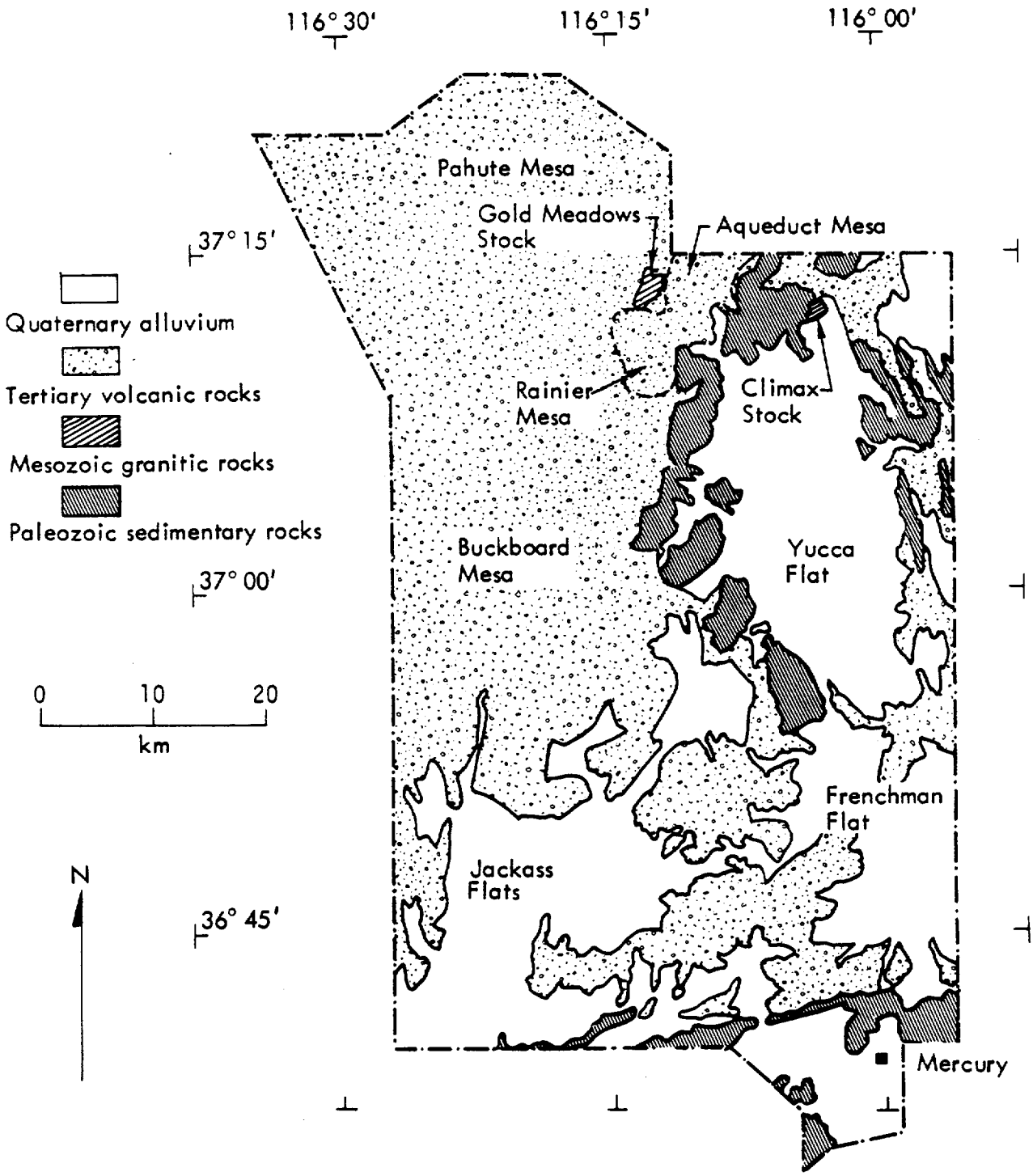


Geologic map of the Nevada Test Site showing location of Rainier Mesa and Aqueduct Mesa. From Murray, 1981.

8908030304

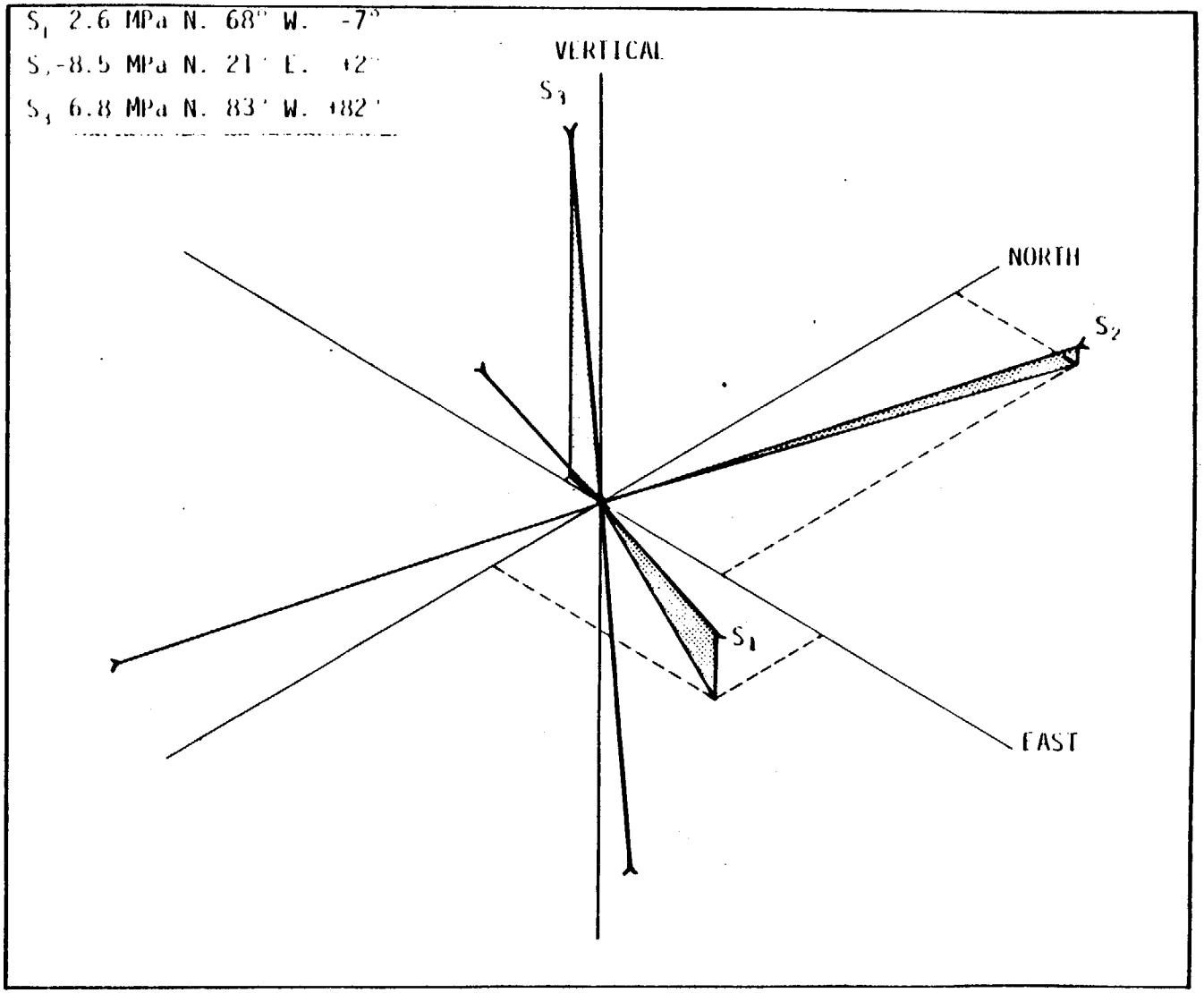
~~8908030303~~ - part 5

Table 1.--State of stress determined in U12g tunnel main drift bypass (USBM overcore method)
[---, not applicable]

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+2.6	±0.4	N. 68° W.	-7°
S_2 (maximum)	+8.5	±0.5	N. 21° E.	+2°
S_3 (intermediate)	+6.8	±0.3	N. 83° W.	+82°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+3.5	±0.3	East	Horizontal
σ_y	+7.7	±0.5	North	Horizontal
σ_z	+6.7	±0.3	---	Vertical
Shear stress components in X, Y, Z coordinate system 1/				
τ_{xy}	+2.0	±0.3	---	---
τ_{yz}	+0.3	±0.3	---	---
τ_{zx}	-0.5	±0.2	---	---

1/ Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12g tunnel, main drift bypass. Rainier Mesa. From Ellis and Magner, 1980.



Graphical representation of principal stresses. U12g tunnel, main drift bypass. Rainier Mesa. From Ellis and Magner, 1980.

Table 2.--State of stress determined in U12e.06 drift (USBM overcore method)
[---, not applicable]

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+3.7	±0.5	N. 88° E.	-20°
S_2 (maximum)	+6.6	±0.5	N. 51° W.	-64°
S_3 (intermediate)	+4.7	±0.4	N. 4° E.	+16°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+4.0	±0.4	East	Horizontal
σ_y	+4.8	±0.4	North	Horizontal
σ_z	+6.1	±0.5	---	Vertical
Shear stress components in X, Y, Z coordinate system 1/				
τ_{xy}	-0.2	±0.3	---	---
τ_{yz}	-0.5	±0.3	---	---
τ_{zx}	+0.9	±0.4	---	---

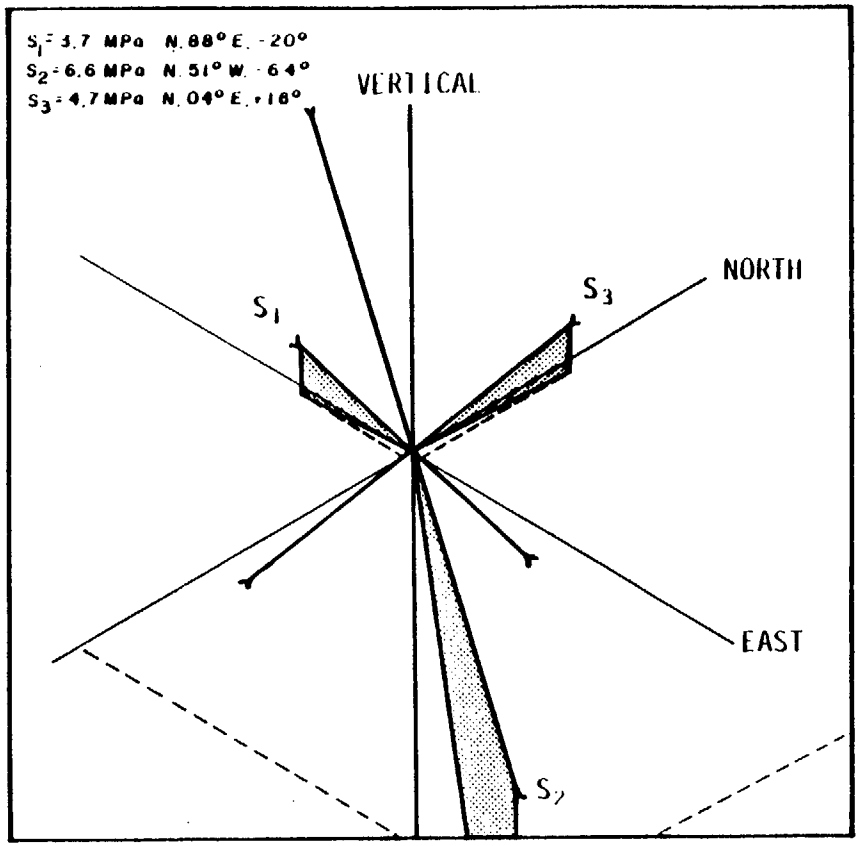
1/ Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12e.06 drift. Rainier Mesa. From Ellis and Magner, 1980.

