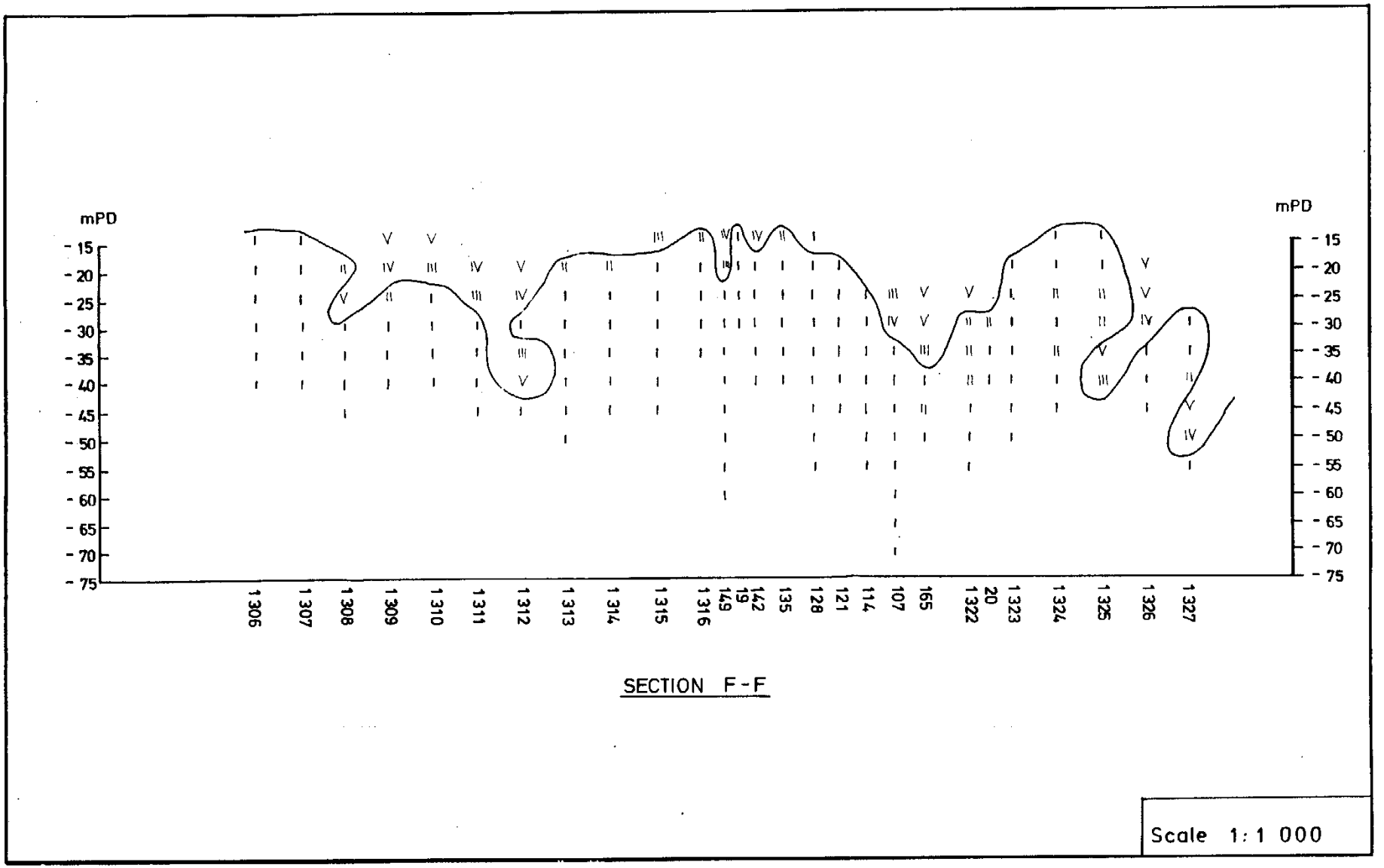
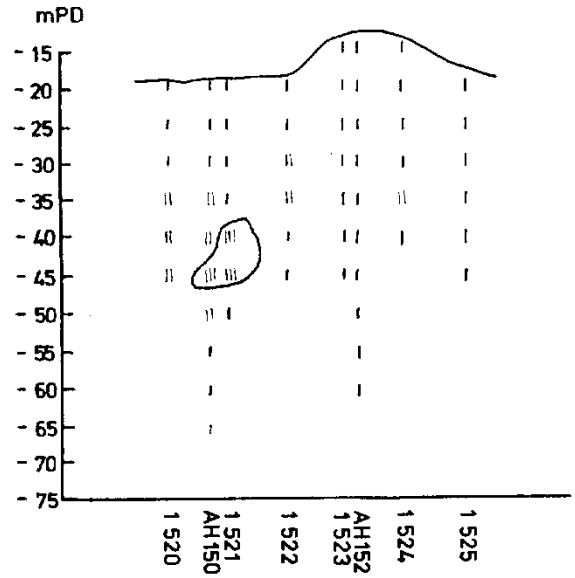