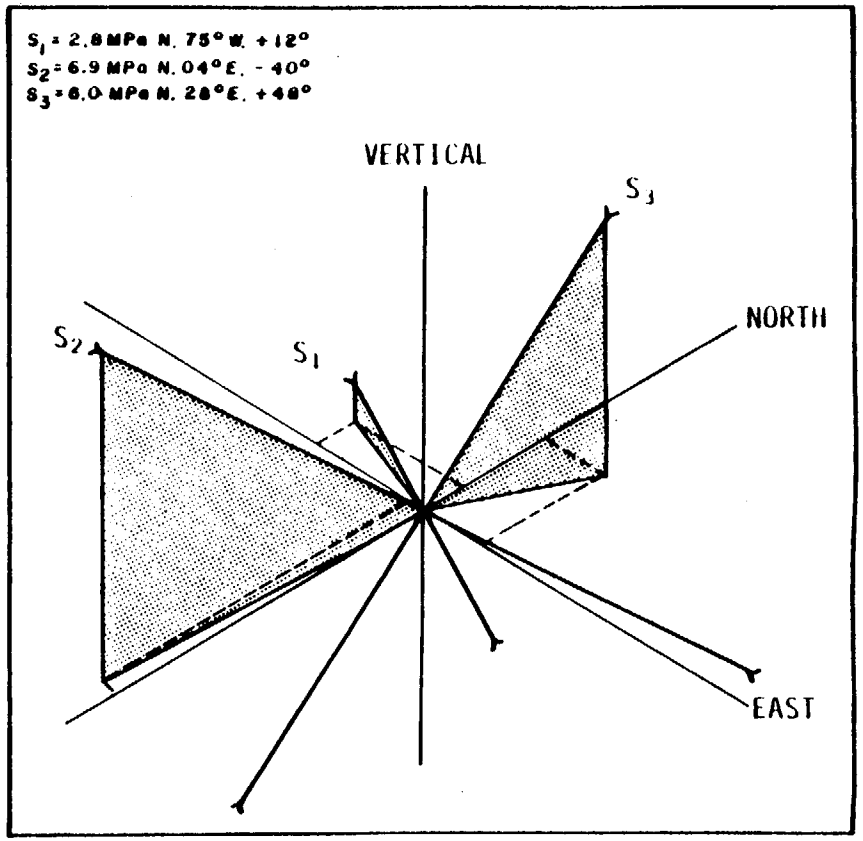
	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+2.8	±0.4	N. 75° W.	+12°
S_2 (maximum)	+6.9	±0.4	N. 4° E.	-40°
S_3 (intermediate)	+6.0	±0.4	N. 28° E.	+48°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+3.1	±0.4	East	Horizontal
σ_y	+6.3	±0.4	North	Horizontal
σ_z	+6.2	±0.3	---	Vertical
Shear stress components in X, Y, Z coordinate system[1/]				
τ_{xy}	+0.8	±0.3	---	---
τ_{yz}	-0.6	±0.3	---	---
τ_{zx}	+0.6	±0.3	---	---

[1/] Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12e.18 working point. Rainier Mesa. From Ellis and Magner, 1980.



U12e.06 drift



U12e.18 working point

Graphical representation of principal stresses. U12e tunnel complex. From Ellis and Magner, 1980.

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+2.4	±0.9	N. 44° W.	-2°
S_2 (maximum)	+8.5	±0.5	N. 47° E.	-20°
S_3 (intermediate)	+5.6	±0.4	N. 42° E.	+70°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+5.4	±1.0	East	Horizontal
σ_y	+5.2	±0.4	North	Horizontal
σ_z	+6.0	±0.4	---	Vertical
Shear stress components in X, Y, Z coordinate system[1/]				
τ_{xy}	+2.9	±0.5	---	---
τ_{yz}	-0.6	±0.3	---	---
τ_{zx}	-0.7	±0.5	---	---

[1/] Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12n.07 drift. Rainier Mesa. From Ellis and Magner, 1980.

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+1.4	±0.5	N. 49° W.	+22°
S_2 (maximum)	+11.7	±0.8	N. 59° E.	+37°
S_3 (intermediate)	+5.8	±0.4	N. 18° E.	-45°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+6.4	±0.5	East	Horizontal
σ_y	+5.1	±0.3	North	Horizontal
σ_z	+7.4	±0.3	---	Vertical
Shear stress components in X, Y, Z coordinate system[1/]				
τ_{xy}	+3.5	±0.3	---	---
τ_{yz}	+0.5	±0.2	---	---
τ_{zx}	+3.6	±0.8	---	---

1/ Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12n.10 working point. Rainier Mesa. From Ellis and Magner, 1980.

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+5.7	±0.7	N. 59° W.	+50°
S_2 (maximum)	+8.6	±0.4	N. 53° E.	+17°
S_3 (intermediate)	+6.2	±0.4	N. 25° W.	-34°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+7.4	±0.7	East	Horizontal
σ_y	+6.9	±0.7	North	Horizontal
σ_z	+6.1	±0.4	---	Vertical
Shear stress components in X, Y, Z coordinate system 1/				
τ_{xy}	+1.1	±0.4	---	---
τ_{yz}	+0.3	±0.4	---	---
τ_{zx}	+0.8	±0.4	---	---

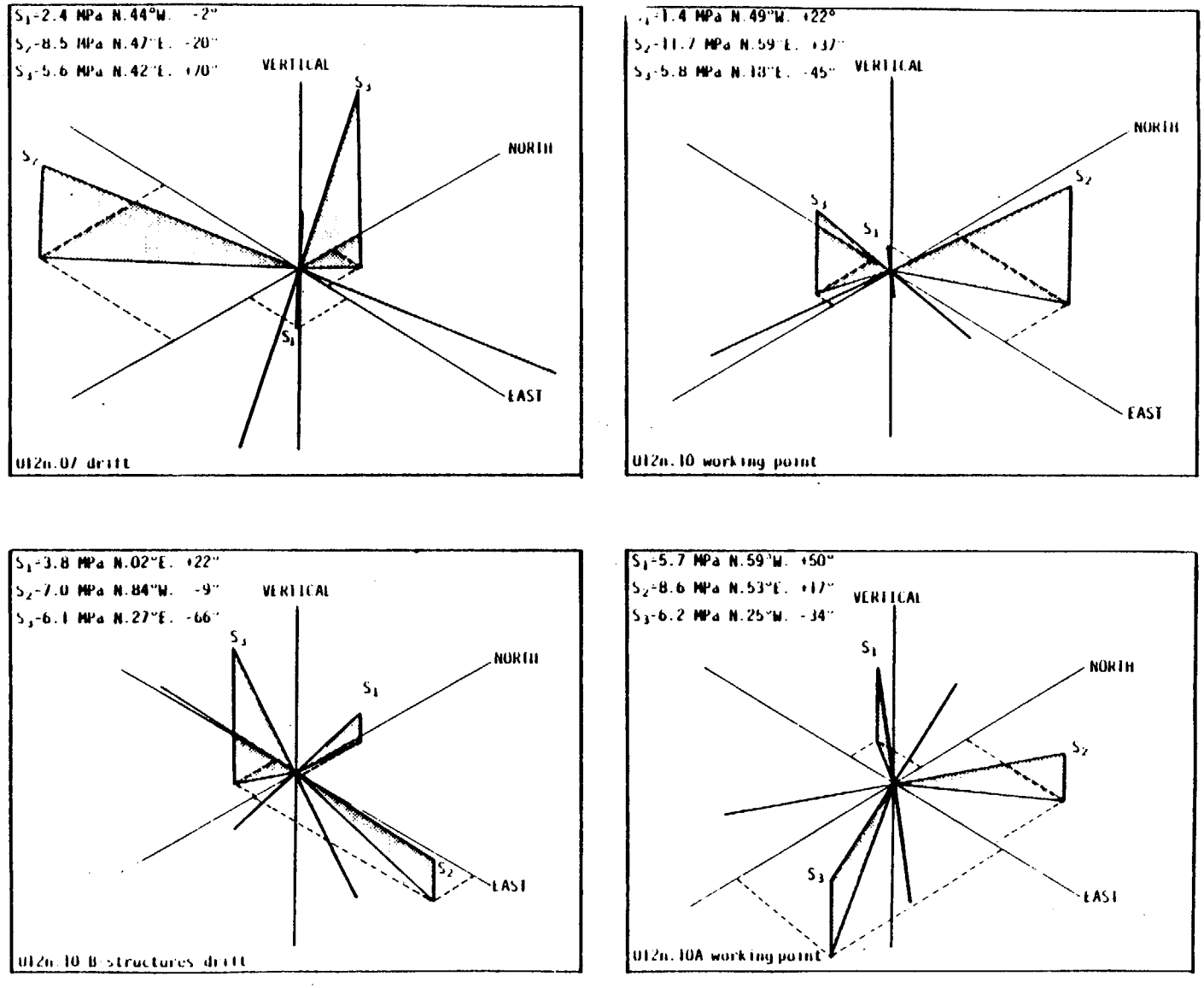
1/ Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12n.10A working point. Rainier Mesa. From Ellis and Magner, 1980.

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+3.8	±0.7	N. 2° E.	+22°
S_2 (maximum)	+7.0	±1.0	N. 84° W.	-9°
S_3 (intermediate)	+6.1	±0.7	N. 27° E.	-66°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+7.0	±1.0	East	Horizontal
σ_y	+4.1	±0.7	North	Horizontal
σ_z	+5.8	±0.6	---	Vertical
Shear stress components in X, Y, Z coordinate system 1/				
τ_{xy}	-0.2	±0.8	---	---
τ_{yz}	-0.8	±0.5	---	---
τ_{zx}	+0.1	±0.6	---	---

1/ Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12n.10B structures drift. Rainier Mesa. From Ellis and Magner, 1980.



Graphical representation of principal stress. U12n tunnel complex. Rainier Mesa.

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+2.6	±0.5	N. 62° W.	+3°
S_2 (maximum)	+6.6	±0.5	N. 73° E.	+86°
S_3 (intermediate)	+5.9	±0.4	N. 28° E.	-3°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+3.3	±0.4	East	Horizontal
σ_y	+5.2	±0.4	North	Horizontal
σ_z	+6.6	±0.5	---	Vertical
Shear stress components in X, Y, Z coordinate system 1/				
τ_{xy}	+1.4	±0.3	---	---
τ_{yz}	-0.1	±0.5	---	---
τ_{zx}	+0.2	±0.5	---	---

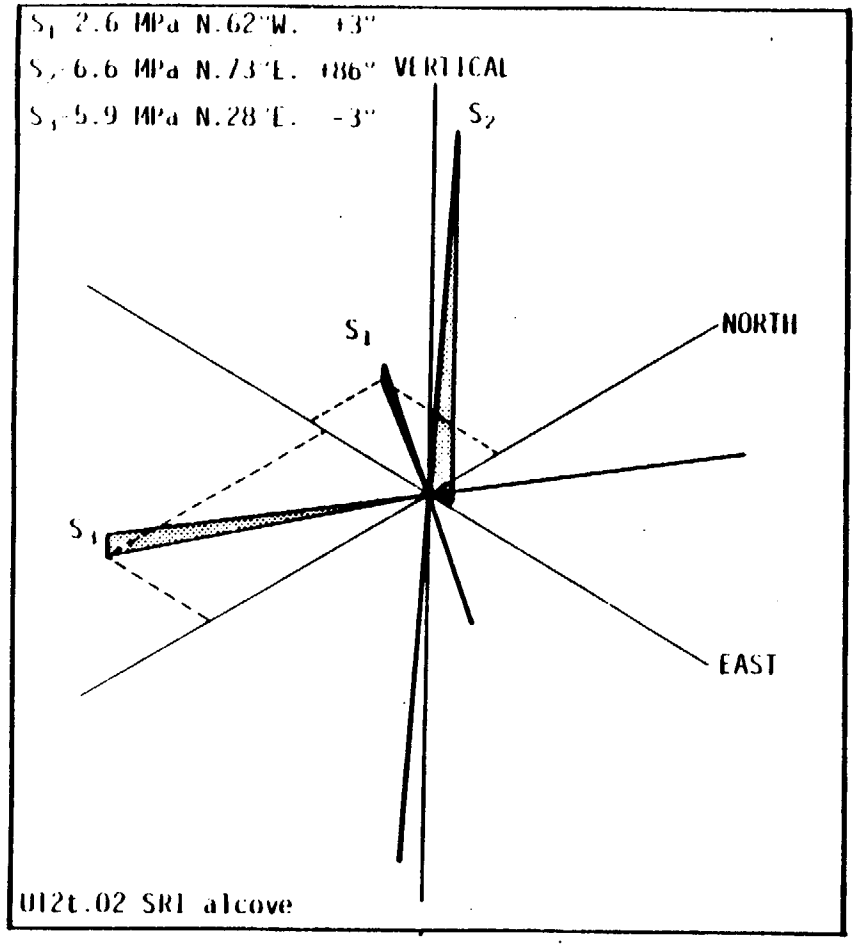
1/ Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

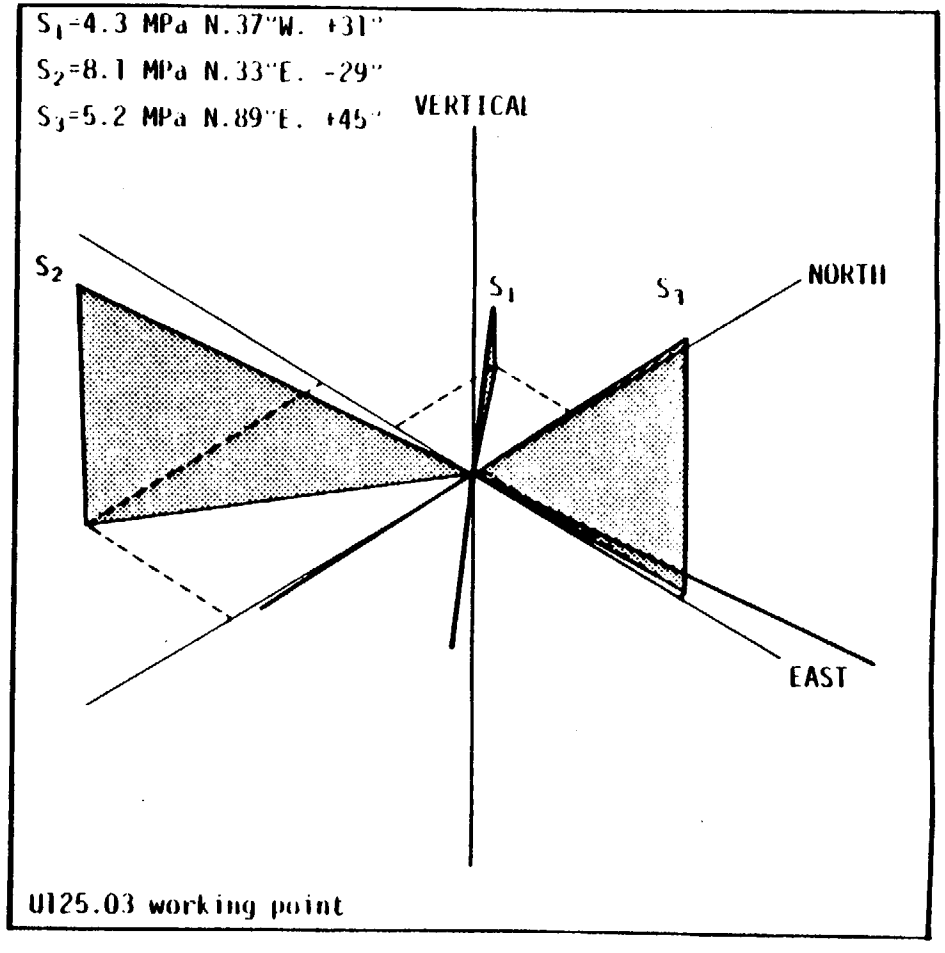
State of in situ stress. U12t.02 SRI alcove. Aqueduct Mesa. From Ellis and Magner, 1980.

	Stress magnitude	Standard deviation	Bearing	Inclination
	MPa	MPa		+ degrees above horizontal - degrees below horizontal
Principal stresses				
	(+, compression)			
S_1 (minimum)	+4.3	±1.0	N. 37° W.	+31°
S_2 (maximum)	+8.1	±0.8	N. 33° E.	-29°
S_3 (intermediate)	+5.2	±0.9	N. 89° E.	+45°
Normal stress components in X, Y, Z (east, north, vertical) coordinate system				
	(+, compression)			
σ_x	+5.6	±0.8	East	Horizontal
σ_y	+6.3	±0.8	North	Horizontal
σ_z	+5.6	±0.8	---	Vertical
Shear stress components in X, Y, Z coordinate system[1/]				
τ_{xy}	+1.3	±0.5	---	---
τ_{yz}	-1.4	±0.7	---	---
τ_{zx}	-0.4	±0.6	---	---

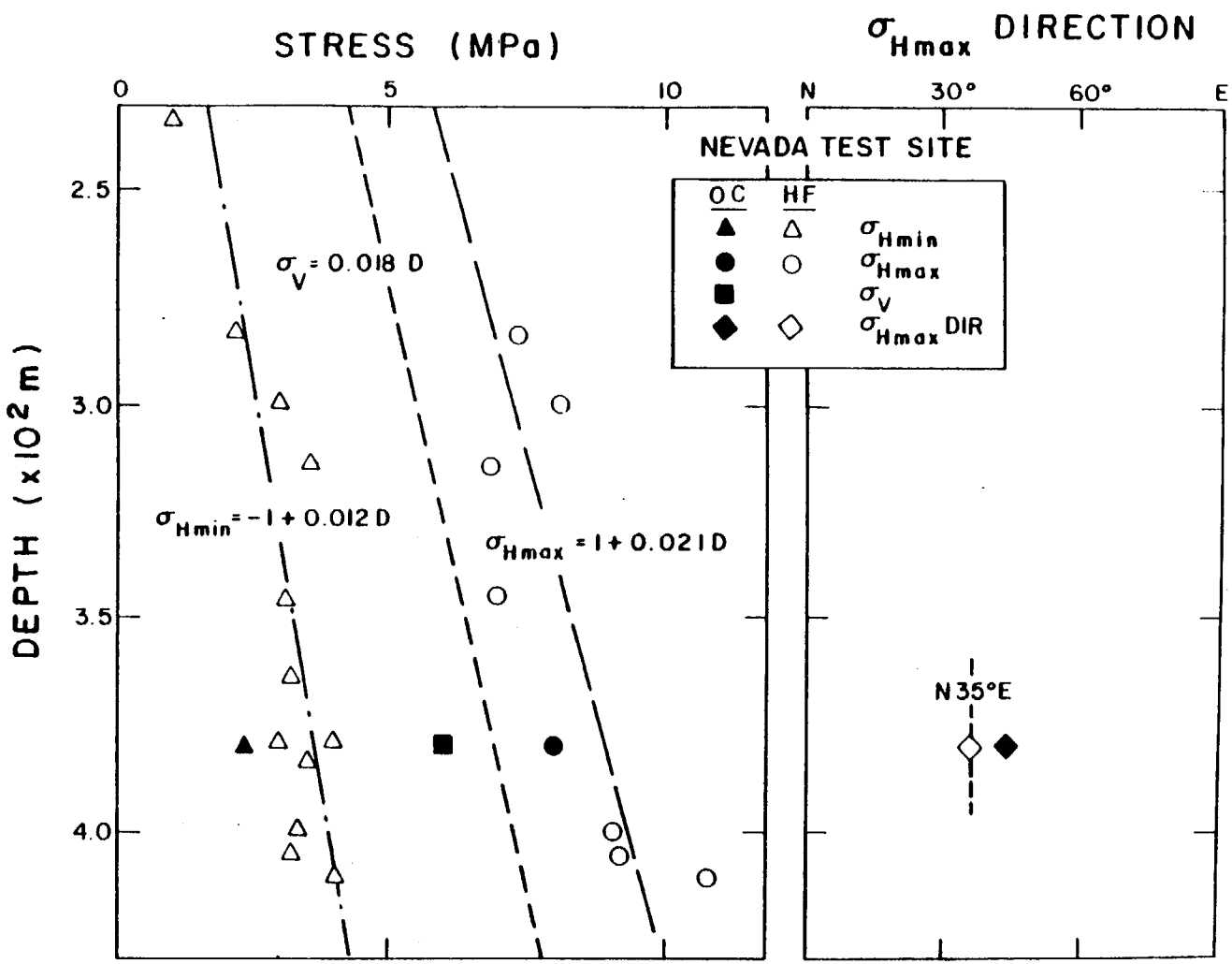
[1/] Positive or negative sign on shear stress magnitude indicates direction of shear stress with respect to X, Y, Z coordinate system.