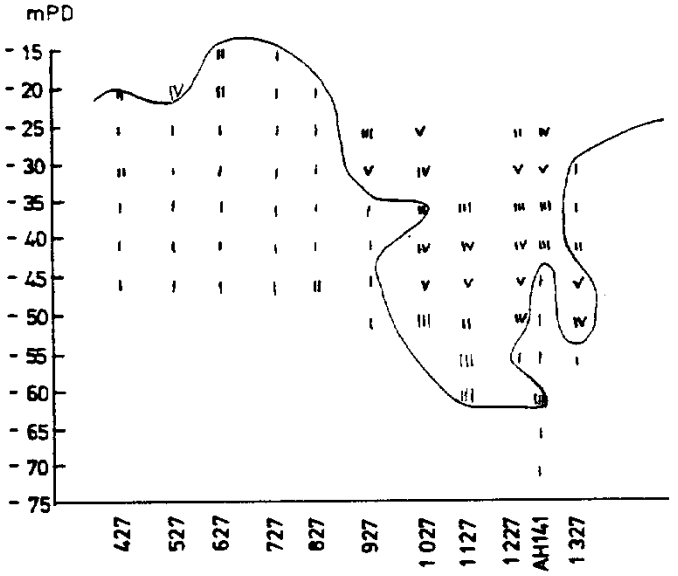
Figure 10 - Longitudinal Section F - F



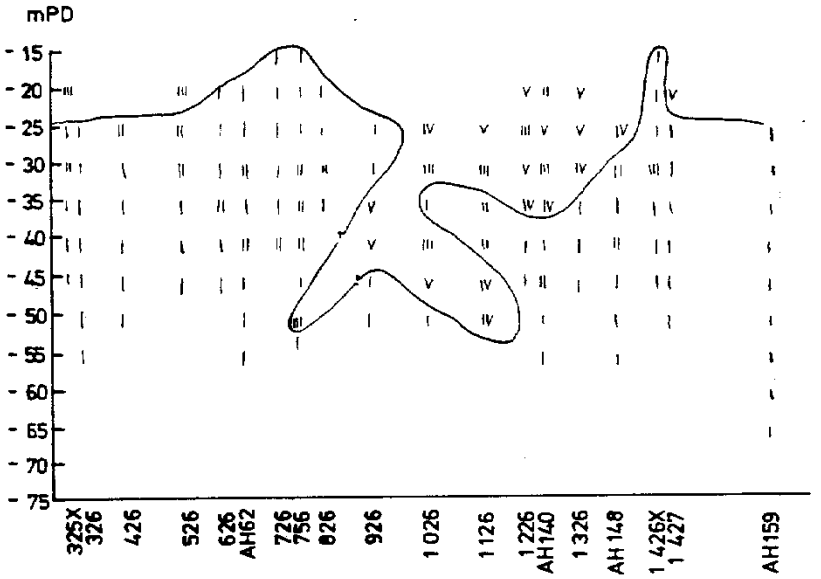
SECTION G-G

Scale 1:1 000

Figure 11 - Longitudinal Section G - G



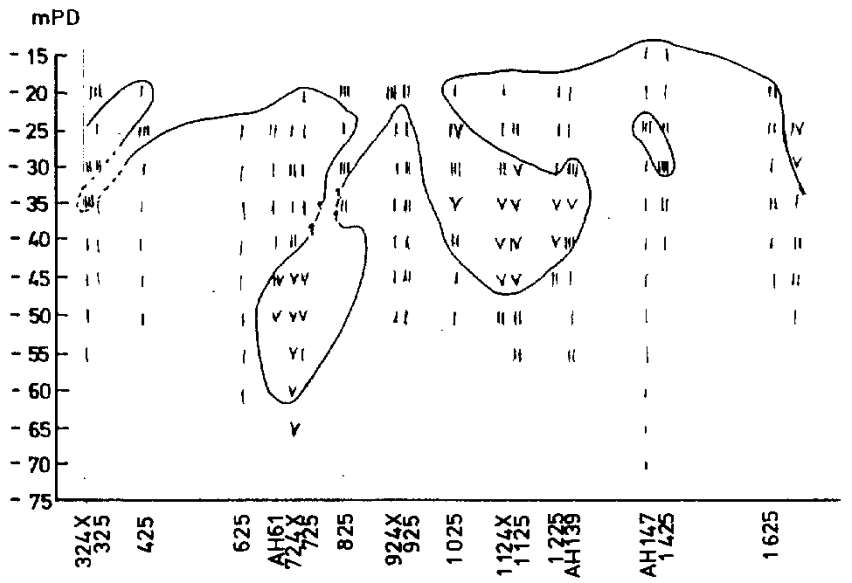
SECTION 1 - 1



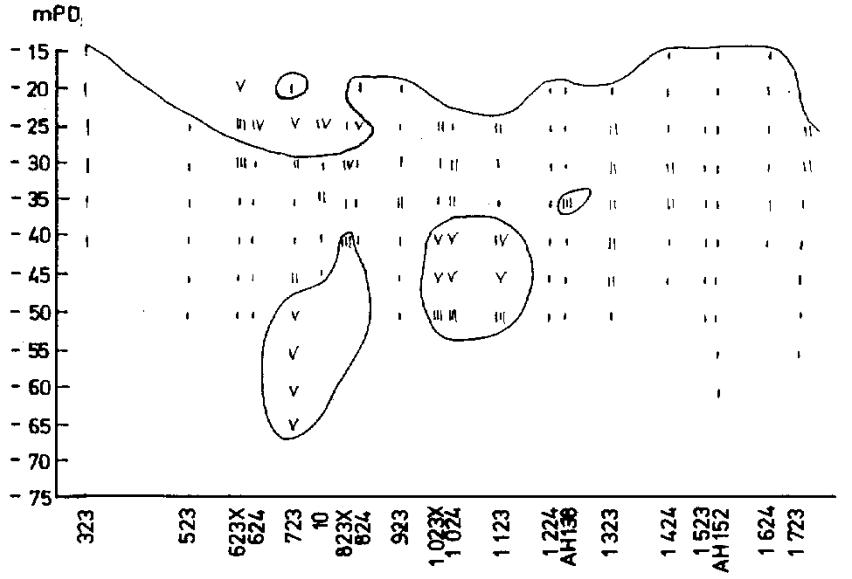
SECTION 2-2

Scale 1:1 000

Figure 12 - Vertical Sections 1 - 1 and 2 - 2



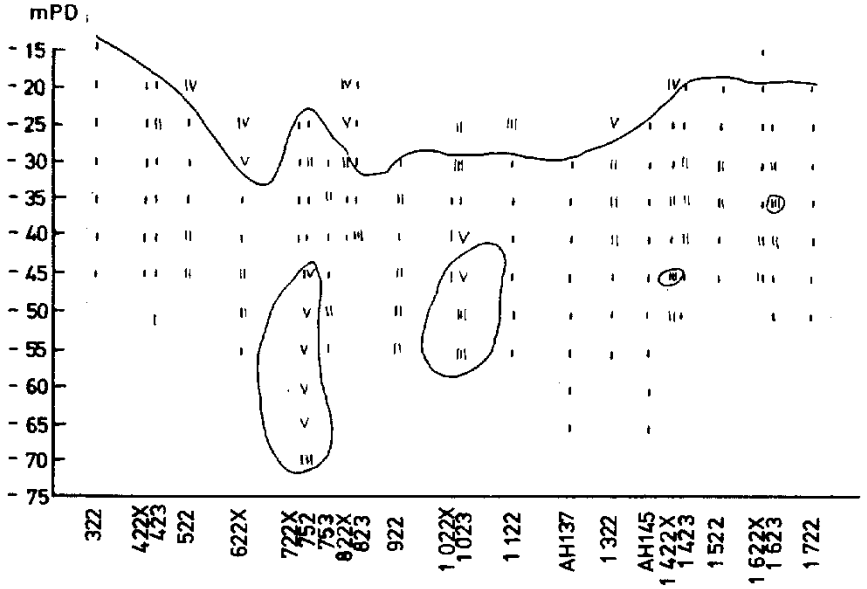
SECTION 3-3



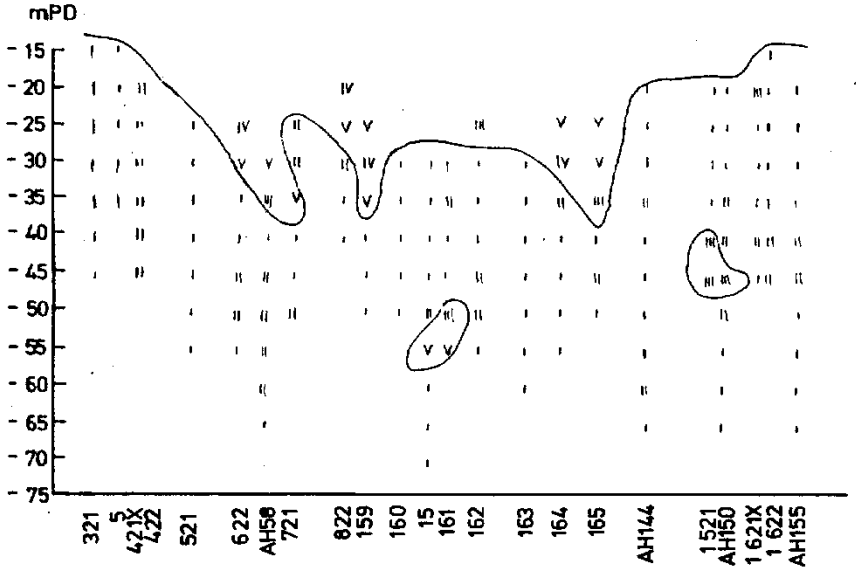
SECTION 4-4

Scale 1:1 000

Figure 13 - Vertical Sections 3 - 3 and 4 - 4



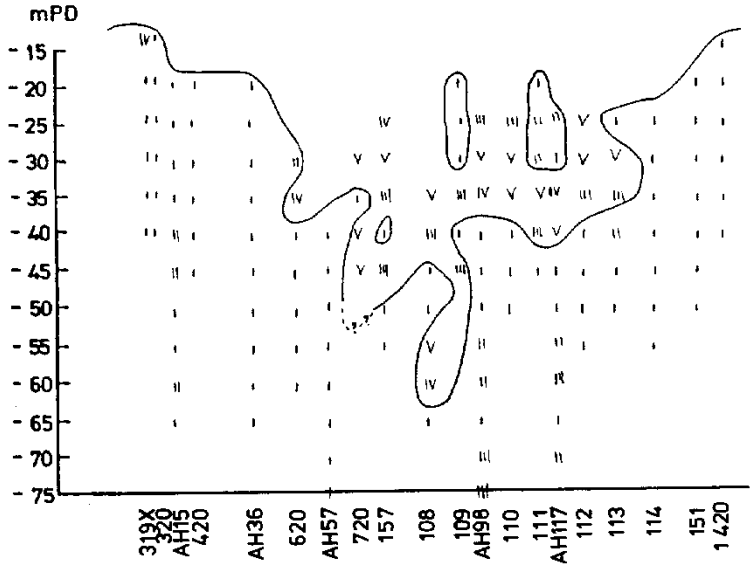
SECTION 5-5



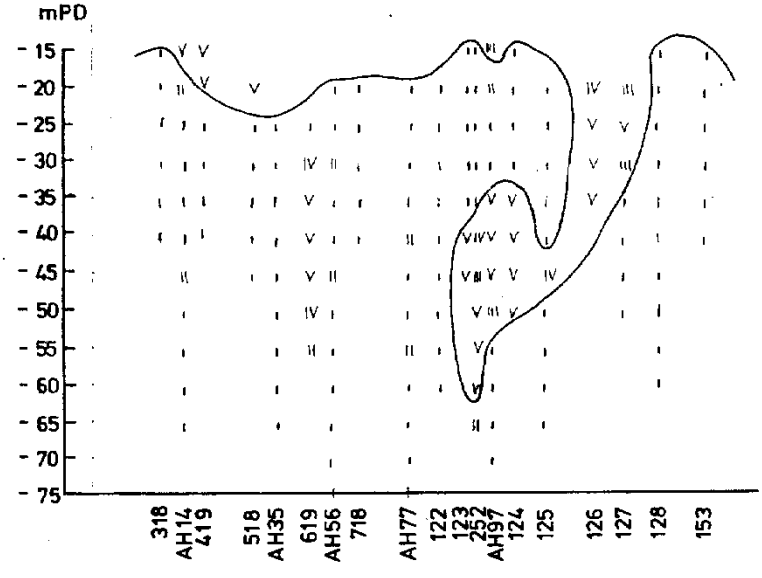
SECTION 6-6

Scale 1:1 000

Figure 14 - Vertical Sections 5 - 5 and 6 - 6



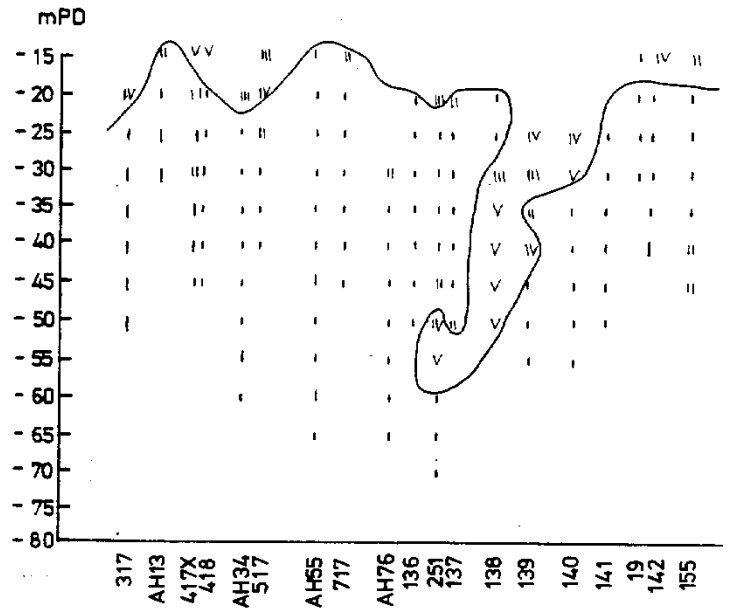
SECTION 7-7



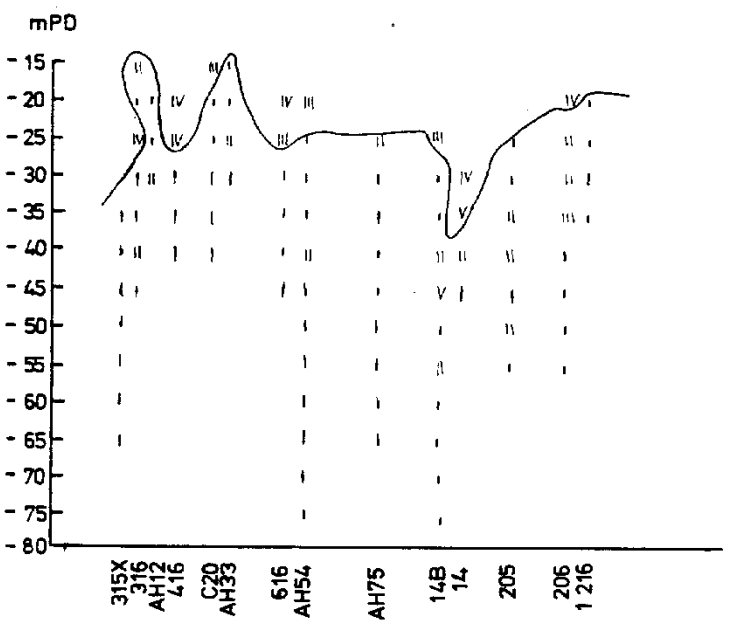
SECTION 8-8

Scale 1:1 000

Figure 15 - Vertical Sections 7 - 7 and 8 - 8



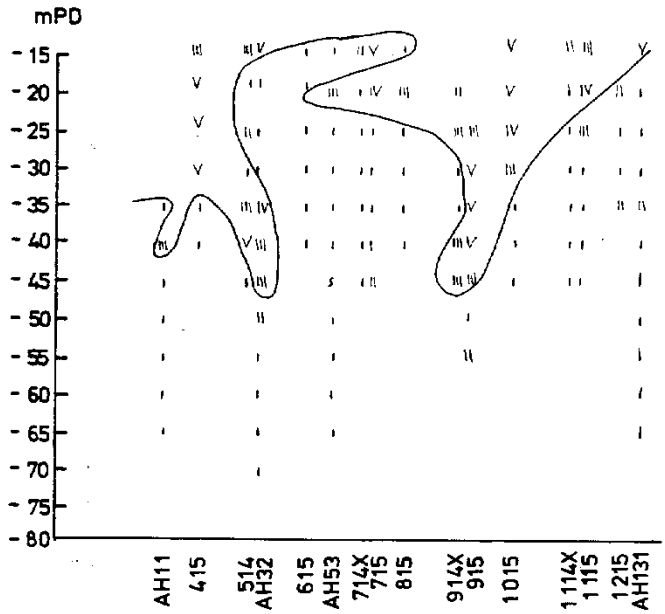
SECTION 9-9



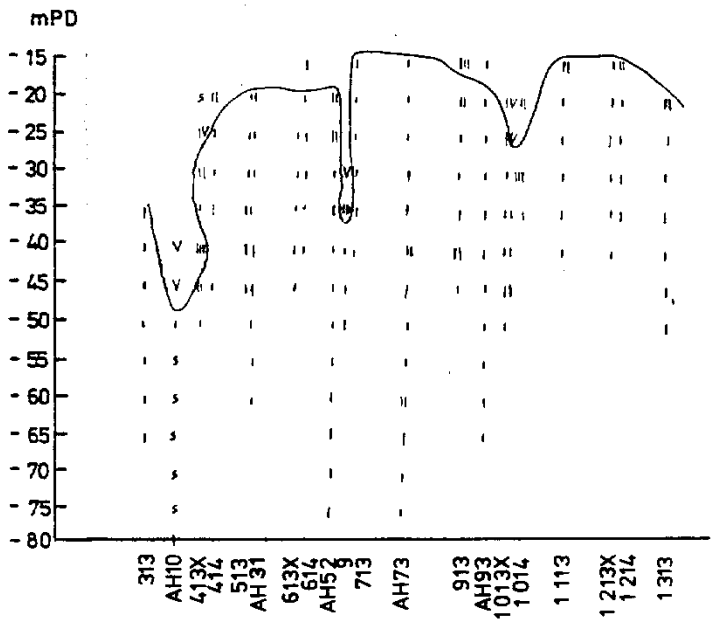
SECTION 10-10

Scale 1:1 000

Figure 16 - Vertical Sections 9 - 9 and 10 - 10



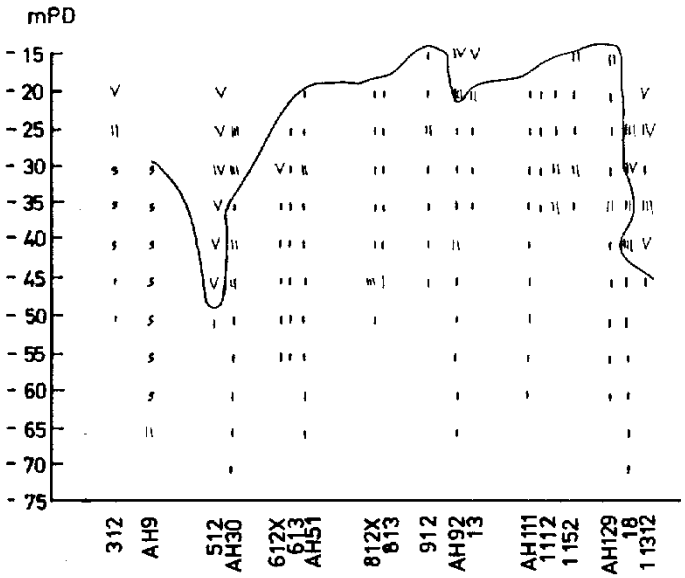
SECTION 11 - 11



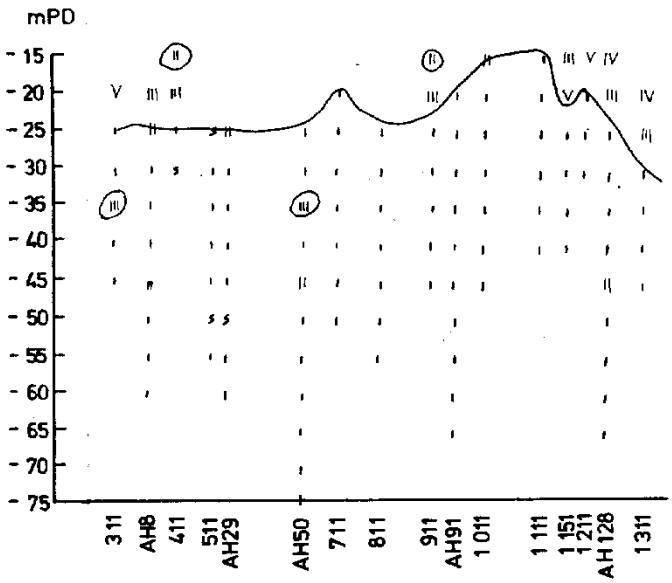
SECTION 12 - 12

Scale 1 : 1 000

Figure 17 - Vertical Sections 11 - 11 and 12 -12



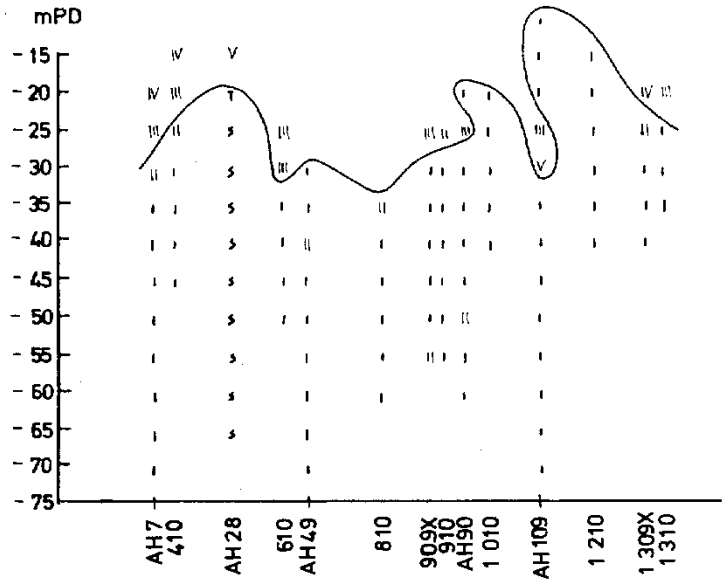
SECTION 13 - 13



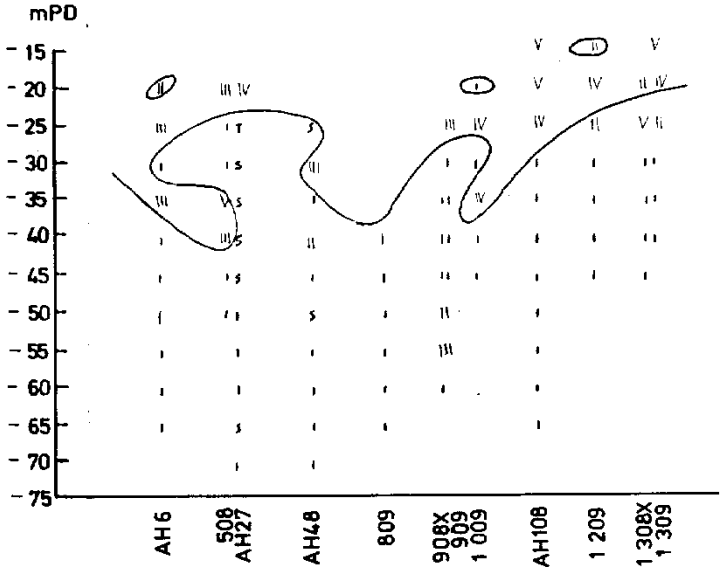
SECTION 14 - 14

Scale 1 : 1 000

Figure 18 - Vertical Sections 13 - 13 and 14 - 14



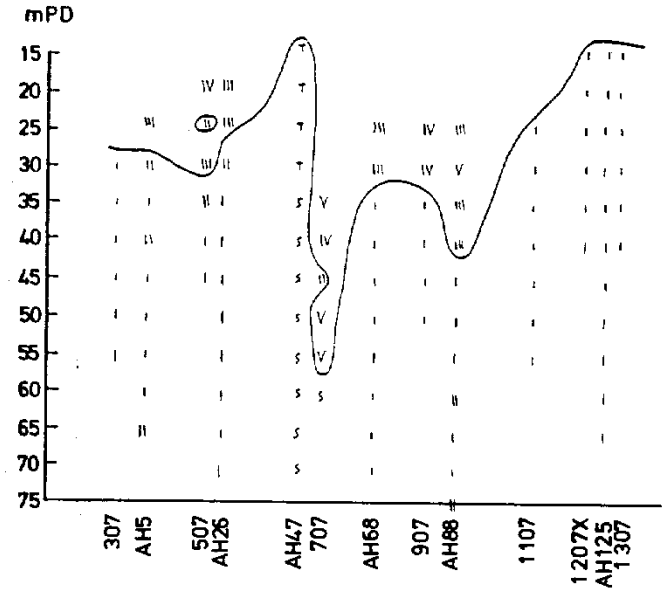
SECTION 15-15



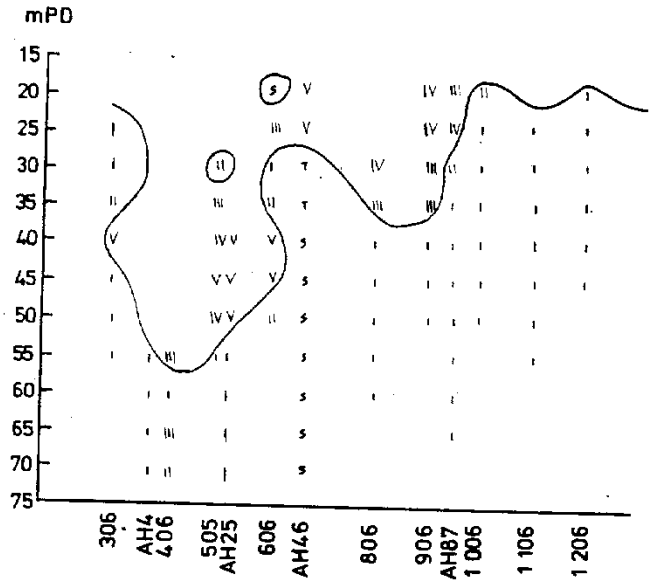
SECTION 16-16

Scale 1:1 000

Figure 19 - Vertical Sections 15 - 15 and 16 - 16



SECTION 17-17



SECTION 18-18

Scale 1:1 000

Figure 20 - Vertical Sections 17 - 17 and 18 - 18

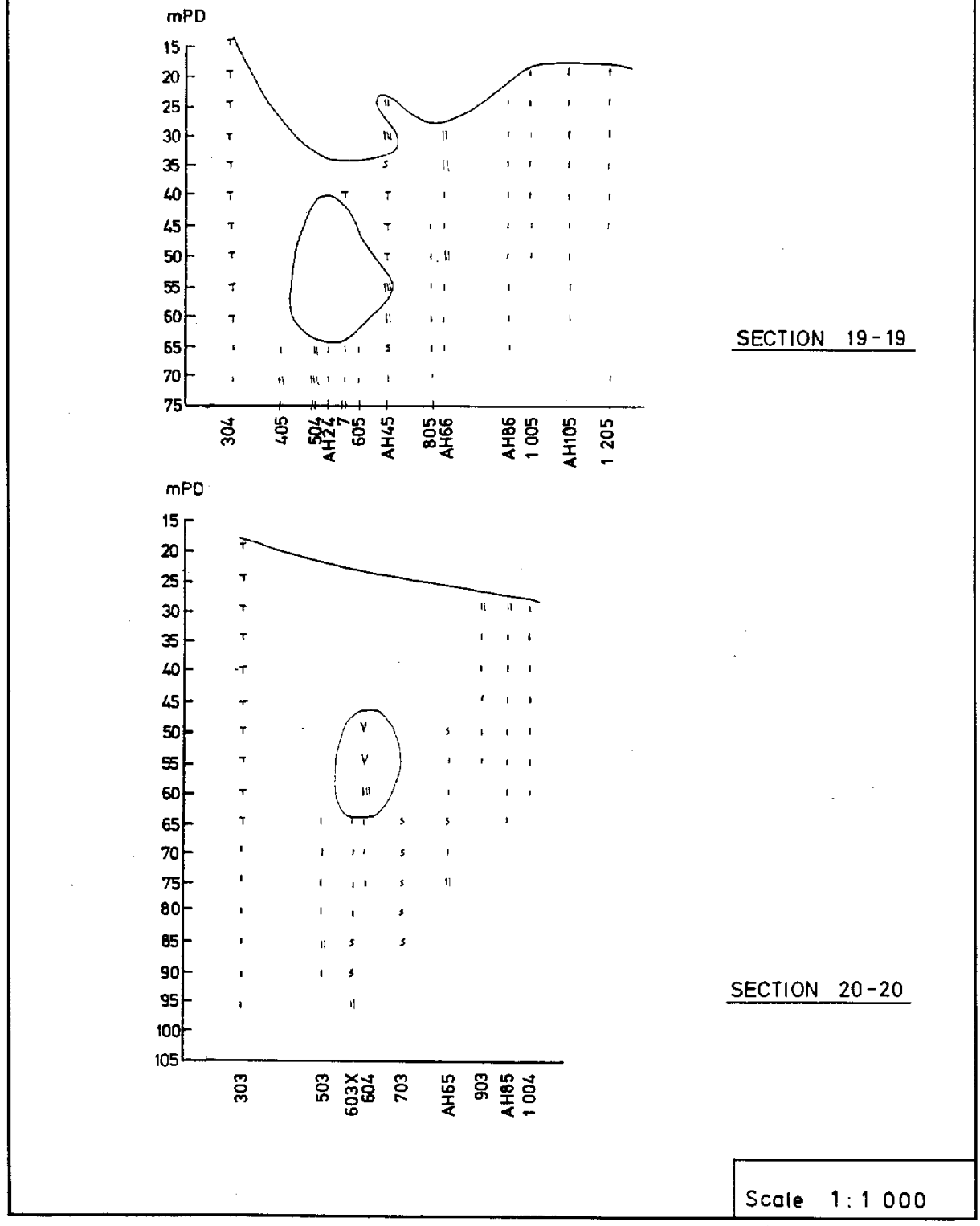


Figure 21 - Vertical Sections 19 - 19 and 20 - 20

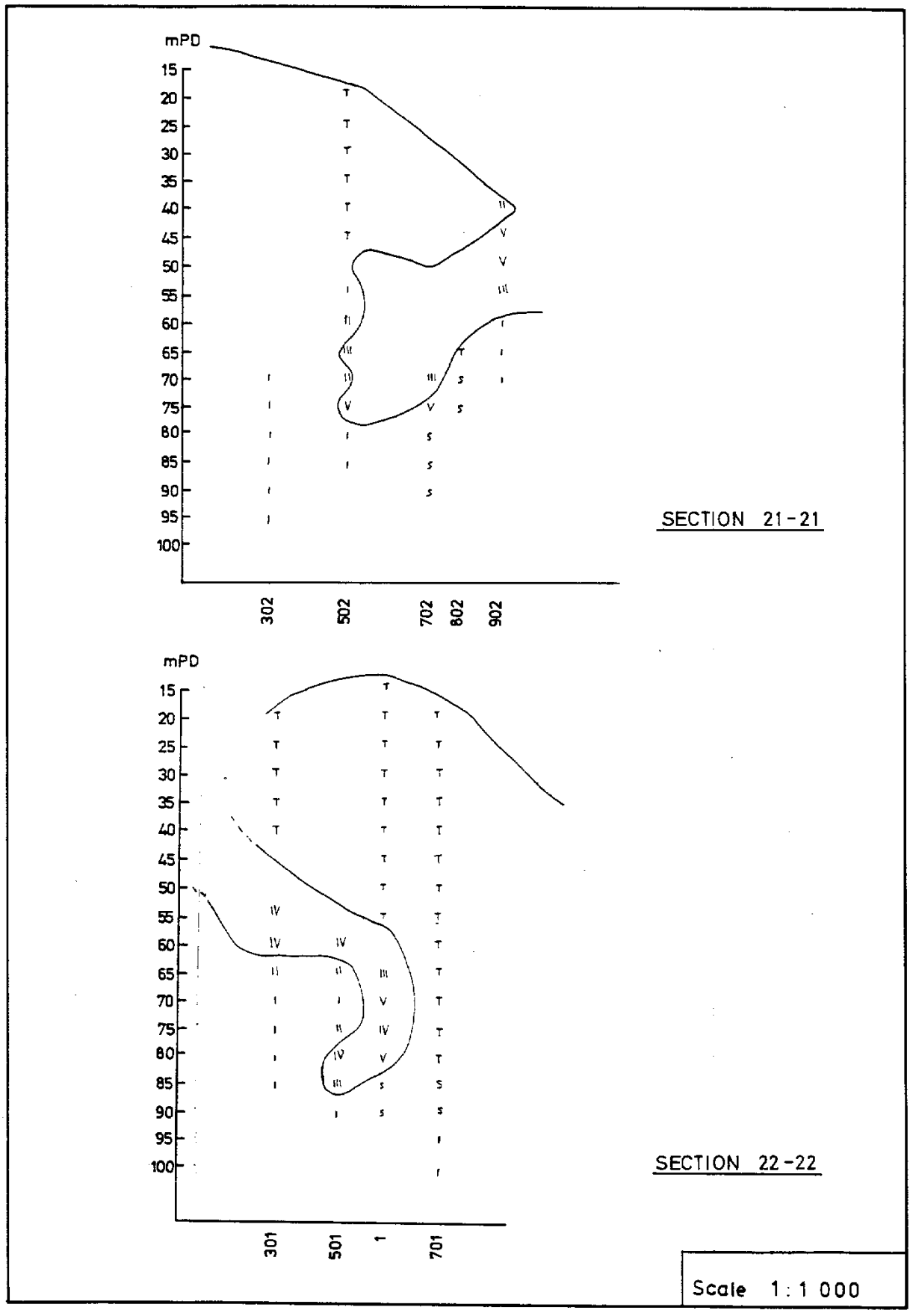
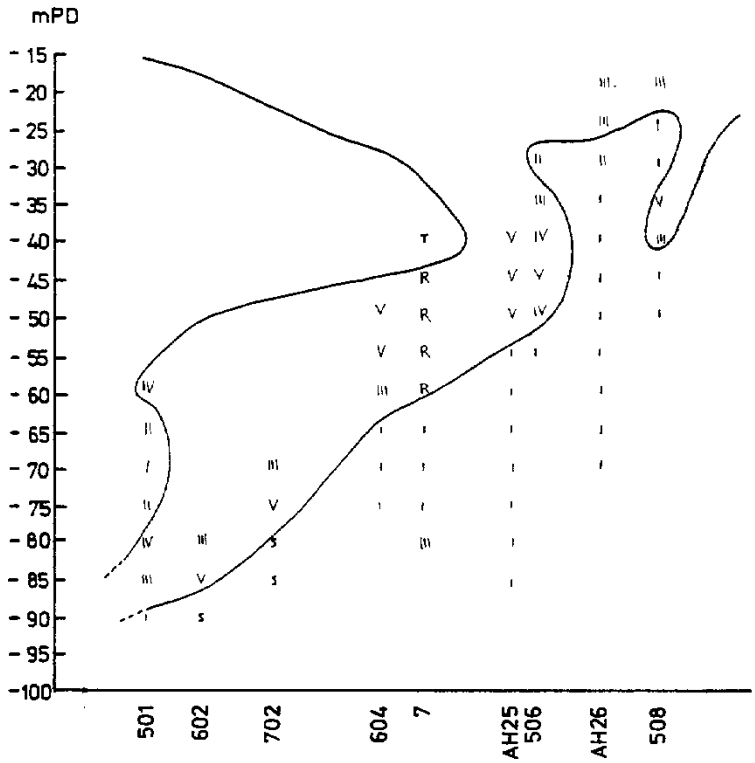
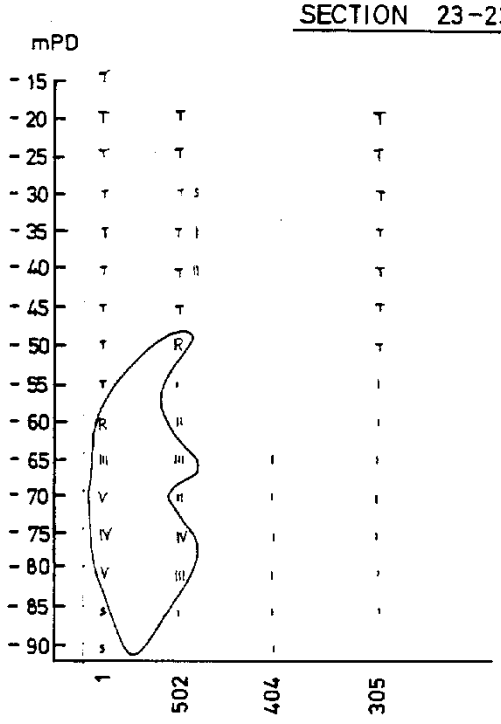