State of in situ stress. U12t.03 working point. Aqueduct Mesa. From Ellis and Magner, 1980.





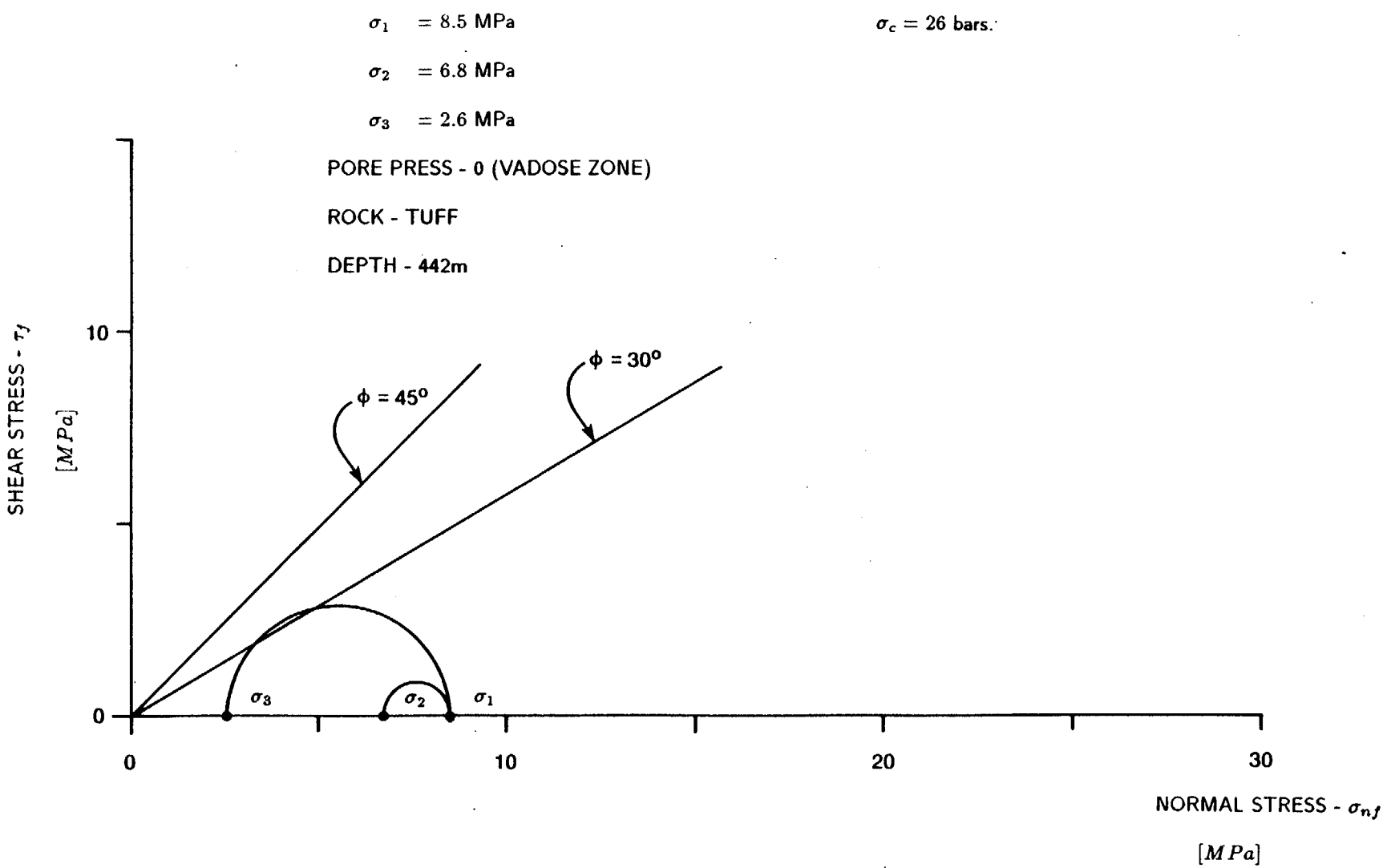
Graphical representation of principal stresses. U12t tunnel complex. Aqueduct Mesa. From Ellis and Magner, 1980.



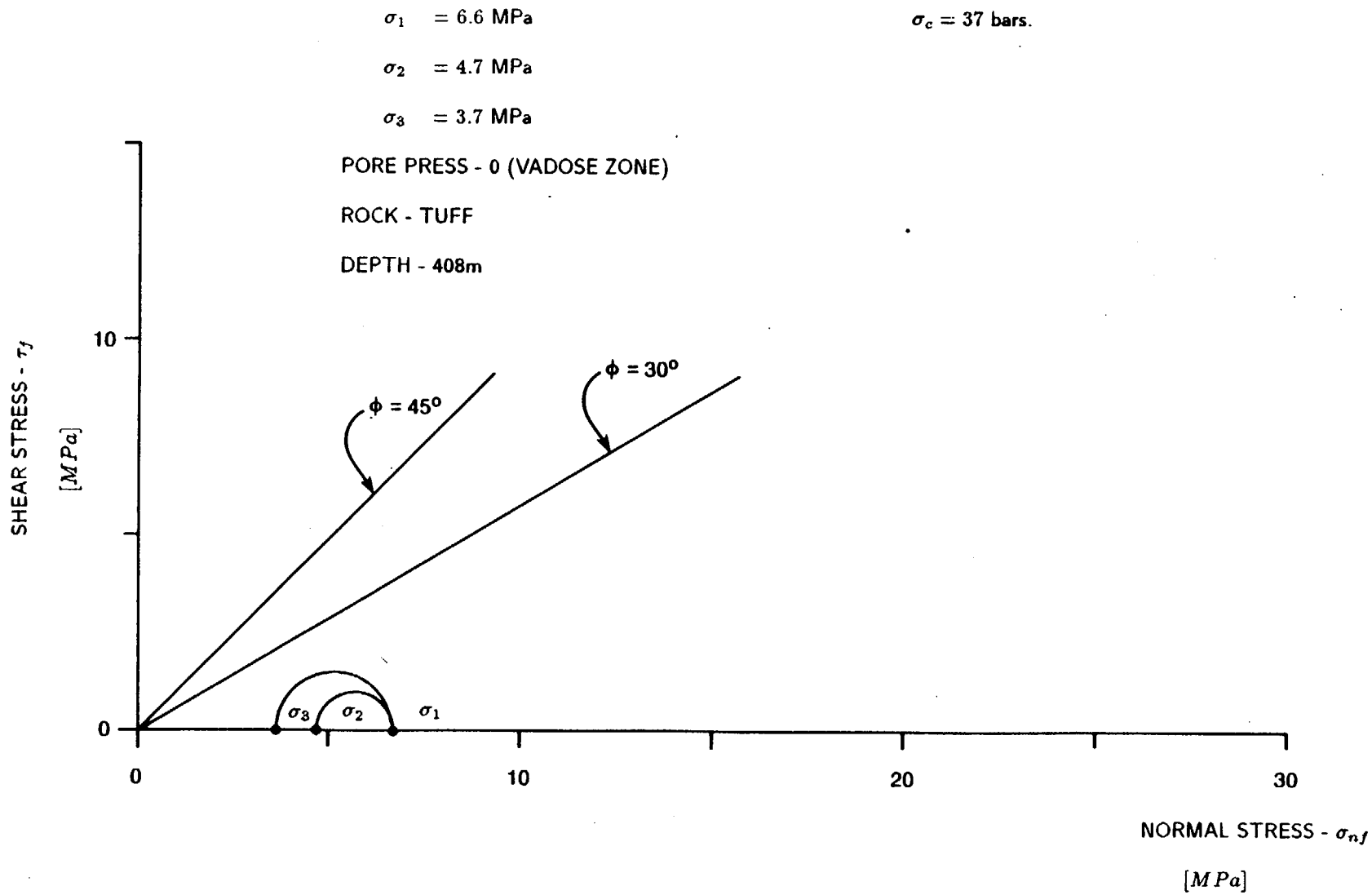
State of in situ stress. U12n tunnel. Rainier Mesa. From Haimson, 1983.

LOCATION	DEPTH [m] BELOW LAND SURFACE	$\sigma_{hor.min.}$ [MPa]	σ_{ver} [MPa]	$\sigma_{hor.max.}$ [MPa]
U12n Tunnel	232	1.0	4.3	5.8
U12n Tunnel	284	2.2	5.2	7.4
U12n Tunnel	300	3.0	5.4	8.2
U12n Tunnel	314	3.6	5.8	6.9
U12n Tunnel	346	3.1	6.3	7.0
U12n Tunnel	364	3.1	6.7	8.7
U12n Tunnel	378	3.0	7.0	9.0
U12n Tunnel	378	4.0	7.0	9.0
U12n Tunnel	380	3.5	7.0	9.0
U12n Tunnel	400	3.4	7.3	9.1
U12n Tunnel	405	3.2	7.5	9.2
U12n Tunnel	410	4.0	7.6	10.7
U12g Tunnel	426	3.0	7.3	7.5