Figure 22 - Vertical Sections 21 - 21 and 22 - 22



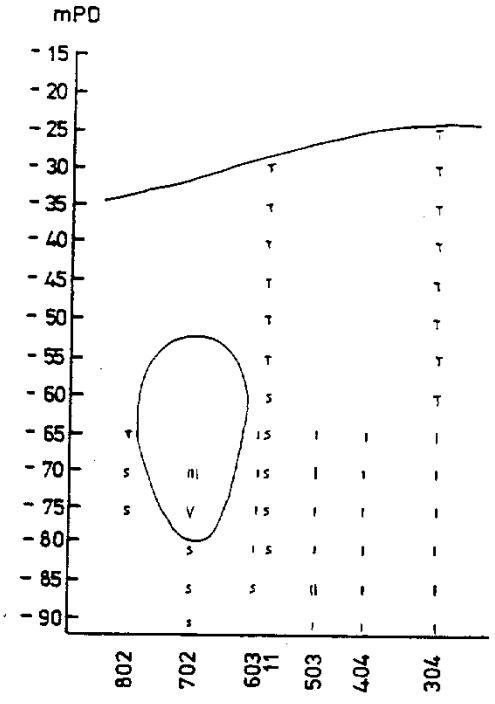
SECTION 23-23



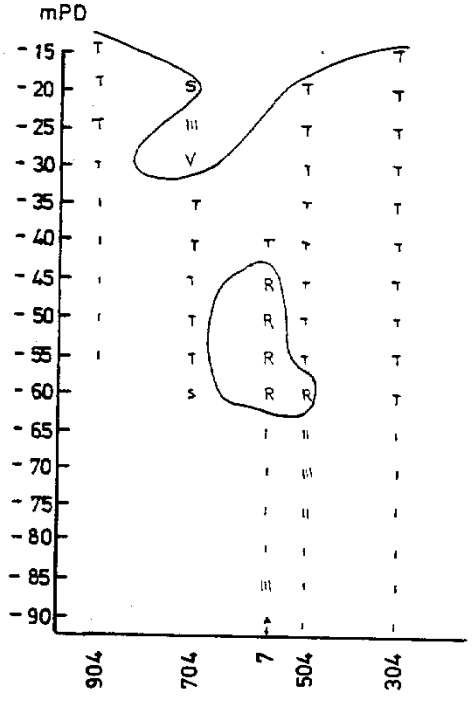
SECTION 24-24

Scale 1:1 000

Figure 23 - Vertical Sections 23 - 23 and 24 - 24



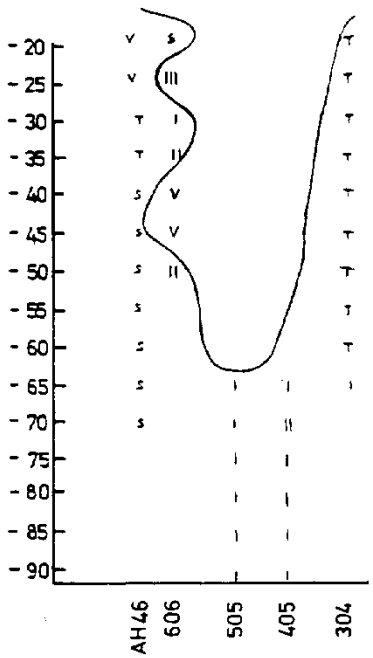
SECTION 25-25



SECTION 26-26

Scale 1:1 000

Figure 24 - Vertical Sections 25 - 25 and 26 - 26



SECTION 27 - 27

Scale 1 : 1 000

Figure 25 - Vertical Section 27 - 27

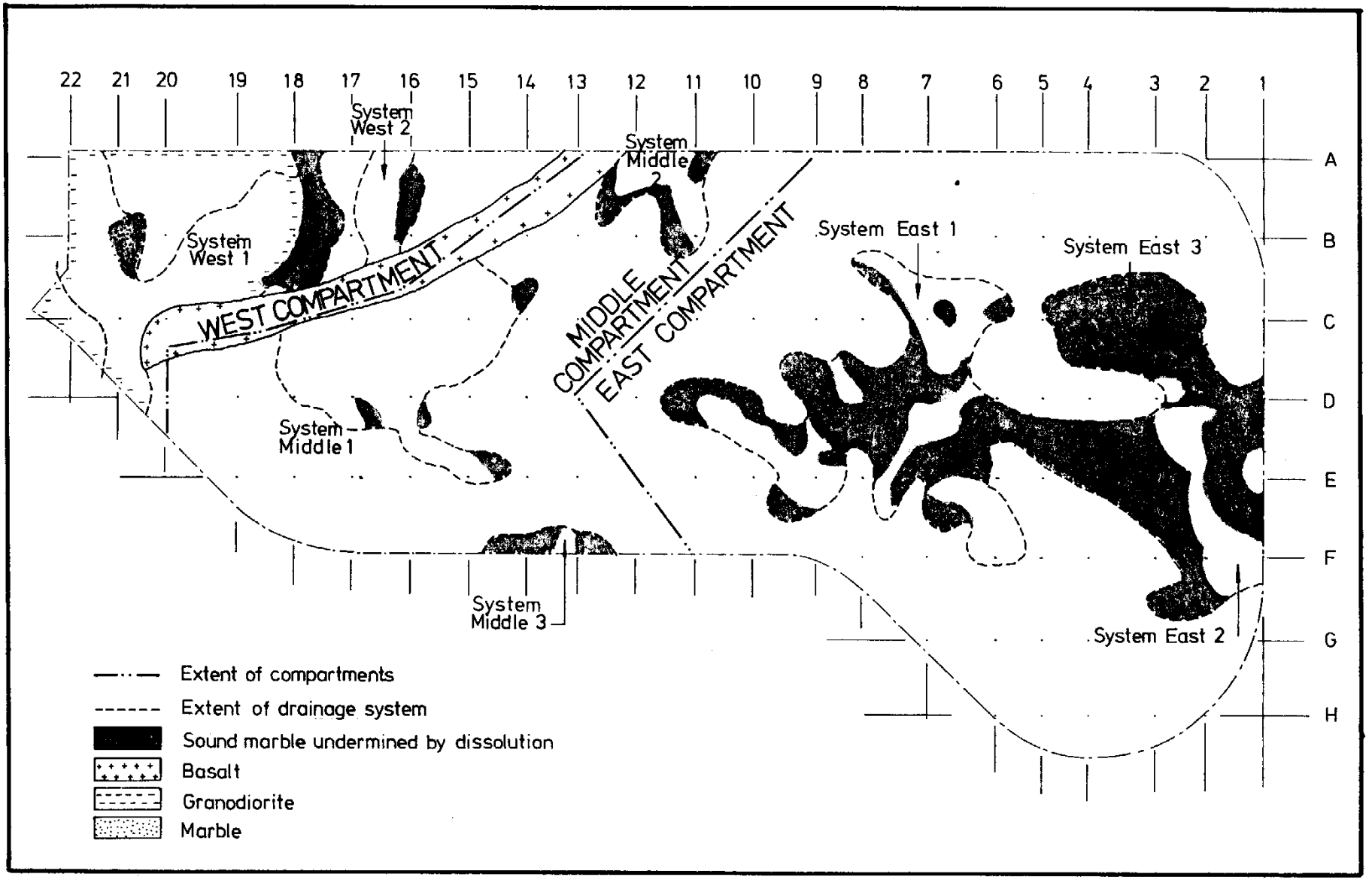


Figure 26 - Extent of Compartments and Drainage Systems

APPENDIX A

MQD VALUES

	SECTION STARTING (mPD)																				
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
AH4								100.0	100.0	93.1	77.9	100.0	100.0	100.0							
AH5		39.9	70.4	95.0	66.6	93.5	93.4	92.8	86.0	65.1											
AH6	57.6	31.8	99.7	47.8	100.0	100.0	100.0	100.0	100.0	100.0											
AH7	16.5	37.7	61.9	100.0	100.0	87.5	95.8	100.0	100.0	94.3	90.7	100.0									
AH8	32.6	72.6	76.4	81.3	93.9	71.9	94.8	95.4	88.6												
AH9			66.8	94.6	100.0	79.0	78.5	36.3	66.8	72.0											
AH10					2.4	1.2	100.0	100.0	100.0	98.0	98.0	77.7	100.0								
AH11				84.2	46.6	81.5	83.6	95.1	93.4	78.1											
AH12	87.3	84.3	100.0	71.5	97.6	71.2	93.4	100.0	92.8	94.9	100.0										
AH13	72.0	93.4	86.8	91.2	97.4	80.9	100.0	93.3	83.0	99.9	100.0										
AH14	9.6	53.6	94.4	98.8	80.1	100.0	74.9	77.8	94.7	94.8	100.0										
AH15		97.1	84.5	95.4	82.6	72.4	59.2	95.2	100.0	52.3	88.1										
AH24										83.7	88.1	92.1	73.8	88.1	91.4	97.3					
AH25						0.1	0.0	0.0	85.1	86.9	93.0	81.4	87.1	94.7	100.0						
AH26		43.6	27.7	53.0	91.4	96.2	88.0	93.8	92.0	93.6	92.9	100.0									
AH27		19.2	4.9	15.6	99.0	100.0	74.3	100.0	77.6	83.4	80.0	76.0									
AH28	0.0	0.0	10.7	93.5	92.3	100.0	92.6	66.0	75.4	82.7	50.0										
AH29			56.0	95.9	91.3	95.1	87.7	96.9	92.9	79.4											
AH30			35.8	47.9	100.0	65.1	64.7	100.0	100.0	100.0	100.0	98.7	99.0	100.0	100.0						
AH31		79.2	87.4	100.0	100.0	96.3	79.1	100.0	100.0	100.0											
AH32	0.2	97.9	100.0	100.0	20.4	72.1	67.4	77.3	93.1	95.2	90.2	92.0									
AH33	100.0	100.0	56.3	97.4	81.5	94.9	97.9	100.0	100.0	94.1	87.0										
AH34		34.4	85.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0											
AH35			100.0	91.1	93.5	98.7	97.1	97.5	88.1	91.8	100.0										
AH36		100.0	77.8	100.0	100.0	100.0	95.2	100.0	100.0	100.0	100.0										
AH45			53.6	39.1	15.2	6.6	0.0	0.3	30.9	73.0	83.7	100.0	100.0	100.0	100.0						
AH46		1.2	0.0	0.0	0.0	17.0	22.6	28.5	42.1	19.3	19.8	33.4									
AH47	0.9	0.0	0.0	0.0	74.3	65.6	93.0	77.9	80.2	94.3	91.2	99.8									
AH48			65.7	25.1	96.6	70.4	94.5	64.1	87.6	100.0	100.0	100.0									
AH49				95.0	95.4	70.7	89.2	100.0	75.4	94.3	100.0	100.0	100.0								
AH50			91.4	94.2	42.4	81.0	74.2	90.7	100.0	87.2	100.0	100.0	100.0	100.0							
AH51		99.8	82.6	71.2	90.8	100.0	94.3	95.4	100.0	100.0	100.0										
AH52		72.9	69.7	98.1	94.1	78.4	99.1	88.8	80.7	75.1	91.9	92.6	80.0								
AH53	88.3	45.7	82.3	100.0	100.0	85.3	80.4	92.6	96.5	99.8	100.0										
AH54		41.7	100.0	84.8	85.7	61.4	90.6	100.0	100.0	91.0	89.8	85.4	100.0	100.0	100.0						
AH55	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0										
AH56		92.6	97.5	71.8	100.0	100.0	73.8	87.5	85.5	99.4	91.8	96.8	90.6	100.0							
AH57						87.4	88.0	81.1	100.0	94.0	81.0	96.2	100.0								
AH58				8.6	41.7	94.7	67.0	60.2	70.3	72.7	79.8	100.0									
AH61			70.7	100.0	92.9	86.4	17.0	0.0													
AH62	97.8	99.5	98.6	57.7	93.4	73.2	96.4	100.0	99.9	92.7	87.0										
AH65								78.0	78.1	96.3	95.4	100.0	85.9	63.0							
AH66				55.9	65.6	84.9	91.6	69.9	100.0	100.0	100.0										
AH68			46.3	45.5	88.1	97.7	76.1	86.8	98.5	89.6	94.3	100.0									
AH73	96.1	100.0	100.0	94.9	100.0	61.1	96.0	87.4	94.9	66.5	90.6	100.0	94.3	93.8	96.8	88.5					
AH74	84.4	3.4	94.7	92.8	96.2	91.4	68.7	92.1	95.3	93.5	100.0										
AH75			52.1	94.7	96.7	87.9	88.7	76.3	87.1	100.0	100.0										
AH76				58.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0										
AH77		87.4	100.0	100.0	91.9	63.6	84.3	100.0	68.6	76.3	93.6	78.5	78.7	95.4	86.6	95.6	96.4	99.1	87.5	94.9	
AH85				65.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0										
AH86			89.6	75.5	100.0	100.0	100.0	100.0	95.9	81.1	100.0										
AH87	76.1	25.4	22.0	72.4	91.9	96.6	100.0	96.7	98.2	98.2	100.0										
AH88			26.0	7.7	30.4	45.3	90.0	96.4	100.0	70.3	88.6	77.2	74.0								
AH90		99.4	32.9	88.7	93.5	95.5	87.9	65.8	98.2	94.4											
AH91		80.6	100.0	95.1	97.0	82.2	96.3	99.6	100.0	84.3	100.0										
AH92	13.9	25.6	100.0	100.0	98.2	74.4	97.2	100.0	100.0	88.6	100.0										
AH93	91.7	90.6	100.0	97.2	88.7	100.0	100.0	100.0	86.8	97.8	100.0										
AH97	43.6	59.2	92.8	82.2	0.7	0.0	0.0	32.3	95.3	80.8	94.8	72.4	85.4	74.8	100.0	95.6	84.4	82.1	100.0	36.2	100.0	100.0
AH98			30.2	0.1	12.9	96.8	100.0	97.7	66.4	68.1	100.0	52.7	47.2	100.0	100.0	100.0	94.3	86.7	89.9	59.4	85.3	87.4

	SECTION STARTING (mPD)																				
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
AH105		100.0	100.0	100.0	96.1	95.4	99.7	100.0	100.0	100.0											
AH108	5.5	1.8	18.0	90.4	98.4	100.0	100.0	100.0	100.0	100.0											
AH109																					
100.0	100.0	99.2	32.8	6.0	90.1	100.0	99.5	84.2	100.0	100.0	100.0	100.0	100.0								
AH111		94.4	100.0	100.0	100.0	90.1	100.0	92.2	90.5	97.3											
AH117		65.3	96.1	15.6	4.1	86.8	100.0	54.2	48.5	92.2	53.7	89.9	94.1	96.6	100.0	96.9	100.0	100.0	84.9	69.8	89.5	95.3
AH125	100.0	100.0	99.5	94.8	96.4	92.9	92.9	100.0	100.0	95.5	92.0										
AH128	23.7	33.5	99.8	100.0	100.0	92.5	65.5	96.1	100.0	100.0	100.0										
AH129	70.0	91.0	97.4	83.4	62.6	87.8	100.0	83.0	88.9	100.0											
AH131	4.7	90.5	93.3	87.7	73.6	88.1	92.3	100.0	91.6	91.8	78.0										
AH137				97.2	94.4	100.0	89.6	100.0	96.0	87.1	100.0										
AH138		100.0	100.0	92.6	41.2	85.6	100.0	88.6	86.5	92.2	100.0										
AH139		97.7	86.9	42.3	0.0	46.6	83.4	100.0	64.1	86.8	100.0	88.5	100.0	100.0							
AH140		53.6	0.0	34.3	10.9	91.0	53.1	98.9	75.6	97.3	94.4	99.6	78.7	97.8	100.0						
AH141			11.6	6.1	33.6	31.6	100.0	84.3	96.1	40.9	100.0	100.0	100.0	100.0	100.0	96.4	100.0				
AH144		80.4	95.1	96.3	62.9	87.0	93.9	85.3	86.8	67.3	81.8										
AH145			100.0	100.0	88.3	75.2	81.0	94.4	77.0	98.9	100.0										
AH147	100.0	88.4	41.2	83.6	87.7	96.3	89.1	93.3	100.0	97.6	100.0										
AH148			16.5	62.4	94.6	68.7	93.8	83.9	100.0	91.7	71.0	84.0									
AH150		98.5	100.0	98.6	61.2	66.6	34.1	66.6	94.8	90.1	79.0										
AH152	100.0	95.2	95.6	97.0	98.7	99.7	99.1	100.0	99.0	99.7											
AH155		100.0	86.9	94.6	100.0	74.6	74.2	85.9	96.5	98.5	93.0										
AH158				96.9	90.9	95.6	97.3	100.0	93.6	90.4	100.0										
AH158A		87.0																			
AH159			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0										
BH-1											27.8	1.6	15.0	0.0	26.6	82.4	90.0				
BH-2								19.5	65.7	99.5	94.1	86.0	91.0	98.5	100.0						
BH-3		56.2	95.8	94.9	97.0	94.0	100.0	99.8	92.1	94.3	92.9	98.2	94.1	98.1	100.0						
BH-4					90.6	84.2	94.0														
BH-5	85.8	89.9	99.6	94.7	80.0																
BH-6	0.0	53.1	87.6	61.6	50.1																
BH-7											91.7	76.1	83.7	49.4							
BH-8			84.2	94.7	78.7	84.5	77.2	81.3	74.5	93.7	85.2	79.3	86.4	88.4	90.0						
BH-9				1.0	27.0	97.8	90.3	93.2													
BH-10			10.1	84.0	74.9	75.6	88.0														
BH-11				5.6	0.0	0.0	0.0	0.0	0.9	88.7	89.4	91.8	94.8	100.0							
BH-12			23.1	0.2	74.5	33.2	83.3	81.1	98.3	98.8	98.5	86.7	91.0								
BH-13	9.4	62.5	100.0	98.2	100.0																
BH-14				14.8	0.0	50.8	92.8														
BH-14A				2.3	0.0	27.2	15.3														
BH-148			41.3	77.0	90.4	73.8	0.0	88.5	71.9	98.2	96.3	92.5	100.0								
BH-15				95.6	99.0	96.8	86.0	53.0	7.6	96.4	98.0	97.1	100.0	100.0	100.0						
BH-16		98.5	100.0	100.0	100.0																
BH-17	100.0	100.0	100.0																		
BH-18			35.4	20.8	73.3	33.2	88.1	93.0	99.6	98.2	94.8	99.1	100.0	100.0	100.0						
BH-19	87.9	84.8	82.9	99.8																	
BH-20				53.4	88.7	95.1															
BH-21					64.3	75.6	100.0	100.0	98.1	97.1	54.1	94.3	89.6	94.6	100.0						
BH-22		95.2	93.4	93.0	94.7	94.2	93.4	97.4	97.2	94.9	96.6	93.7	91.9	91.6	98.0						
BH-23			96.1	89.8	78.8	85.6	85.7	100.0	100.0	85.3	95.3	95.4	100.0	100.0							
BH-101				28.4	62.7	84.0	76.5	98.2	92.2	91.6	96.6	90.9									
BH-102			2.9	0.0	20.4	0.0															
BH-103			4.2	0.7	25.7	82.7	88.4	59.7	88.0												
BH-104			90.9	97.7	97.0	96.1	94.4	19.9	92.1	96.0	92.0	100.0									
BH-105				1.3	38.7	90.8	94.3	87.0	81.8	94.1											
BH-106			93.6	95.6	96.4	92.0	94.5	97.5	95.0												
BH-107			38.6	14.2	84.2	81.2	100.0	92.9	92.9	93.2	91.0	94.0									
BH-108					6.4	28.9	89.6	88.4	4.8	24.0	86.0										
BH-108A					50.0																

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-108B		0.6	9.5																		
BH-109	98.4	96.7	83.0	27.8	80.3	35.8															
BH-110		37.3	0.0	5.1	91.8	93.8	86.0														
BH-111	97.1	70.9	65.3	5.2	31.3	100.0															
BH-112		85.0																			
BH-112A		1.0	0.0	32.0	85.6	91.5	90.2	90.0													
BH-113		78.0	4.8	44.8	59.0	77.1	96.8														
BH-114		93.7	100.0	100.0	100.0	99.0	89.5	93.8													
BH-115		89.5	84.0	85.0	61.0	41.2	100.0														
BH-116	78.2	100.0	72.9	96.4	54.0	94.3	88.0														
BH-117		77.6	7.1	0.0	43.3	96.8	80.6														
BH-118	92.4	100.0	98.1	85.2	98.7	94.2	68.6														
BH-119	61.7	99.9	100.0	96.1	90.0	81.5															
BH-120	77.8	98.3	95.0	98.1	93.0	91.9	100.0														
BH-121	91.4	99.4	92.0	100.0	100.0	100.0															
BH-122	97.2	96.4	95.7	96.2	97.9	96.3	97.9	83.2	80.9												
BH-123 88.6	88.2	98.3	94.2	94.1	7.0	2.3															
BH-124 90.4	92.3	79.6	86.0	0.0	0.0	0.0	0.0														
BH-125	91.6	99.4	97.6	88.5	78.3	17.7	98.1	78.6	83.2	98.0											
BH-126	21.9	0.0	0.0	0.0																	
BH-127	36.9	1.1	39.5	93.9	100.0	100.0	100.0														
BH-128 97.0	92.5	98.5	94.4	84.7	98.3	97.1	94.5	89.0	82.0												
BH-129	98.6	100.0	100.0	100.0	94.9	1.5															
BH-130	98.1	98.4	100.0	98.3	78.5	95.0															
BH-131	90.5	80.6	98.3	97.1	99.1	20.5	0.0														
BH-132	57.9	72.5	94.2	88.4	91.6	100.0	100.0														
BH-133	94.0	96.0	100.0	78.9	99.1	95.5	77.2														
BH-134	3.6	56.2	100.0	96.4	97.2	100.0															
BH-135 60.5	87.3	94.1	97.7	85.0	92.0																
BH-136	95.2	100.0	96.1	100.0	100.0	87.6	97.0														
BH-137	57.2	98.9	97.1	91.2	88.2	81.7	57.0														
BH-138	90.9	95.0	47.3	0.0	0.0	0.0	0.0														
BH-139		14.8	47.2	52.5	24.6	100.0	94.4	80.0													
BH-140		13.6	0.0	95.0	93.5	99.3	100.0	100.0													
BH-141	91.0	86.6	93.0	98.9	90.1	100.0	100.0														
BH-142 19.5	100.0	89.8	99.7	98.9	84.7																
BH-143		88.1	94.0	81.6	98.5	96.8	94.1	96.1	93.8	24.3											
BH-144	54.6	93.5	98.0	95.6	98.0	97.9	100.0														
BH-145			92.9	38.4	10.1	92.9	96.7	95.1	100.0												
BH-146		16.6	0.8	18.0	89.4	93.8	96.9	86.4	89.8	96.0	100.0										
BH-147		7.8	35.7	98.3	88.5	86.8	92.5	90.0													
BH-148 0.0	3.2	88.2	96.0	95.5	92.9	100.0															
BH-149 17.4	42.8	83.4	91.1	98.8	89.8	97.9	95.1	87.6	94.0												
BH-150		94.4	98.4	100.0	100.0	100.0	78.0														
BH-151	93.6	88.1	100.0	100.0	100.0	98.1	95.0														
BH-152 97.9	100.0	99.3	72.7	100.0	98.8	100.0															
BH-153 98.9	99.0	100.0	89.3	93.0	100.0																
BH-154 96.1	93.8	100.0	100.0	86.8	84.4																
BH-155 63.5	82.7	91.4	83.0	85.3	61.5	60.0															
BH-156 17.2	93.8	94.9	96.8	94.0	97.7	100.0															
BH-157		23.1	1.8	49.0	94.0	35.3	94.8	94.0													
BH-158		10.8	2.7	99.2	62.0	64.5	90.6														
BH-159		1.9	18.4	5.2	94.0	85.1	75.9														
BH-160			80.6	98.2	90.4	80.3	76.2														
BH-161			91.8	66.2	95.9	85.5	46.5	0.0													
BH-162		45.1	95.2	100.0	87.3	52.0	75.0	94.0													
BH-163			80.9	87.7	79.6	94.5	88.7	97.2	98.0												
BH-164		8.1	17.1	60.4	95.8	96.0	98.2	100.0													
BH-165		0.0	2.3	43.0	92.8	59.8	80.0														

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-201				78.1	94.2	30.2	30.3	96.0	91.9	92.5	100.0	100.0									
BH-202			12.5	28.8	63.0	84.6	12.8	99.0	91.3	93.9	100.0										
BH-203		13.0	13.4	21.8	57.2	90.0	93.2	90.8	75.0												
BH-205		85.5	100.0	67.0	68.0	99.1	55.6	96.0	100.0												
BH-206	19.1	58.7	57.1	41.2	100.0	97.9	99.1	100.0													
BH-207		89.8	99.8	10.0	0.0	36.0	47.9	80.3													
BH-208					41.4	0.0	0.0	3.6	6.5	8.7	4.6	49.9									
BH-251	39.4	90.1	98.2	100.0	83.7	66.6	13.3	4.0	100.0	95.8	100.0										
BH-252	87.3	80.2	100.0	98.0	96.2	20.5	27.0	0.1	0.0	0.0	59.0										
BH-253		76.2	90.9	96.1	92.6	43.2	66.7	27.9	58.5	76.0	91.7	98.0									
BH-254						32.2	99.0	89.4	96.7	90.8	96.5	95.0									
BH-301									13.4	19.5	70.5	83.3	96.2	100.0	100.0						
BH-302												91.1	87.1	99.2	100.0	99.2	93.6				
BH-303												89.8	87.0	91.5	82.9	95.9	100.0				
BH-304											93.1	81.6	89.2	93.7	97.8	96.5	93.0				
BH-305									97.2	96.3	81.7	81.3	88.2	76.9	82.9						
BH-306		94.0	99.6	65.7	0.0	98.1	97.0	85.0													
BH-307			82.1	94.5	90.7	95.1	91.2	96.6													
BH-309	10.6	98.0	98.0	95.0	98.9	100.0	100.0														
BH-310	50.8	81.8	84.7	97.2	95.1	93.9	100.0														
BH-311	0.9	94.3	90.1	47.1	89.7	100.0															
BH-312	8.7	52.5	90.1	72.1	76.0	87.2	94.5														
BH-313					71.0	67.6	83.7	89.7	94.4	100.0											
BH-314						90.2	99.6	95.6	48.3	85.9	100.0										
BH-315				98.0	100.0	97.3	79.2	92.6	94.7	100.0											
BH-316	68.8	93.5	23.3	91.1	81.1	61.0	94.7														
BH-317		23.0	88.7	99.6	98.1	97.8	100.0	100.0													
BH318	98.0	100.0	98.5	98.6	98.5	89.5															
BH-319	18.9	83.0	92.6	98.3	95.0	88.5															
BH-320	98.1	99.5	86.2	95.3	90.3	93.4	100.0														
BH-321	90.3	96.2	97.2	92.0	90.5	97.7	100.0														
BH-322	96.8	86.7	80.7	92.4	98.8	94.2	96.0														
BH-323	96.7	99.7	100.0	100.0	97.0	100.0															
BH-324				71.9	19.3	91.6	97.1	92.0	86.9												
BH-325		42.7	85.1	62.2	77.9	78.9	91.0														
BH-326			94.8	83.0	85.3	91.6	98.8	98.8	100.0												
BH-402								7.2	44.8	43.0	85.2	83.2	98.3	100.0							
BH-403												85.0	91.3	88.2	90.2	99.5	77.6				
BH-404											78.7	88.2	76.4	92.3	96.8	87.8	100.0				
BH-405											84.6	56.9	96.2	96.5	93.4	97.6					
BH-406									26.3	80.2	47.9	73.4	93.4	86.1							
BH-410	12.6	30.2	66.6	100.0	100.0	99.4	94.0														
BH-411	61.6	31.3	2.0	40.0																	
BH-412	0.1	0.0	24.5	87.0	91.4	44.5	61.7	77.2	82.3												
BH-413		44.4	16.7	59.9	98.2	31.6	74.5	100.0													
BH-414		59.4	89.0	98.4	92.6	78.4	92.0														
BH-415	27.8	3.2	0.0	9.4	90.6	100.0															
BH-416	28.9	13.9	12.4	86.9	97.4	93.2															
BH-417	5.9	71.4	93.5	100.0	97.4	99.8	100.0														
BH-418	2.2	92.5	98.8	100.0	98.0	96.0	98.5														
BH-419	2.9	4.1	95.1	97.8	100.0	100.0															
BH-420		95.2	100.0	96.0	98.5	87.3	85.7														
BH-421		84.2	93.7	97.0	97.0	92.8	100.0														
BH-422		100.0	81.2	87.6	91.7	82.8	76.2														
BH-423		97.0	74.7	90.0	100.0	81.3	91.6	97.5													
BH-424			98.7	96.2	73.5	49.9	93.3	86.0													
BH-425		93.0	27.9	88.7	86.1	84.3	99.8	95.7													
BH-426			54.5	80.6	78.5	91.8	88.8	98.6													
BH-427		61.4	87.1	66.1	88.6	87.5	90.0														