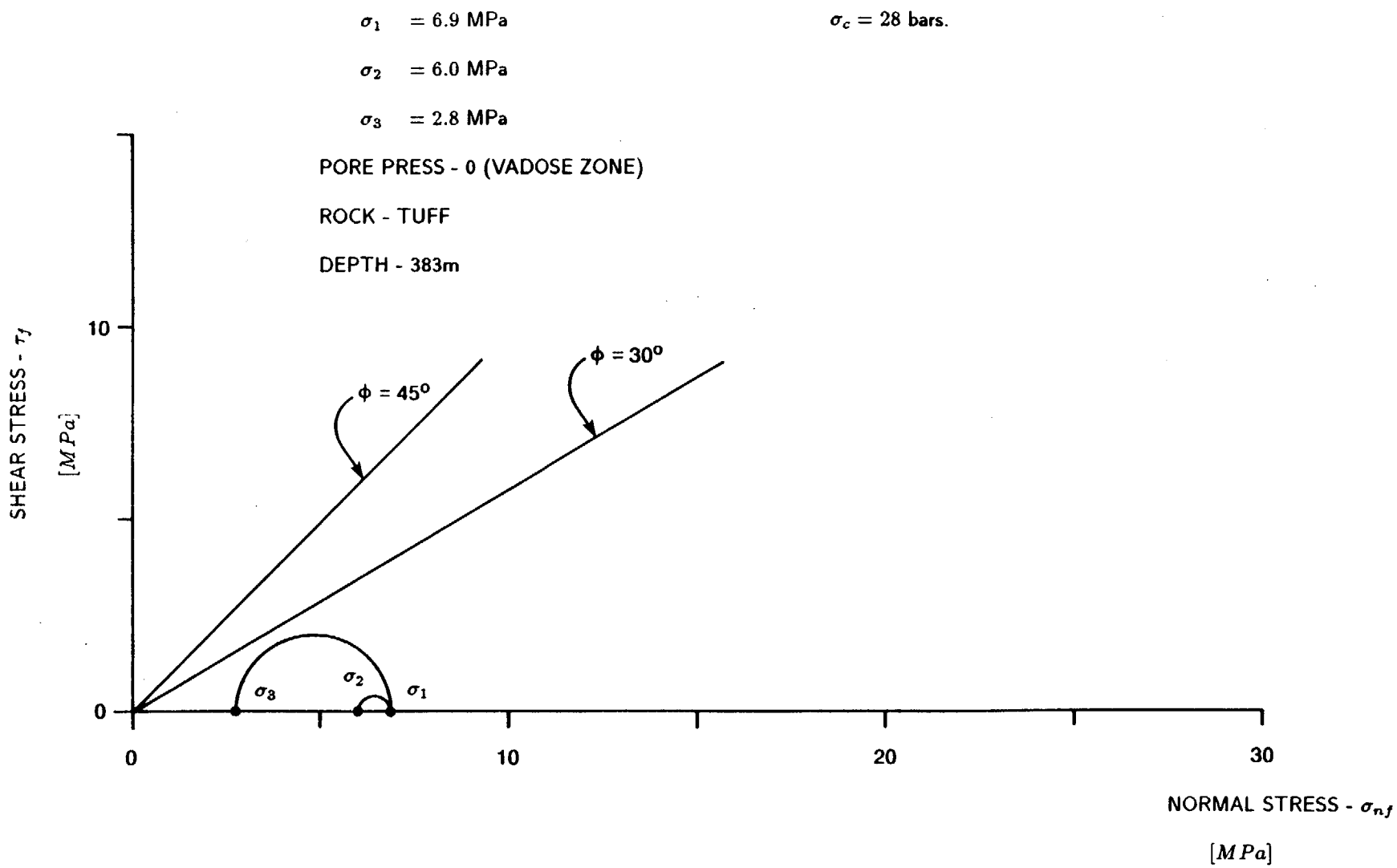
State of in situ stress. U12n and U12g tunnels. Rainier Mesa. From Haimson, 1983.



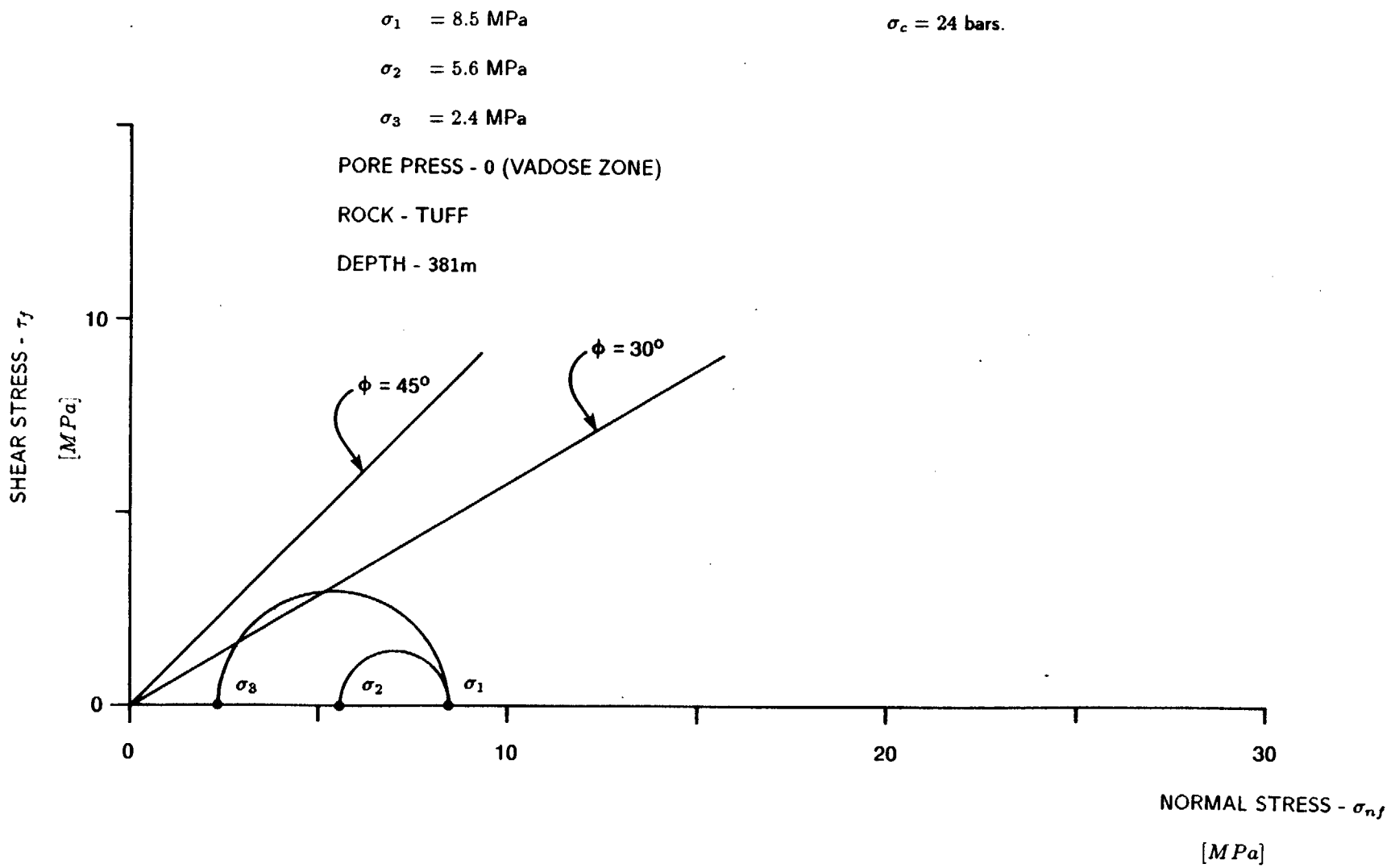
Mohr representation of in situ stress. U12g tunnel, main drift bypass. Rainier Mesa, Aqueduct Mesa.



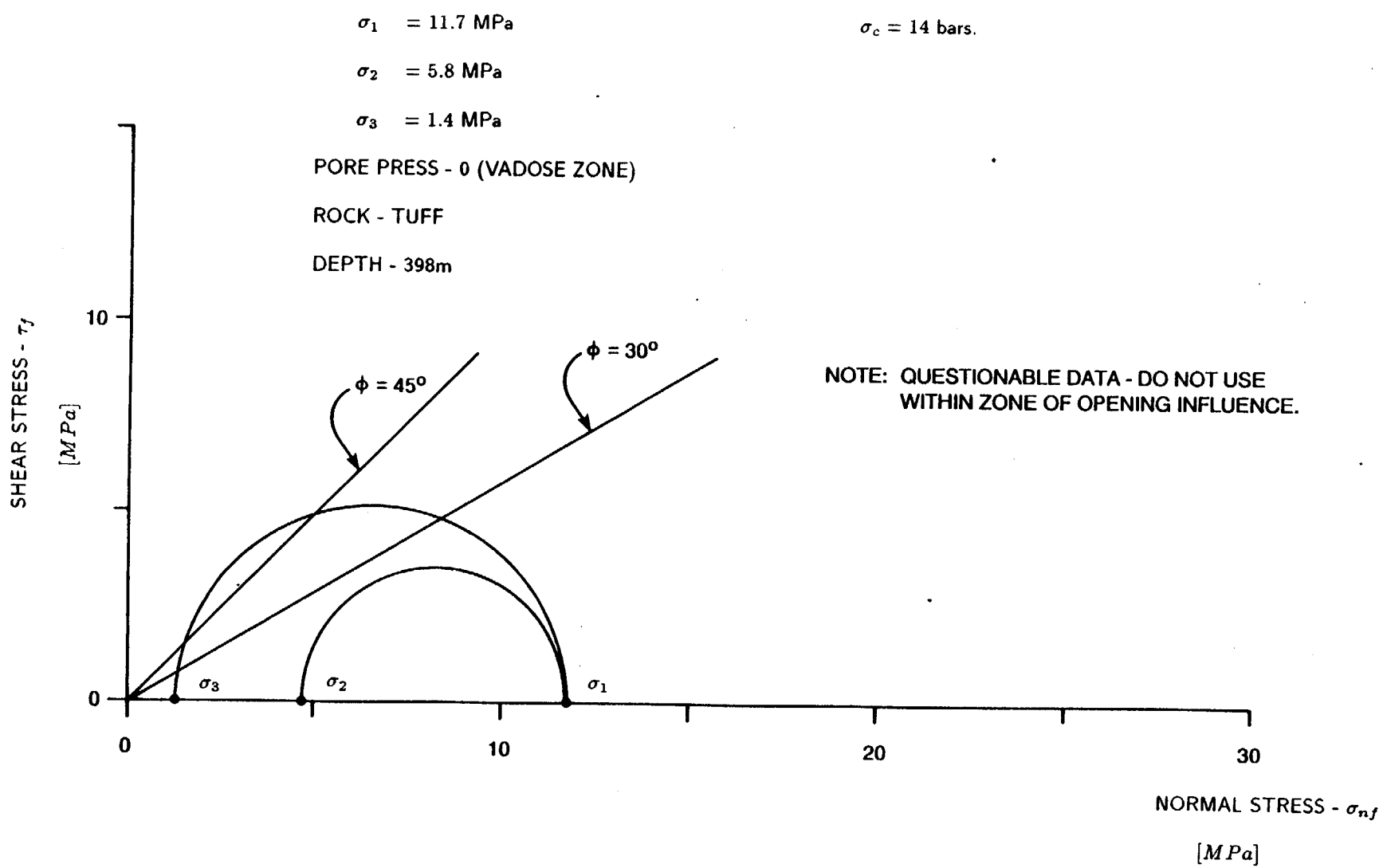
Mohr representation of in situ stress. U12e.06 drift. Rainier Mesa, Aqueduct Mesa.



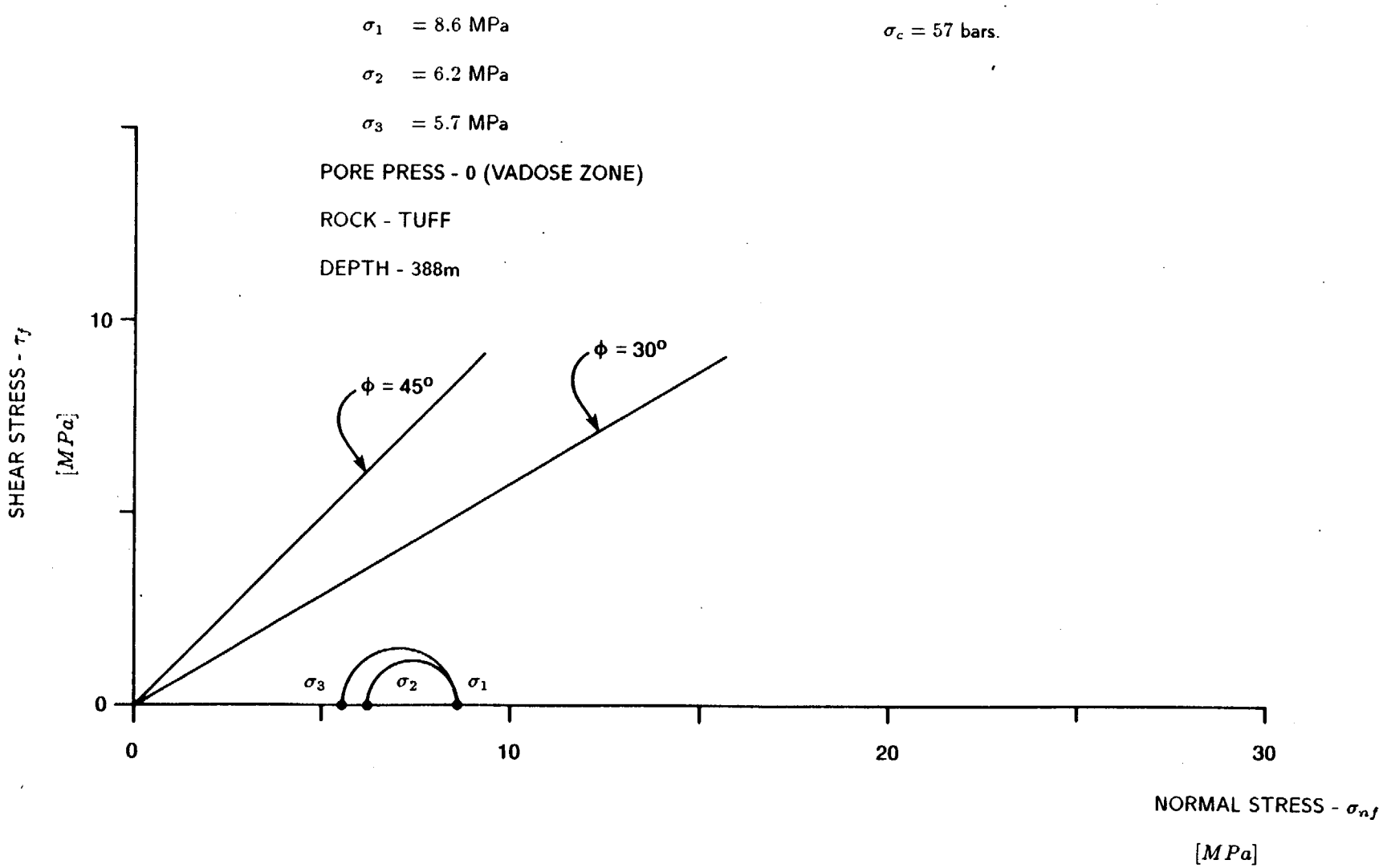
Mohr representation of in situ stress. U12e working point. Rainier Mesa, Aqueduct Mesa.



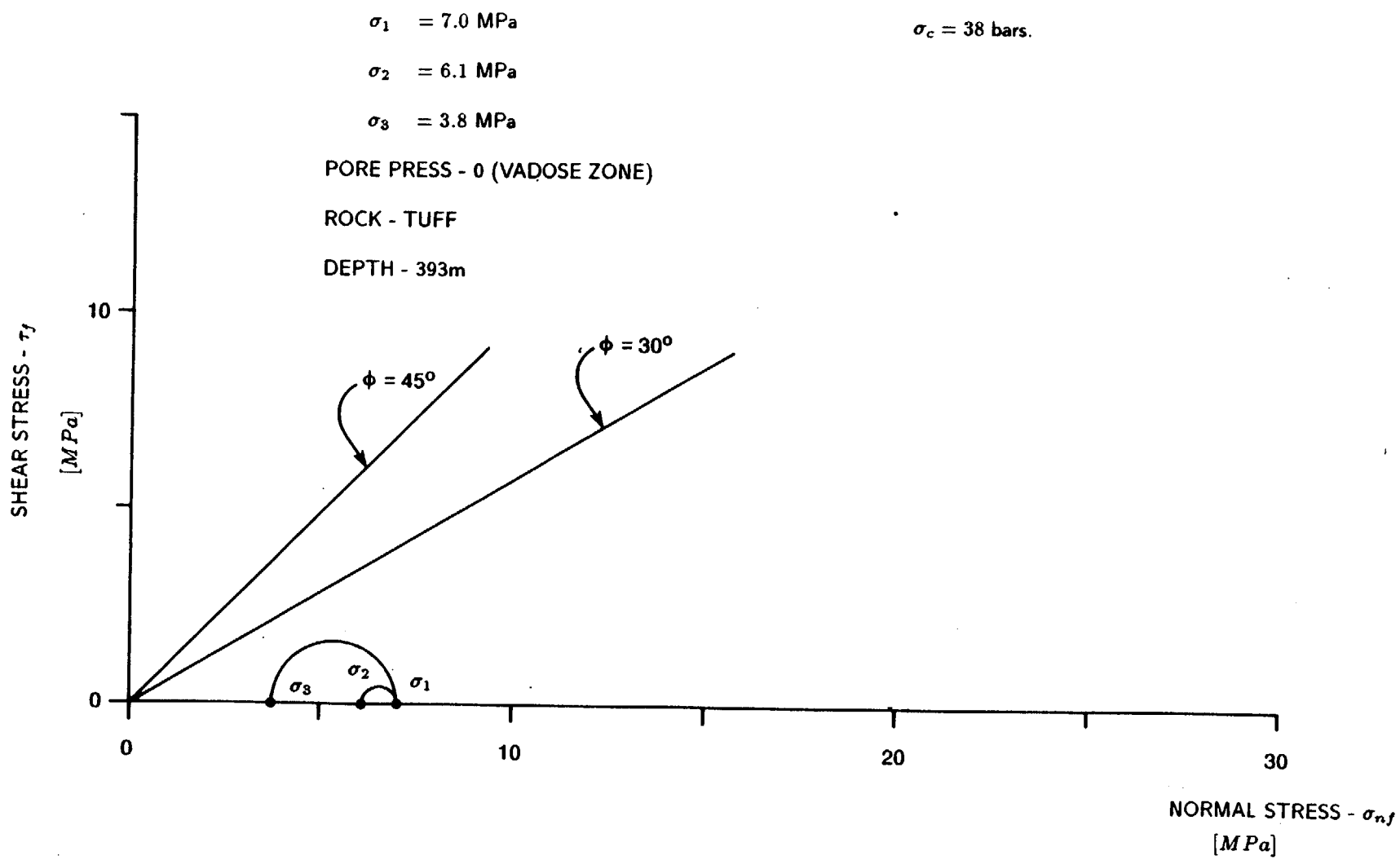
Mohr representation of in situ stress. U12n.07 drift. Rainier Mesa, Aqueduct Mesa.



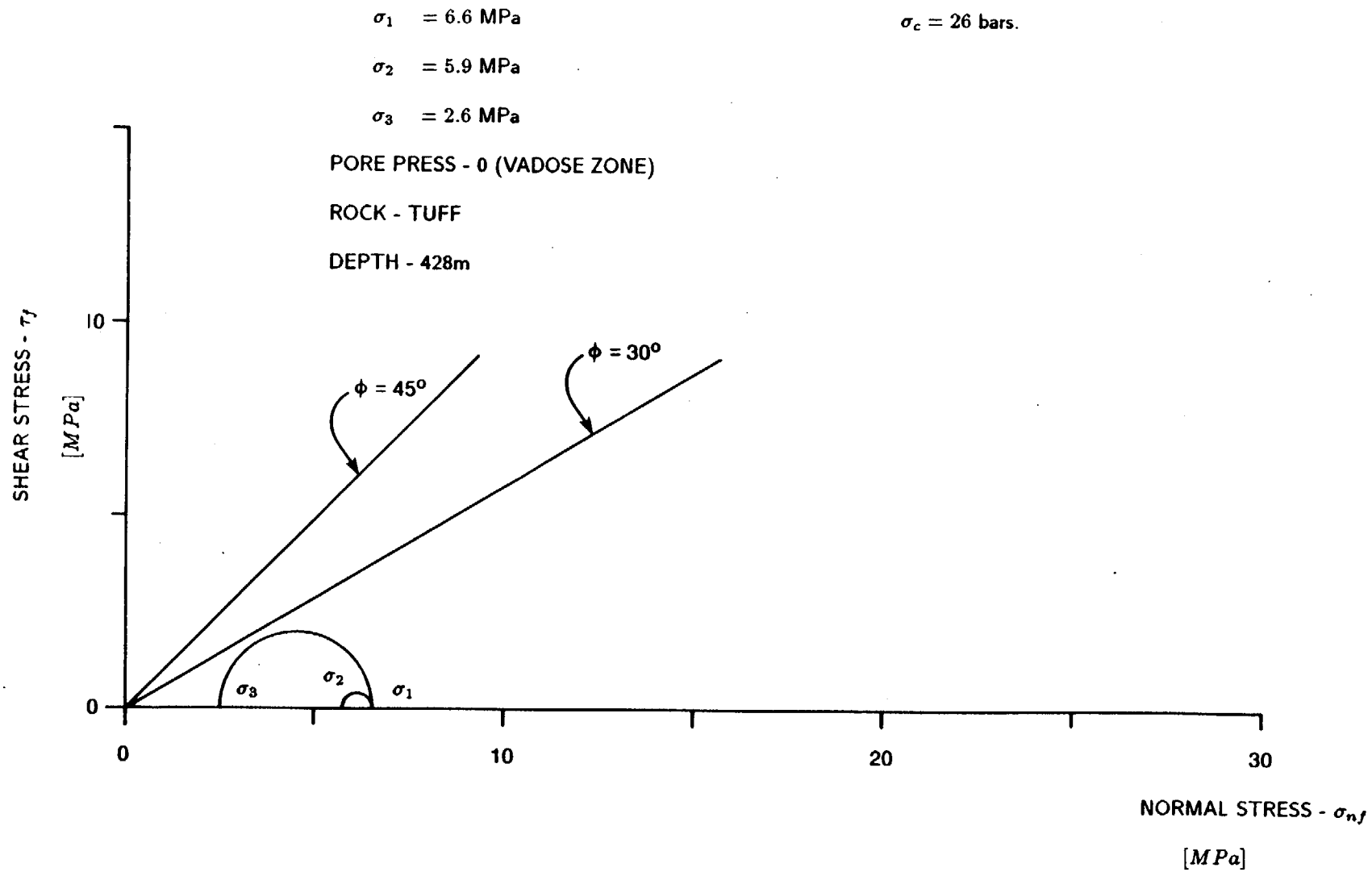
Mohr representation of in situ stress. U12n.10 working point. Rainier Mesa, Aqueduct Mesa.