	SECTION STARTING (mPD)																				
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-501									15.2	58.5	79.9	61.0	13.0	32.5	100.0						
BH-502								88.2	59.8	33.0	63.0	0.0	77.4	100.0							
BH-503										91.4	88.3	88.5	78.0	60.6	97.0						
BH-504										74.4	45.7	70.3	93.0	83.8	75.8	25.0					
BH-505										98.5	76.8	97.0	98.7	97.4	100.0						
BH-506			66.7	45.8	24.3	0.0	13.3	99.7													
BH-507	11.4	54.1	35.8	74.3	98.5	96.3															
BH-508	40.3	79.0	94.4	1.3	29.4	87.4	94.1														
BH-509 0.0	0.5	11.7	73.3	93.0	92.7	27.8															
BH-510		53.4	88.8	70.5	92.9	68.5	66.4														
BH-511		38.6	89.8	99.5	100.0	95.6	97.0	97.0													
BH-512	3.1	0.2	14.5	0.8	90.0	96.2															
BH-513	98.1	100.0	100.0	99.4	98.2	92.7															
BH-514 63.6	100.0	86.8	98.0	41.2	2.6	100.0															
BH-516 97.1	97.4	85.2	85.6	99.1	95.7																
BH-517 50.0	15.9	62.8	98.1	94.1	96.4																
BH-518	6.1	91.0	96.8	97.3	90.4	84.6															
BH-519	90.8	96.6	80.0	100.0	100.0	90.2	92.3														
BH-520		70.9	99.1	90.0	94.0	94.2	98.6														
BH-521		97.6	98.2	98.4	95.0	95.4	99.1	100.0													
BH-522	10.8	100.0	95.8	100.0	66.6	73.6															
BH-523		100.0	96.9	81.9	82.8	91.2	93.2														
BH-524		86.4	96.8	54.0	89.1	96.2	94.3														
BH-525		99.4	98.5	92.1	83.4	86.5	93.6														
BH-526	46.6	72.5	72.6	84.7	90.5	93.6															
BH-527	22.0	89.1	85.5	91.2	81.4	80.0															
BH-602													34.2	9.6	95.7	94.1	93.3	51.9			
BH-603										82.7	93.4	95.7	97.2	90.5	92.9	70.8					
BH-604							5.2	5.4	42.8	95.9	80.8	91.9									
BH-605										78.4	86.7	75.1	84.2	100.0							
BH-606	16.7	33.9	89.1	69.6	0.0	7.3	73.5														
BH-608				23.0	91.9	97.7	90.9	100.0													
BH-610		27.6	47.9	94.2	90.2	93.7	96.6														
BH-612			6.0	76.1	93.8	98.8	95.7	91.5													
BH-613		97.0	98.4	90.3	94.1	92.2	86.9														
BH-614 98.7	100.0	98.1	99.2	96.0	95.0	100.0															
BH-615 98.2	100.0	100.0	94.0	96.4	99.2																
BH-616	17.9	47.3	92.8	97.6	89.1	96.0															
BH-617 34.7	52.4	100.0	100.0	98.9	95.6	82.0															
BH-618 80.9	41.7	73.3	100.0	100.0	100.0																
BH-619		75.8	14.2	6.1	0.0	0.0	12.1	65.0													
BH-620			71.6	18.6	96.8	96.0	100.0	100.0													
BH-621			22.7	53.4	97.3	61.4	93.9	88.6													
BH-622		10.6	4.9	79.8	87.2	69.1	54.2	88.0													
BH-623	2.7	32.3	35.9	96.0	76.9	81.8	93.9														
BH-624		15.9	57.1																		
BH-624A		24.0	90.9	94.7	84.8	78.9	99.0	94.2	100.0												
BH-625		82.6	97.0	96.1	88.4	100.0	100.0	100.0	100.0												
BH-626	87.8	75.9	88.8	72.0	90.2	86.5															
BH-627 57.3	59.0	95.4	98.8	87.7	95.7	94.0															
BH-651		98.0	98.4	75.9	86.9	85.0	99.3	100.0													
BH-701														92.6	88.0	99.5	100.0				
BH-702											26.3	0.3	33.5	98.2	100.0						
BH-703										70.8	93.4	88.9	100.0	99.0							
BH-704	10.4	28.2	0.0	0.0	0.0	0.0	0.0	0.4	81.5												
BH-705	0.7	0.0	0.0	0.0	0.0	0.0	18.9	5.1	13.7	63.4	95.1	100.0									
BH-707				8.1	11.2	52.3	0.0	5.2	20.2												
BH-709			46.7	98.0	87.5	91.8	88.9	89.1													
BH-710		9.1	38.3	24.6	32.0	87.3	54.9	93.0													

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-711	99.0	100.0	98.0	100.0	92.6	88.5	88.0														
BH-712	96.5	95.2	97.4	96.8	86.0	93.4	100.0														
BH-713 91.6	97.0	98.0	100.0	97.6	80.0																
BH-714 75.0	93.0	95.9	91.5	99.8	97.6	100.0															
BH-715 5.6	28.0	100.0	97.4	92.6	100.0	86.2															
BH-716	95.3	83.8	72.2	92.1	92.9	80.9															
BH-717 65.8	93.8	91.4	93.4	97.2	97.5	94.0															
BH-718	97.4	96.0	99.6	98.0	93.2	100.0															
BH-719		92.9	90.1	97.5	98.0	93.8	100.0														
BH-720			6.5	75.0	0.0	3.5															
BH-721		68.1	51.9	2.9	96.4	94.4	69.6														
BH-722		97.7	86.0	80.7	91.1																
BH-723	96.2	6.7	71.2	96.0	90.3	58.1	0.0	0.0	0.0	5.5											
BH-724		98.1	72.1	85.4	56.1	0.0	0.0	0.0	0.0	2.8											
BH-725	82.5	95.8	90.0	93.2	93.6	4.8	4.5	94.0													
BH-726 98.2	97.3	82.3	80.6	87.6	50.0																
BH-727100.0	100.0	97.0	90.5	82.9	75.3	85.0															
BH-751			1.6	0.0																	
BH-751A		17.4	89.9	46.6	76.0	57.5	87.2	87.0													
BH-752		96.8	70.7	96.1	86.6	21.9	0.0	0.0	0.0	0.0	36.5										
BH-753			97.8	52.6	89.5	87.9	54.3	100.0													
BH-754		62.1	46.6	41.9	79.6	69.7	66.3														
BH-755	99.5	77.3	69.2	65.2	88.5	24.4	0.0	0.0	4.3	99.3											
BH-756 80.8	82.2	88.8	64.2	69.5	67.0	79.6	45.3	78.0													
BH-802										2.1	92.1	96.9									
BH-803									69.9	98.1											
BH-804						57.4	97.1	100.0	99.4	94.1	98.7	100.0									
BH-805			82.6	93.9	95.9	100.0	100.0	92.1	100.0												
BH-806			18.0	47.2	95.4	93.9	85.2	85.4	100.0												
BH-807		44.0	88.2	75.3	87.0																
BH-808		21.3	66.0	87.4	93.8	91.4															
BH-809					78.5	95.5	87.1	85.3	85.5	81.4											
BH-810				64.2	100.0	97.0	95.7	95.9	100.0												
BH-811		100.0	87.1	97.4	88.7	85.9	90.3	100.0													
BH-812	100.0	92.8	97.0	97.1	100.0	39.6	81.8														
BH-813	81.1	100.0	93.2	98.7	97.6	100.0															
BH-814 18.5	94.0	97.2	98.6	100.0	36.1	96.0															
BH-815 95.4	35.6	90.6	99.9	96.1	96.4																
BH-816	45.3	98.9	95.1	93.6	56.4	100.0															
BH-822	14.4	9.0	73.1	100.0	100.0																
BH-823		89.3	24.4	76.7	36.2																
BH-824	81.3	4.8	86.8	92.4	100.0																
BH-825	42.3	93.7	26.2	59.6																	
BH-826	93.0	96.0	55.1	91.7																	
BH-827	97.5	84.3	90.0	90.7	83.4	73.6															
BH-902					56.4	0.0	0.0	41.1	96.0	100.0	100.0										
BH-903			67.9	99.4	91.5	100.0	100.0	100.0													
BH-904			84.3	93.3	100.0	98.0	100.0	100.0													
BH-905		54.7	80.2	89.9	100.0	98.5	99.6														
BH-906	18.3	23.6	36.0	37.4	95.4	98.1	99.2														
BH-907		19.1	20.3	79.3	95.1	80.9	100.0														
BH-908				82.6	100.0	100.0	84.9	98.4	95.9												
BH-909		32.0	94.3	98.2	100.0	98.2	81.7	65.1													
BH-910		72.4	89.0	100.0	92.9	94.2	95.9	91.5													
BH-911 58.7	46.9	90.3	100.0	100.0	100.0	100.0															
BH-912100.0	81.0	52.8	93.2	97.6	93.0	98.0															
BH-913 25.0	60.1	100.0	97.9	99.9	66.0	100.0															
BH-914	66.8	29.2	94.2	100.0	35.2	41.1															
BH-915		34.2	0.0	0.0	0.0	37.8	77.4	70.0													

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-922			77.6	63.3	85.8	74.0	67.5	68.4													
BH-923	97.9	95.0	95.9	70.6	82.3	98.0	100.0														
BH-924	32.1	95.6	75.9	91.2	91.5	98.1	96.0														
BH-925	65.1	81.7	66.7	69.2	99.3	32.7	100.0														
BH-926		79.5	88.2	9.1	7.9	98.9	84.0														
BH-927		33.1	4.6	81.0	96.1	90.5	97.9														
BH-1004			100.0	99.7	98.5	97.8	87.3	100.0	100.0												
BH-1005	100.0	100.0	100.0	100.0	100.0	100.0	100.0														
BH-1006	50.4	83.7	95.7	100.0	99.2	85.7	100.0														
BH-1007	23.9	95.8	99.0	97.3	100.0	94.5	100.0														
BH-1008		38.8	76.8	98.1	98.8	92.0	98.5														
BH-1009	89.7	23.3	97.3	18.2	75.4	79.6															
BH-1010																					
	21.4	85.2	100.0	88.7	99.4	100.0															
BH-1011																					
	72.1	92.5	100.0	100.0	100.0	94.5	95.0														
BH-1012	67.3	100.0	100.0	94.2	98.3	100.0	100.0														
BH-1013	18.1	98.3	90.3	100.0	99.8	98.2	100.0														
BH-1014	67.5	6.5	35.9	97.9	98.0	100.0															
BH-1015																					
	4.0	0.3	13.9	38.5	90.5	100.0	100.0														
BH-1022			75.6	93.2	96.3	88.6															
BH-1023		60.1	98.6	80.2	0.2	0.0	38.5														
BH-1024		89.3	60.7	50.2	0.7	0.0	44.2														
BH-1025	97.5	22.3	43.9	1.6	11.6	88.9	100.0														
BH-1026		14.4	33.3	76.1	29.2	0.2	96.1														
BH-1027		3.3	22.8	80.2	12.6	0.0	38.9														
BH-1104	98.0	98.1	97.9	98.0	99.7	100.0	100.0														
BH-1105	85.8	60.8	100.0	98.2	100.0	99.4	100.0														
BH-1106		96.3	100.0	100.0	100.0	100.0	100.0	100.0													
BH-1107		98.2	88.4	100.0	98.5	100.0	100.0	100.0													
BH-1108																					
	72.8	96.8	98.8	100.0	100.0	17.9	75.0														
BH-1109	11.3	32.5	73.5	100.0	100.0	100.0															
BH-1110																					
	98.6	99.6	98.5	60.3	0.1																
BH-1111																					
	94.0	94.1	99.2	97.1	100.0	100.0															
BH-1112	97.6	98.4	78.8	85.3																	
BH-1113																					
	57.6	82.0	96.7	99.1	100.0	100.0															
BH-1114																					
	53.4	94.2	94.7	95.9	100.0	99.4	100.0														
BH-1115																					
	43.3	21.9	34.1	94.3	99.5	100.0	100.0														
BH-1116	1.3	15.5	100.0	99.0	99.5																
BH-1122		31.8	100.0	100.0	96.1	90.0	91.7	80.5													
BH-1123		74.1	97.2	99.7	23.0	0.0	45.1														
BH-1124	80.7	100.0	70.7	0.5	0.0	0.0	52.8														
BH-1125		0.6	73.8																		
BH-1125A		62.1	6.2	2.9	16.4	0.0	71.2	61.0													
BH-1126		2.8	36.8	50.9	55.4	24.6	21.6	65.0													
BH-1127				44.6	21.8	0.5	62.7	31.0	37.4												
BH-1151																					
	45.1	1.2	94.6	79.9	98.1	87.4															
BH-1152																					
	50.1	99.2	82.5	69.4	76.7																
BH-1205	99.0	88.4	100.0	100.0	100.0	100.0															
BH-1206	94.9	92.2	100.0	100.0	100.0	100.0															