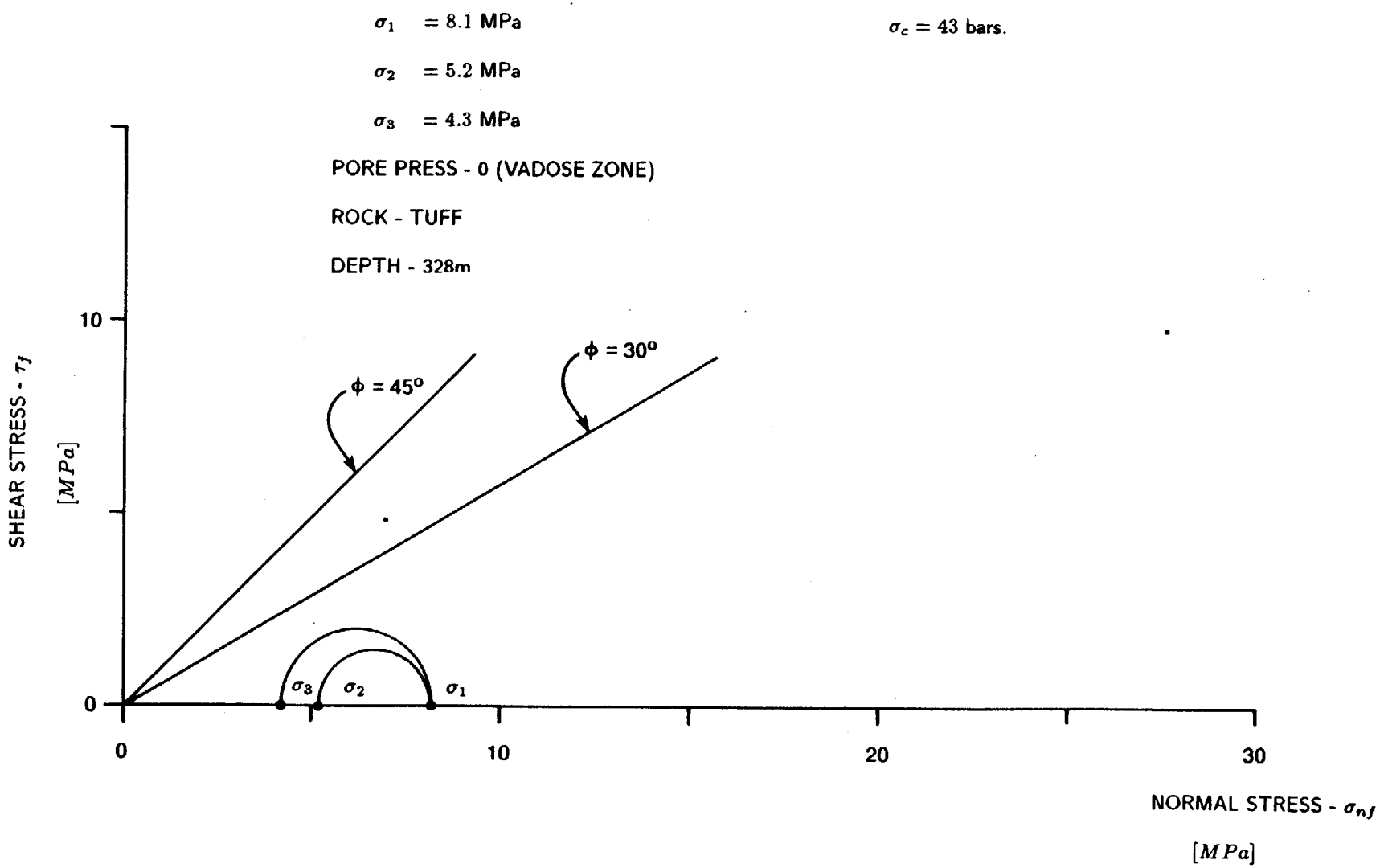
Mohr representation of in situ stress. U12n.10A working point. Rainier Mesa, Aqueduct Mesa.



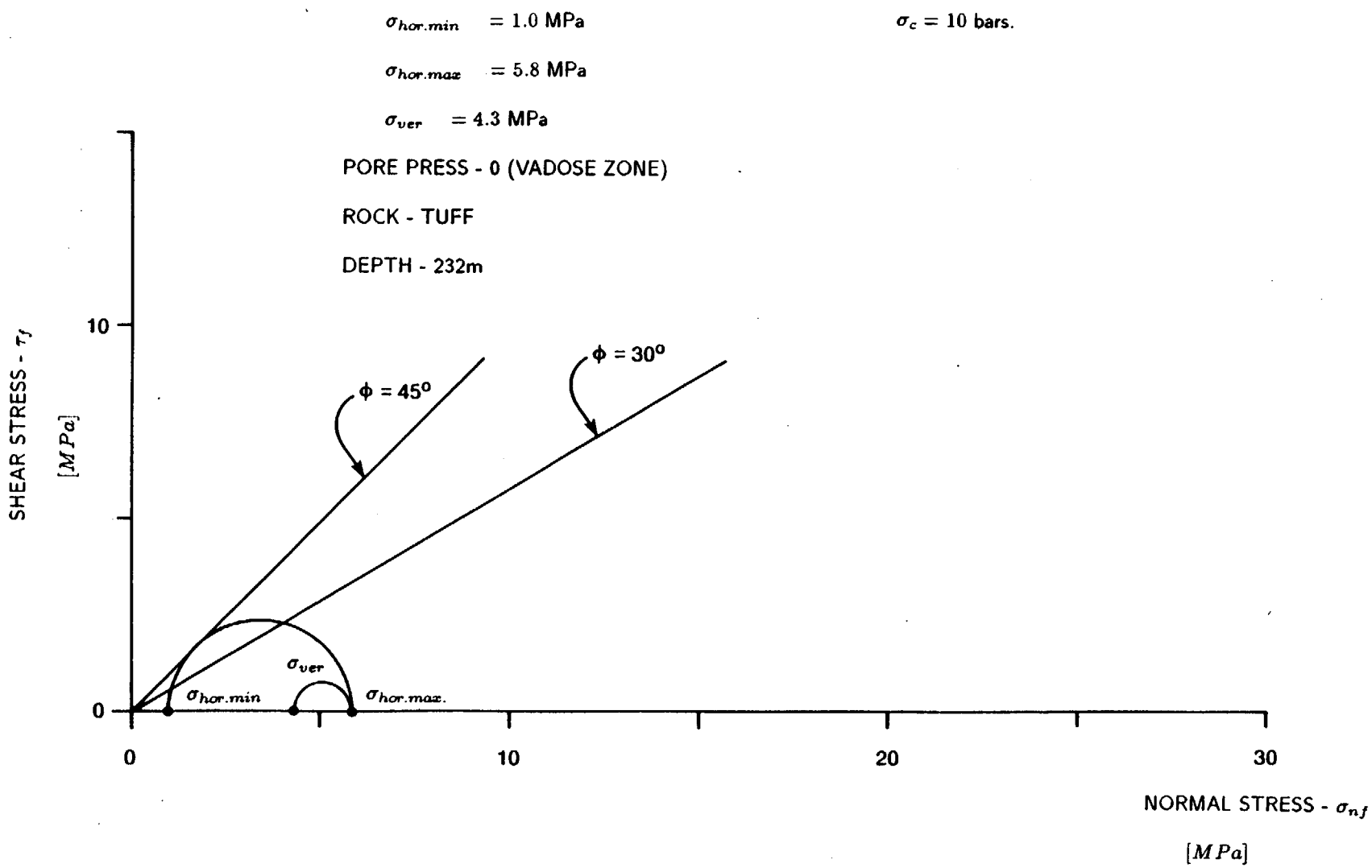
Mohr representation of in situ stress. U12n.10B structures drift. Rainier Mesa, Aqueduct Mesa.