	SECTION STARTING (mPO)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-1207																					
	99.4	100.0	100.0	99.8	99.0	100.0															
BH-1208																					
100.0	98.8	56.3	65.6	100.0	100.0	100.0															
BH-1209																					
	62.6	19.2	73.1	93.9	99.5	100.0	100.0														
BH-1210																					
	95.8	99.2	99.0	100.0	100.0	100.0															
BH-1211																					
5.5	0.0	90.5	91.5	85.0																	
BH-1212		95.1	97.1	90.7	91.1																
BH-1213																					
	98.5	89.1	83.0	96.0	100.0	100.0															
BH-1214																					
	64.2	96.2	92.7	99.9	100.0																
BH-1215		68.1	98.8	98.7	88.6																
BH-1216																					
	4.3	81.2	91.4	88.5	87.0																
BH-1222			24.3	86.8	100.0	96.5	90.0	99.2	94.0												
BH-1223				58.2	58.5	90.9	94.5	87.1	100.0												
BH-1224		99.0	97.7	95.0	96.5	94.1	98.5	100.0													
BH-1225		97.6	86.9	75.9	0.7	0.0	70.2														
BH-1226		1.9	33.0	7.5	22.7	91.0	100.0														
BH-1227			53.4	8.9	30.0	10.9	0.0	24.8	96.0												
BH-1251																					
	94.8	0.9	44.5	5.9	0.0	0.0	3.5														
BH-1252		93.0	100.0	100.0	98.1	89.0	95.0														
BH-1306																					
	99.0	100.0	96.3	98.9	100.0	100.0															
BH-1307																					
	100.0	99.7	98.5	92.9	100.0	100.0															
BH-1308		66.9	5.8	94.3	97.9	100.0	99.6														
BH-1309																					
	5.1	13.7	56.7	100.0	100.0	100.0															
BH-1310																					
	3.3	33.5	96.5	88.6	0.0	0.0															
BH-1311		24.0	38.9	97.6	95.7	94.6	94.2														
BH-1312		1.2	10.9	100.0	41.7	6.9	93.0														
BH-1313		62.9	86.4	98.0	90.4	98.3	78.1	100.0													
BH-1314		65.2	100.0	96.2	95.3	97.3	98.2														
BH-1315																					
	39.2	98.1	91.2	94.0	98.5	99.5	100.0														
BH-1316																					
	57.1	98.9	79.3	93.0	99.8																
BH-1322			9.4	73.7	68.8	72.9	88.8	100.0	100.0												
BH-1323		99.3	81.8	88.9	77.5	87.9	89.6	100.0													
BH-1324																					
	98.2	94.1	73.3	82.5	55.8	83.6	100.0														
BH-1325																					
	98.3	90.0	65.2	63.8	0.0	46.2															
BH-1326		1.6	2.5	22.1	94.4	92.7	91.2														
BH-1327				94.2	93.1	67.9	0.0	15.9	97.6												
BH-1420																					
	100.0	100.0	100.0	100.0	100.0	99.2	100.0														
BH-1421																					
	100.0	93.3	85.6	98.0	65.4	82.9	75.4														
BH-1422		19.1	99.5	93.9	62.7	77.3	48.3	55.0													
BH-1423		96.3	92.1	65.2	74.7	56.1	87.6	100.0													
BH-1424																					

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
100.0	97.8	97.0	86.0	88.6	96.3	95.0															
BH-1425																					
96.7	90.6	57.0	41.3	74.0	100.0																
BH-1426																					
75.0	91.5	86.4	37.2	97.9	83.5	99.4															
BH-1427	4.9	77.6	87.7	91.2	93.7	94.7	93.0														
BH-1520	97.7	98.0	90.8	67.5	52.2	74.2															
BH-1521	89.3	89.8	97.9	86.2	37.5	47.3	96.0														
BH-1522	99.1	75.5	72.9	66.8	87.8	79.4															
BH-1523																					
96.3	96.9	97.2	96.4	91.6	88.5	100.0															
BH-1524																					
92.7	79.5	82.8	82.9	53.4	98.0																
BH-1525	88.8	76.7	96.8	89.7	98.9	99.9															
BH-1621	31.9	86.5	79.4	79.0	71.1	88.5															
BH-1622																					
100.0	81.4	90.5	83.7	92.4	65.5	58.0															
BH-1623	95.4	82.2	59.1	86.7	99.7	98.1															
BH-1624																					
89.2	76.1	76.8	79.8	100.0	98.7	97.9															
BH-1625	54.3	72.5	94.9	74.3	90.2	93.5															
BH-1626		94.5	79.3	96.0	97.1	97.8	95.2														
BH-1721	90.0	76.6	69.9	89.0	87.5	47.8															
BH-1722	97.3	83.8	79.6	79.4	94.0	94.0	93.8														
BH-1723		58.6	64.4	83.2	100.0	97.7	99.4	100.0													
BH-1724			96.7	97.8	97.1	98.6	100.0	100.0	80.5												
BH-1725			93.2	92.3	99.2	98.9	98.9	100.0	100.0												
B'21 18.1	33.9	29.7	94.3	93.8	97.3																
B'23 5.7	42.9	95.8	94.2	94.6	92.0																
C'20 45.8	84.6	95.8	98.5	98.6	100.0																
C'23	8.7	27.1	96.6	85.8	91.9	90.4															
E'23 6.5	99.6	96.2	99.9	98.6	99.4	100.0															

APPENDIX B

MARBLE MASS CLASSES

	SECTION STARTING (mPD)																				
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
AH4								I	I	I	I	I	I	I							
AH5			III	II	I	II	I	I	I	I	II										
AH6		II	III	I	III	I	I	I	I	I	I										
AH7		IV	III	II	I	I	I	I	I	I	I	I	I								
AH8		III	II	I	I	I	II	I	I	I											
AH9				S	S	S	S	S	S	S	II										
AH10						V	V	I	S	S	S	S	S	I							
AH11					I	III	I	I	I	I	I										
AH12	I	I	I	II	I	II	I	I	I	I	I										
AH13	II	I	I	I	I	I	I	I	I	I	I										
AH14	V	II	I	I	I	I	II	I	I	I	I										
AH15		I	I	I	I	II	II	I	I	II	I										
AH24										I	I	I	II	I	S	S					
AH25						V	V	V	I	I	I	I	I	I							
AH26		III	III	II	I	I	I	I	I	I	I	I									
AH27		IV	T	S	S	S	S	I	I	I	S	I									
AH28	V	T	S	S	S	S	S	S	S	S	II										
AH29			II	I	I	I	I	S	I	I											
AH30			III	III	I	II	II	I	I	I	I	I	I	I							
AH31		I	I	I	I	I	I	I	I	I											
AH32	V	I	I	I	IV	II	II	I	I	I	I	I									
AH33	I	I	II	I	I	I	I	I	I	S	I										
AH34		III	I	I	I	I	I	I	I	I											
AH35			I	I	I	I	I	I	I	I	I										
AH36		I	I	I	I	I	I	I	I	I	I										
AH45			II	III	S	T	T	T	III	II	S	I	I	I	I						
AH46		V	V	T	T	S	S	S	S	S	S	S									
AH47	T	T	T	T	S	S	S	S	S	S	S	S									
AH48			S	III	I	II	I	S	I	I	I	I									
AH49				I	I	II	I	I	I	I	I	I	I								
AH50			I	I	III	I	II	I	I	I	I	I	I	I							
AH51		I	I	II	I	I	I	I	I	I	I										
AH52		II	II	I	I	I	I	I	I	I	I	I	I								
AH53	I	III	I	I	I	I	S	I	I	I	I										
AH54		III	I	I	I	II	I	I	I	I	I	I	I	I	I						
AH55	I	I	I	I	I	I	I	I	I	I	I										
AH56		I	I	II	I	I	II	I	I	I	I	I	I	I							
AH57						I	I	I	I	I	I	I	I								
AH58				V	III	I	II	II	II	II	I	I									
AH61			II	I	I	I	IV	V													
AH62	I	I	I	II	I	II	I	I	I	I	I										
AH65								S	I	I	S	I	I	II							
AH66				II	II	I	I	II	I	I	I										
AH68			III	III	I	I	I	I	I	I	I	I									
AH73	I	I	I	I	I	II	I	I	I	II	I	I	I	I	I	I					
AH74	I	V	I	I	I	I	II	I	I	I	I										
AH75			II	I	I	I	I	I	I	I	I										
AH76				II	I	I	I	I	I	I	I										
AH77		I	I	I	I	II	I	I	II	I	I	I	I	I	I	I	I	I	I		
AH85				II	I	I	I	I	I	I	I										
AH86			I	I	I	I	I	I	I	I	I										
AH87	I	III	IV	II	I	I	I	I	I	I	I										
AH88			III	V	III	III	I	I	I	II	I	I	II								
AH90		I	III	I	I	I	I	II	I	I											
AH91		I	I	I	I	I	I	I	I	I	I										
AH92	IV	III	I	I	I	II	I	I	I	I	I										
AH93	I	I	I	I	I	I	I	I	I	I	I										
AH97	III	II	I	I	V	V	V	III	I	I	I	II	I	II	I	I	I	I	I	III	I	I
AH98			III	V	IV	I	I	I	II	II	I	II	III	I	I	I	I	I	I	II	I	I

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
AH105	I	I	I	I	I	I	I	I	I												
AH108 V	V	IV	I	I	I	I	I	I	I	I											
AH109																					
I I	I	III	V	I	I	I	I	I	I	I	I	I									
AH111	I	I	I	I	I	I	I	I	I												
AH117	II	I	IV	V	I	I	II	III	I	II	I	I	I	I	I	I	I	I	II	I	I
AH125 I	I	I	I	I	I	I	I	I	I	I											
AH128 IV	III	I	I	I	I	II	I	I	I	I											
AH129 II	I	I	I	II	I	I	I	I	I												
AH131 V	I	I	I	II	I	I	I	I	I	I											
AH137			I	I	I	I	I	I	I	I											
AH138	I	I	I	III	I	I	I	I	I	I											
AH139	I	I	III	V	III	I	I	II	I	I	I	I	I								
AH140	II	V	III	IV	I	II	I	I	I	I	I	I	I	I							
AH141		IV	V	III	III	I	I	I	III	I	I	I	I	I	I	I					
AH144	I	I	I	II	I	I	I	I	II	I											
AH145		I	I	I	I	I	I	I	I	I											
AH147 I	I	III	I	I	I	I	I	I	I	I											
AH148		IV	II	I	II	I	I	I	I	II	I										
AH150	I	I	I	II	II	III	II	I	I	I											
AH152 I	I	I	I	I	I	I	I	I	I												
AH155	I	I	I	I	II	II	I	I	I	I											
AH158			I	I	I	I	I	I	I	I											
AH158A	I																				
AH159		I	I	I	I	I	I	I	I	I											
BH-1 T T	T	T	T	T	T	T	T	T	R	III	V	IV	V	S	S	I					
BH-2 T T	T	T	T	T	T	R	IV	II	I	I	I	I	I	I							
BH-3	II	I	I	I	I	I	I	I	I	I	I	I	I	I							
BH-4				I	I	I															
BH-5 I	I	I	I	I																	
BH-6 V	II	I	II	II																	
BH-7					T	R	R	R	R	I	I	I	III								
BH-8		I	I	I	I	I	I	II	I	I	I	I	I	I							
BH-9			V	III	I	I	I														
BH-10		IV	I	II	I	I															
BH-11			T	T	T	T	T	T	S	S	S	S	S								
BH-12		S	V	II	III	I	I	I	I	I	I	I									
BH-13 V	II	I	I	I																	
BH-14			IV	V	II	I															
BH-14A			V	V	III	IV															
BH-14B		III	I	I	II	V	I	II	I	I	I	I									
BH-15			I	I	I	I	II	V	I	I	I	I	I	I							
BH-16	I	I	I	I																	
BH-17 I	I	I																			
BH-18		III	IV	II	III	I	I	I	I	I	I	I	I	I							
BH-19 I	I	I	I																		
BH-20			II	I	I																
BH-21				II	I	I	I	I	I	II	I	I	I	I							
BH-22	I	I	I	I	I	I	I	I	I	I	I	I	I	I							
BH-23		I	I	I	I	I	I	I	I	I	I	I	I								
BH-101			III	II	I	I	I	I	I	I	I										
BH-102		V	V	IV	V																
BH-103		V	V	III	I	I	II	I													
BH-104		I	I	I	I	I	IV	I	I	I	I										
BH-105			V	III	I	I	I	I	I												
BH-106		I	I	I	I	I	I	I													
BH-107		III	IV	I	I	I	I	I	I	I	I										
BH-108				V	III	I	I	V	IV	I											
BH-108A				II																	

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-1088		V	V																		
BH-109	I	I	I	III	I	III															
BH-110		III	V	V	I	I	I														
BH-111	I	II	II	V	III	I															
BH-112		I																			
BH-112A		V	V	III	I	I	I	I													
BH-113		I	V	III	II	I	I														
BH-114		I	I	I	I	I	I	I													
BH-115		I	I	I	II	III	I														
BH-116	I	I	II	I	II	I	I														
BH-117		I	V	V	III	I	I														
BH-118	I	I	I	I	I	I	II														
BH-119	II	I	I	I	I	I															
BH-120	I	I	I	I	I	I	I														
BH-121	I	I	I	I	I	I															
BH-122	I	I	I	I	I	I	I	I	I												
BH-123 I	I	I	I	I	V	V															
BH-124 I	I	I	I	V	V	V	V														
BH-125	I	I	I	I	I	IV	I	I	I	I											
BH-126	IV	V	V	V																	
BH-127	III	V	III	I	I	I	I														
BH-128 I	I	I	I	I	I	I	I	I	I												
BH-129	I	I	I	I	I	V															
BH-130	I	I	I	I	I	I															
BH-131	I	I	I	I	I	IV	V														
BH-132	II	II	I	I	I	I	I														
BH-133	I	I	I	I	I	I	I														
BH-134	V	II	I	I	I	I															
BH-135 II	I	I	I	I	I																
BH-136	I	I	I	I	I	I	I														
BH-137	II	I	I	I	I	I	II														
BH-138	I	I	III	V	V	V	V														
BH-139		IV	III	II	IV	I	I	I													
BH-140		IV	V	I	I	I	I	I													
BH-141	I	I	I	I	I	I	I														
BH-142 IV	I	I	I	I	I																
BH-143		I	I	I	I	I	I	I	I	IV											
BH-144	II	I	I	I	I	I	I														
BH-145			I	III	IV	I	I	I	I												
BH-146		IV	V	IV	I	I	I	I	I	I	I										
BH-147		V	III	I	I	I	I	I													
BH-148 V	V	I	I	I	I	I															
BH-149 IV	III	I	I	I	I	I	I	I	I												
BH-150		I	I	I	I	I	I														
BH-151	I	I	I	I	I	I	I														
BH-152 I	I	I	II	I	I	I															
BH-153 I	I	I	I	I	I																
BH-154 I	I	I	I	I	I																
BH-155 II	I	I	I	I	II	II															
BH-156 IV	I	I	I	I	I	I															
BH-157		IV	V	III	I	III	I	I													
BH-158		IV	V	I	II	II	I														
BH-159		V	IV	V	I	I	I														
BH-160			I	I	I	I	I														
BH-161			I	II	I	I	III	V													
BH-162		III	I	I	I	II	II	I													
BH-163			I	I	I	I	I	I	I												
BH-164		V	IV	II	I	I	I	I													
BH-165		V	V	III	I	II	I														

	SECTION STARTING (mPO)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-201				I	I	III	III	I	I	I	I	I									
BH-202			IV	III	II	I	IV	I	I	I	I										
BH-203		IV	IV	IV	II	I	I	I	I												
BH-205		I	I	II	II	I	II	I	I												
BH-206	IV	II	II	III	I	I	I	I													
BH-207		I	I	IV	V	III	III	I													
BH-208					III	V	V	V	V	V	V	III									
BH-251	III	I	I	I	I	II	IV	V	I	I	I										
BH-252 I	I	I	I	I	IV	III	V	V	V	II											
BH-253	I	I	I	I	III	II	III	II	I	I	I										
BH-254					III	I	I	I	I	I	I										
BH-301	T	T	T	T	T	R	R	IV	IV	II	I	I	I	I							
BH-302											I	I	I	I	I	I					
BH-303	T	T	T	T	T	T	T	T	T	T	I	I	I	I	I	I					
BH-304 T	T	T	T	T	T	T	T	T	T	I	I	I	I	I	I	I					
BH-305	T	T	T	T	T	T	T	I	I	I	I	I	I	I							
BH-306		I	I	II	V	I	I	I													
BH-307			I	I	I	I	I	I													
BH-309	IV	I	I	I	I	I	I														
BH-310	II	I	I	I	I	I	I														
BH-311	V	I	I	III	I	I															
BH-312	V	II	S	S	S	I	I														
BH-313					S	S	S	S	I	I											
BH-314						I	I	I	S	S	I										
BH-315				I	I	I	I	I	I												
BH-316 II	I	IV	I	I	II	I															
BH-317	IV	I	I	I	I	I	I														
BH-318 I	I	I	I	I	I																
BH-319 IV	I	I	I	I	I																
BH-320 I	I	I	I	I	I	I															
BH-321 I	I	I	I	I	I	I															
BH-322 I	I	I	I	I	I	I															
BH-323 I	I	I	I	I	I																
BH-324			II	IV	I	I	I	I													
BH-325	III	I	II	I	I	I															
BH-326		I	I	I	I	I	I	I													
BH-402							V	III	III	I	I	I	I								
BH-403											I	I	I	I	I	I					
BH-404										I	I	I	I	I	I	I					
BH-405										I	II	I	I	I	I						
BH-406								III	I	III	II	I	I								
BH-410 IV	III	II	I	I	I	I															
BH-411 II	III	T	S																		
BH-412 V	V	S	S	S	S	S	S	S													
BH-413	S	IV	II	I	III	II	I														
BH-414	II	I	I	I	I	I															
BH-415 III	V	V	V	I	I																
BH-416 III	IV	IV	I	I	I																
BH-417 V	II	I	I	I	I	I															
BH-418 V	I	I	I	I	I	I															
BH-419 V	V	I	I	I	I																
BH-420	I	I	I	I	I	I															
BH-421	I	I	I	I	I	I															
BH-422	I	I	I	I	I	I															
BH-423	I	II	I	I	I	I	I														
BH-424		I	I	II	III	I	I														
BH-425	I	III	I	I	I	I	I														
BH-426		II	I	I	I	I	I														
BH-427	II	I	II	I	I	I															

BOREHOLE	SECTION STARTING (mPD)																			
	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-501									IV	II	I	II	IV	III	I						
BH-502	T	T	T	T	T	T	R	I	II	III	II	V	I	I							
BH-503										I	I	I	I	II	I						
BH-504	T	T	T	T	T	T	T	T	R	II	III	II	I	I	I	III					
BH-505										I	I	I	I	I	I						
BH-506			II	III	IV	V	IV	I													
BH-507	IV	II	III	II	I	I															
BH-508	III	I	I	V	III	I	I														
BH-509 V	V	S	S	S	S	S															
BH-510 T	T	S	S	S	I	S	S														
BH-511		S	I	I	I	I	S	I													
BH-512	V	V	IV	V	I	I															
BH-513	I	I	I	I	I	I															
BH-514 II	I	I	I	III	V	I															
BH-516 I	I	I	I	I	I																
BH-517 III	IV	II	I	I	I																
BH-518	V	I	I	I	I	I															
BH-519	I	I	I	I	I	I	I														
BH-520		II	I	I	I	I	I														
BH-521		I	I	I	I	I	I	I													
BH-522	IV	I	I	I	II	II															
BH-523		I	I	I	I	I	I														
BH-524		I	I	II	I	I	I														
BH-525		I	I	I	I	I	I														
BH-526	III	II	II	I	I	I															
BH-527	IV	I	I	I	I	I															
BH-602													III	V	S	S	I	II			
BH-603										I	I	I	I	S	S	II					
BH-604							V	V	III	I	I	I									
BH-605										I	I	I	S	S							
BH-606	S	III	I	II	V	V	II														
BH-608				S	S	S	S	I													
BH-610		III	III	I	I	I	I														
BH-612			V	I	I	I	I	I													
BH-613		I	I	I	I	I	I														
BH-614 I	I	I	I	I	I	I															
BH-615 I	I	I	I	I	I																
BH-616	IV	III	I	I	I	I															
BH-617 III	II	I	I	I	I	I															
BH-618 I	III	II	I	I	I																
BH-619		I	IV	V	V	V	IV	II													
BH-620			II	IV	I	I	I	I													
BH-621			IV	II	I	II	I	I													
BH-622		IV	V	I	I	II	II	I													
BH-623	V	III	III	I	I	I	I														
BH-624		IV	II																		
BH-624A		IV	I	I	I	I	I	I	I												
BH-625		I	I	I	I	I	I	I	I												
BH-626	I	I	I	II	I	I															
BH-627 II	II	I	I	I	I	I															
BH-651		I	I	I	I	I	I	I													
BH-701	T	T	T	T	T	T	T	T	T	T	T	T	T	S	S	I	I				
BH-702											III	V	S	S	S						
BH-703							T	T	T	S	S	S	S	S							
BH-704	S	III	V	T	T	T	T	T	S												
BH-705	T	T	T	T	T	T	S	T	S	S	S	I									
BH-707				V	IV	II	V	V	S												
BH-709			S	I	I	I	I	I													
BH-710		V	III	IV	III	I	II	I													

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-711	I	I	I	I	I	I	I														
BH-712	I	I	I	I	I	I	I														
BH-713 I	I	I	I	I	I																
BH-714 I	I	I	I	I	I	I															
BH-715 V	III	I	I	I	I	I															
BH-716	I	I	II	I	I	I															
BH-717 II	I	I	I	I	I	I															
BH-718	I	I	I	I	I	I															
BH-719		I	I	I	I	I	I														
BH-720			V	I	V	V															
BH-721		II	II	V	I	I	II														
BH-722		I	I	I	I																
BH-723	I	V	II	I	I	II	V	V	V	V											
BH-724		I	II	I	II	V	V	V	V	V											
BH-725	I	I	I	I	I	V	V	I													
BH-726 I	I	I	I	I	II																
BH-727 I	I	I	I	I	I	I															
BH-751			V	V																	
BH-751A		IV	I	III	I	II	I	I													
BH-752		I	II	I	I	IV	V	V	V	V	III										
BH-753			I	II	I	I	II	I													
BH-754		II	III	III	I	II	II														
BH-755	I	I	II	II	I	IV	V	V	V	I											
BH-756 I	I	I	II	II	II	I	III	I													
BH-802										T	S	S									
BH-803									S	S											
BH-804						S	I	I	I	I	I	I									
BH-805			I	I	I	I	I	I	I												
BH-806			IV	III	I	I	I	I	I												
BH-807		III	I	I	I																
BH-808		IV	II	I	I	I															
BH-809					I	I	I	I	I	I											
BH-810				II	I	I	I	I	I												
BH-811		I	I	I	I	I	I	I													
BH-812	I	I	I	I	I	III	I														
BH-813	I	I	I	I	I	I															
BH-814 IV	I	I	I	I	III	I															
BH-815 I	III	I	I	I	I																
BH-816	III	I	I	I	II	I															
BH-822	IV	V	II	I	I																
BH-823		I	IV	I	III																
BH-824	I	V	I	I	I																
BH-825	III	I	III	II																	
BH-826	I	I	II	I																	
BH-827	I	I	I	I	I	II															
BH-902					II	V	V	III	I	I	I										
BH-903			II	I	I	I	I	I													
BH-904 T	T	T	I	I	I	I	I	I													
BH-905		II	I	I	I	I	I														
BH-906	IV	IV	III	III	I	I	I														
BH-907		IV	IV	I	I	I	I														
BH-908				I	I	I	I	I	I												
BH-909		III	I	I	I	I	I	II													
BH-910		II	I	I	I	I	I	I													
BH-911 II	III	I	I	I	I	I															
BH-912 I	I	II	I	I	I	I															
BH-913 III	II	I	I	I	II	I															
BH-914	II	III	I	I	III	III															
BH-915		III	V	V	V	III	I	II													

	SECTION STARTING (mPD)																			
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-922			I	II	I	II	II	II													
BH-923	I	I	I	II	I	I	I														
BH-924	III	I	I	I	I	I	I														
BH-925	II	I	II	II	I	III	I														
BH-926		I	I	V	V	I	I														
BH-927		III	V	I	I	I	I														
BH-1004			I	I	I	I	I	I	I												
BH-1005	I	I	I	I	I	I	I														
BH-1006	II	I	I	I	I	I	I														
BH-1007	IV	I	I	I	I	I	I														
BH-1008		III	I	I	I	I	I														
BH-1009	I	IV	I	IV	I	I															
BH-1010IV	I	I	I	I	I																
BH-1011II	I	I	I	I	I	I															
BH-1012	II	I	I	I	I	I	I														
BH-1013	IV	I	I	I	I	I	I														
BH-1014	II	V	III	I	I	I															
BH-1015V	V	IV	III	I	I	I															
BH-1022			I	I	I	I															
BH-1023		II	I	I	V	V	III														
BH-1024		I	II	II	V	V	III														
BH-1025	I	IV	III	V	IV	I	I														
BH-1026		IV	III	I	III	V	I														
BH-1027		V	IV	I	IV	V	III														
BH-1104	I	I	I	I	I	I	I														
BH-1105	I	II	I	I	I	I	I														
BH-1106		I	I	I	I	I	I	I													
BH-1107		I	I	I	I	I	I	I													
BH-1108II	I	I	I	I	IV	I															
BH-1109	IV	III	II	I	I	I															
BH-1110I	I	I	II	V																	
BH-1111I	I	I	I	I	I																
BH-1112	I	I	I	I																	
BH-1113II	I	I	I	I	I																
BH-1114II	I	I	I	I	I	I															
BH-1115III	IV	III	I	I	I	I															
BH-1116	V	IV	I	I	I																
BH-1122		III	I	I	I	I	I	I													
BH-1123		II	I	I	IV	V	III														
BH-1124	I	I	II	V	V	V	II														
BH-1125		V	II																		
BH-1125A		II	V	V	IV	V	II	II													
BH-1126		V	III	II	II	IV	IV	II													
BH-1127				III	IV	V	II	III	III												
BH-1151III	V	I	I	I	I																
BH-1152II	I	I	II	I																	
BH-1205	I	I	I	I	I	I															
BH-1206	I	I	I	I	I	I															
BH-1207I	I	I	I	I	I																
BH-1208																					
I I	II	II	I	I	I																
BH-1209II	IV	II	I	I	I	I															
BH-1210I	I	I	I	I	I																
BH-1211																					
V V	I	I	I																		
BH-1212	I	I	I	I																	
BH-1213I	I	I	I	I	I																
BH-1214II	I	I	I	I																	
BH-1215	II	I	I	I																	

	SECTION STARTING (mPD)																		
BOREHOLE	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115	-120
BH-1216V	I	I	I	I																	
BH-1222		IV	I	I	I	I	I	I													
BH-1223			II	II	I	I	I	I													
BH-1224	I	I	I	I	I	I	I														
BH-1225	I	I	I	V	V	II															
BH-1226	V	III	V	IV	I	I															
BH-1227		II	V	III	IV	V	IV	I													
BH-1251I	V	III	V	V	V	V															
BH-1252	I	I	I	I	I	I															
BH-1306I	I	I	I	I	I																
BH-1307I	I	I	I	I	I																
BH-1308	II	V	I	I	I	I															
BH-1309V	IV	II	I	I	I																
BH-1310V	III	I	I	V	V																
BH-1311	IV	III	I	I	I	I															
BH-1312	V	IV	I	III	V	I															
BH-1313	II	I	I	I	I	I	I														
BH-1314	II	I	I	I	I	I															
BH-1315III	I	I	I	I	I	I															
BH-1316II	I	I	I	I																	
BH-1322		V	II	II	II	I	I	I													
BH-1323	I	I	I	I	I	I	I														
BH-1324I	I	II	I	II	I	I															
BH-1325I	I	II	II	V	III																
BH-1326	V	V	IV	I	I	I															
BH-1327			I	I	II	V	IV	I													
BH-1420I	I	I	I	I	I	I															
BH-1421I	I	I	I	II	I	I															
BH-1422	IV	I	I	II	I	III	II														
BH-1423	I	I	II	II	II	I	I														
BH-1424I	I	I	I	I	I	I															
BH-1425I	I	II	III	II	I																
BH-1426I	I	I	III	I	I	I															
BH-1427	V	I	I	I	I	I	I														
BH-1520	I	I	I	II	II	II															
BH-1521	I	I	I	I	III	III	I														
BH-1522	I	I	II	II	I	I															
BH-1523I	I	I	I	I	I	I															
BH-1524I	I	I	I	II	I																
BH-1525	I	I	I	I	I	I															
BH-1621	III	I	I	I	II	I															
BH-1622I	I	I	I	I	II	II															
BH-1623	I	I	II	I	I	I															
BH-1624I	I	I	I	I	I	I															
BH-1625	II	II	I	II	I	I															
BH-1626		I	I	I	I	I	I														
BH-1721	I	I	II	I	I	III															
BH-1722	I	I	I	I	I	I	I														
BH-1723		II	II	I	I	I	I	I													
BH-1724			I	I	I	I	I	I	I												
BH-1725			I	I	I	I	I	I	I												
B'21 IV	III	III	I	I	I																
B'23 V	III	I	I	I	I																
C'20 III	I	I	I	I	I																
C'23	V	III	I	I	I	I															
E'23 V	I	I	I	I	I	I															

LIST OF DRAWINGS

Drawing No.	
GCSP 25/1	Karst Morphology of a Site in the Eastern Part of Yuen Long Town, Horizontal Sections