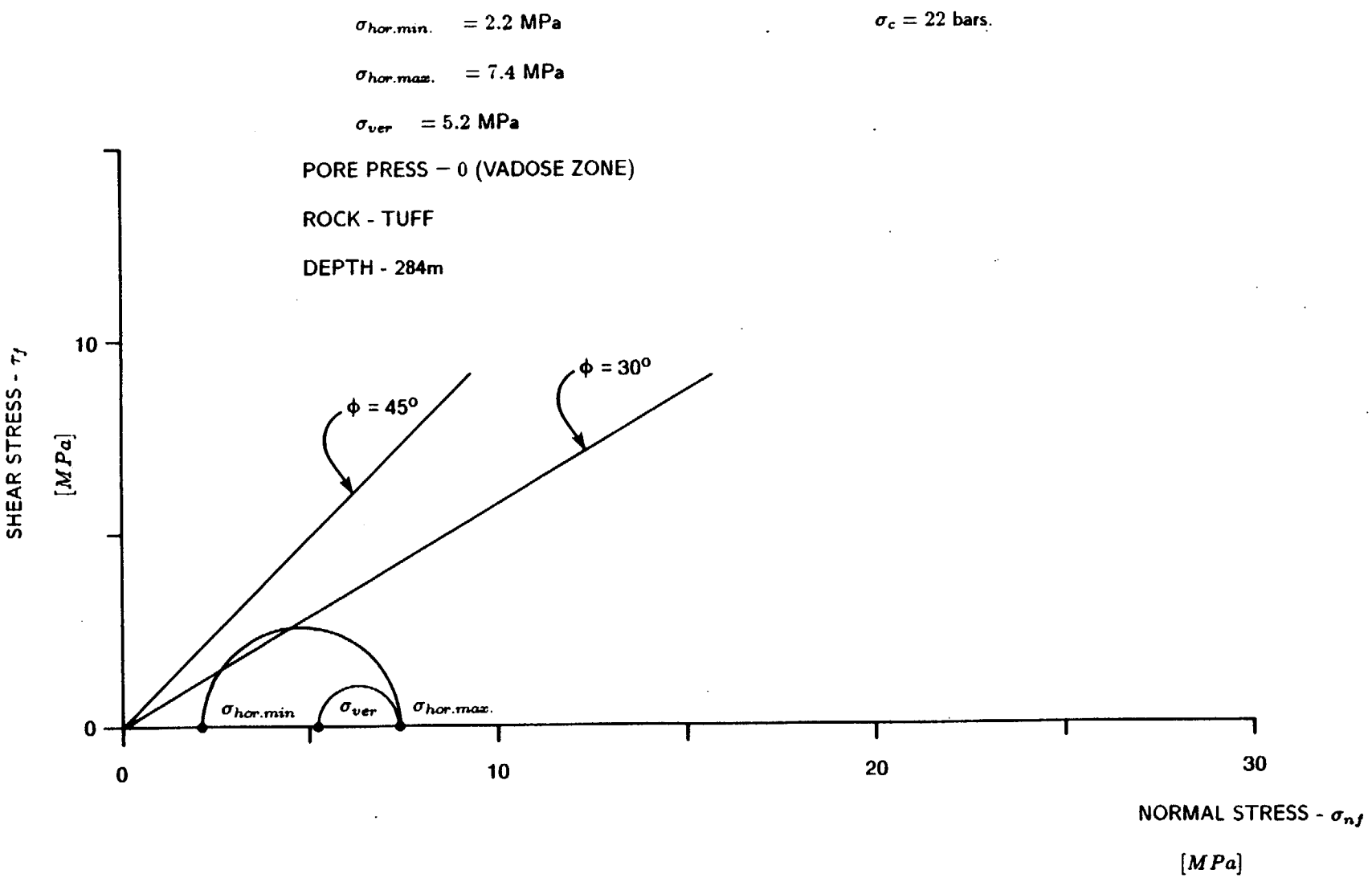
Mohr representation of in situ stress. U12t.02 SRI alcove. Rainier Mesa, Aqueduct Mesa.



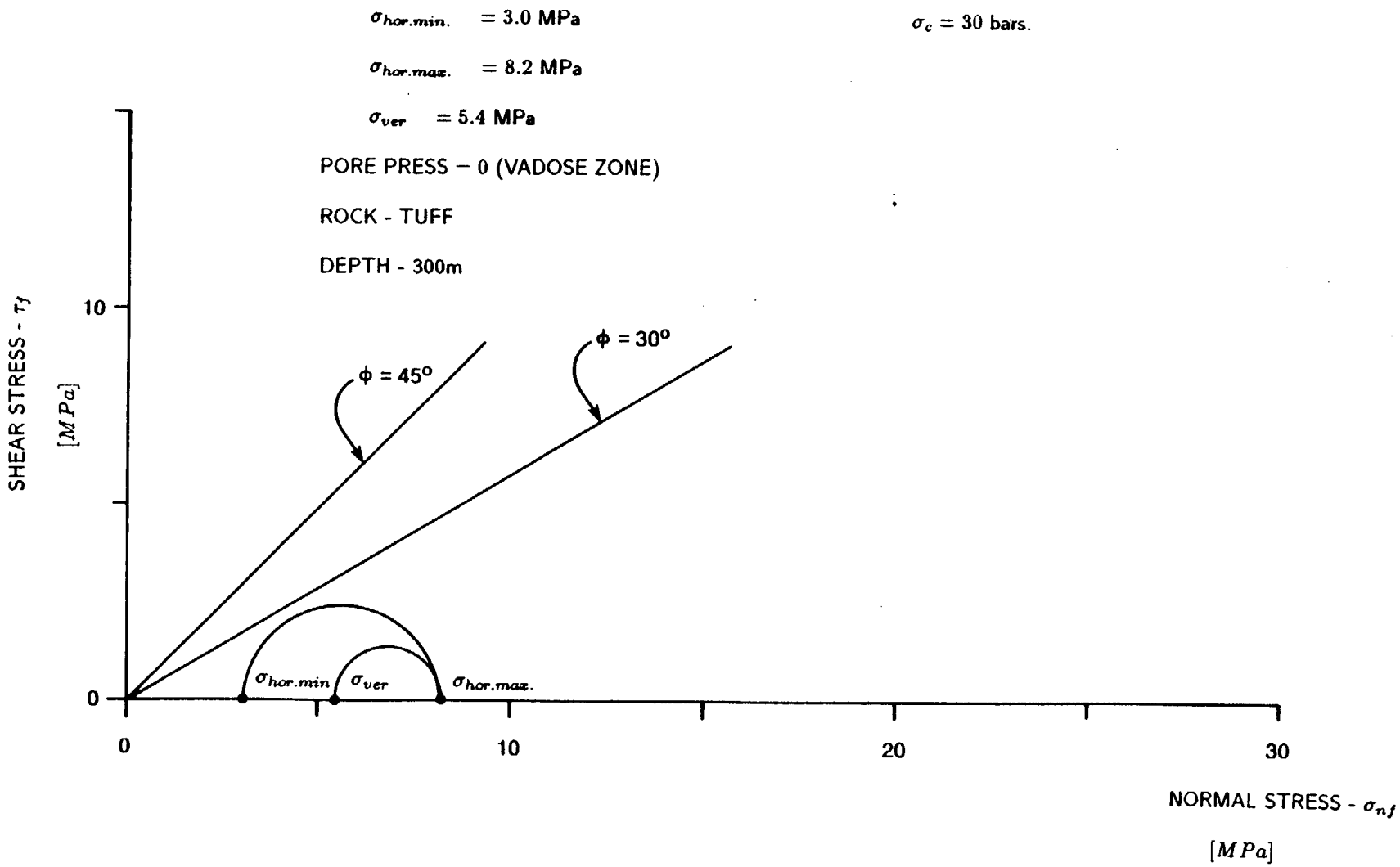
Mohr representation of in situ stress. U12t.03 working point. Rainier Mesa, Aqueduct Mesa.



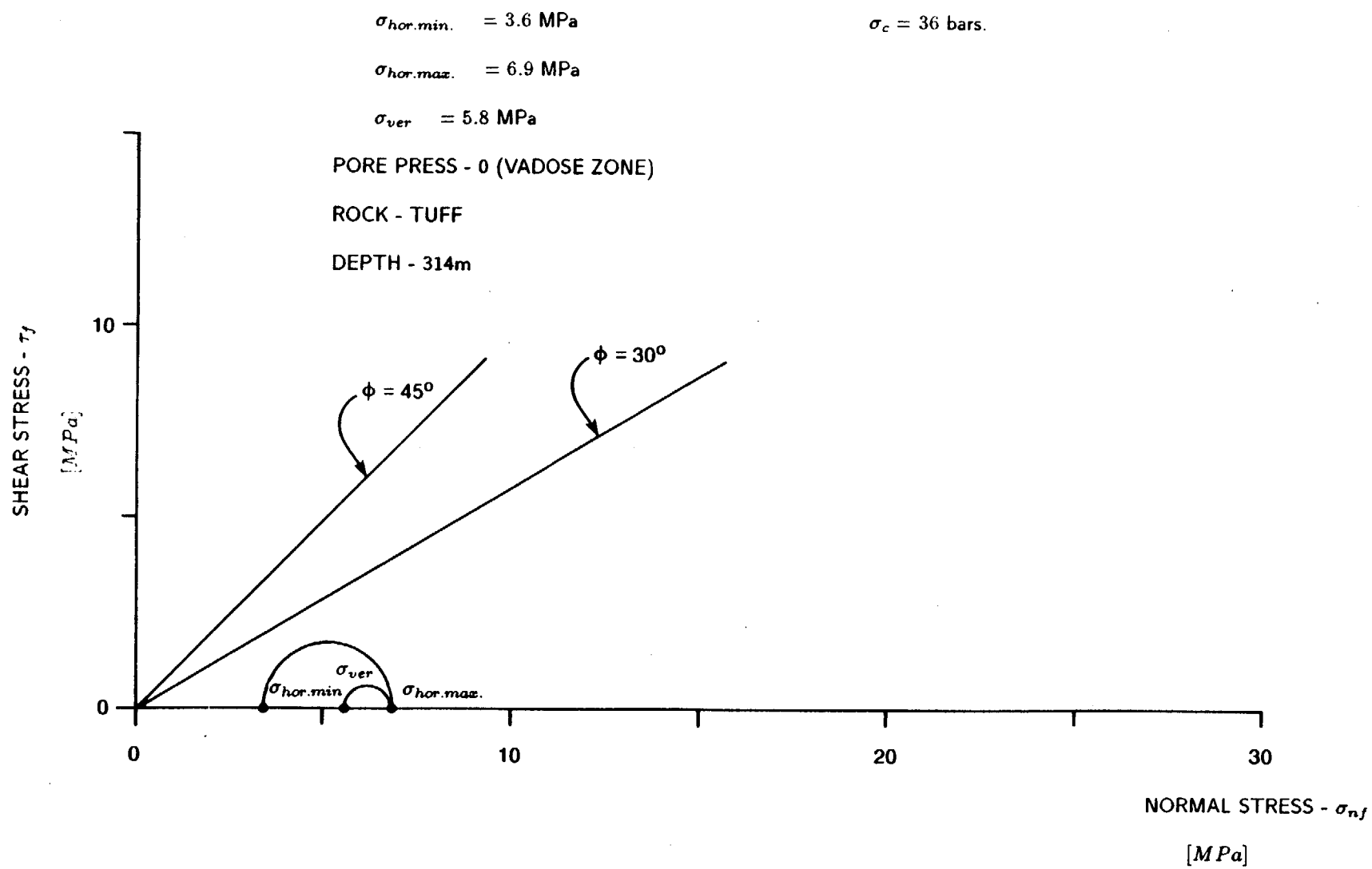
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



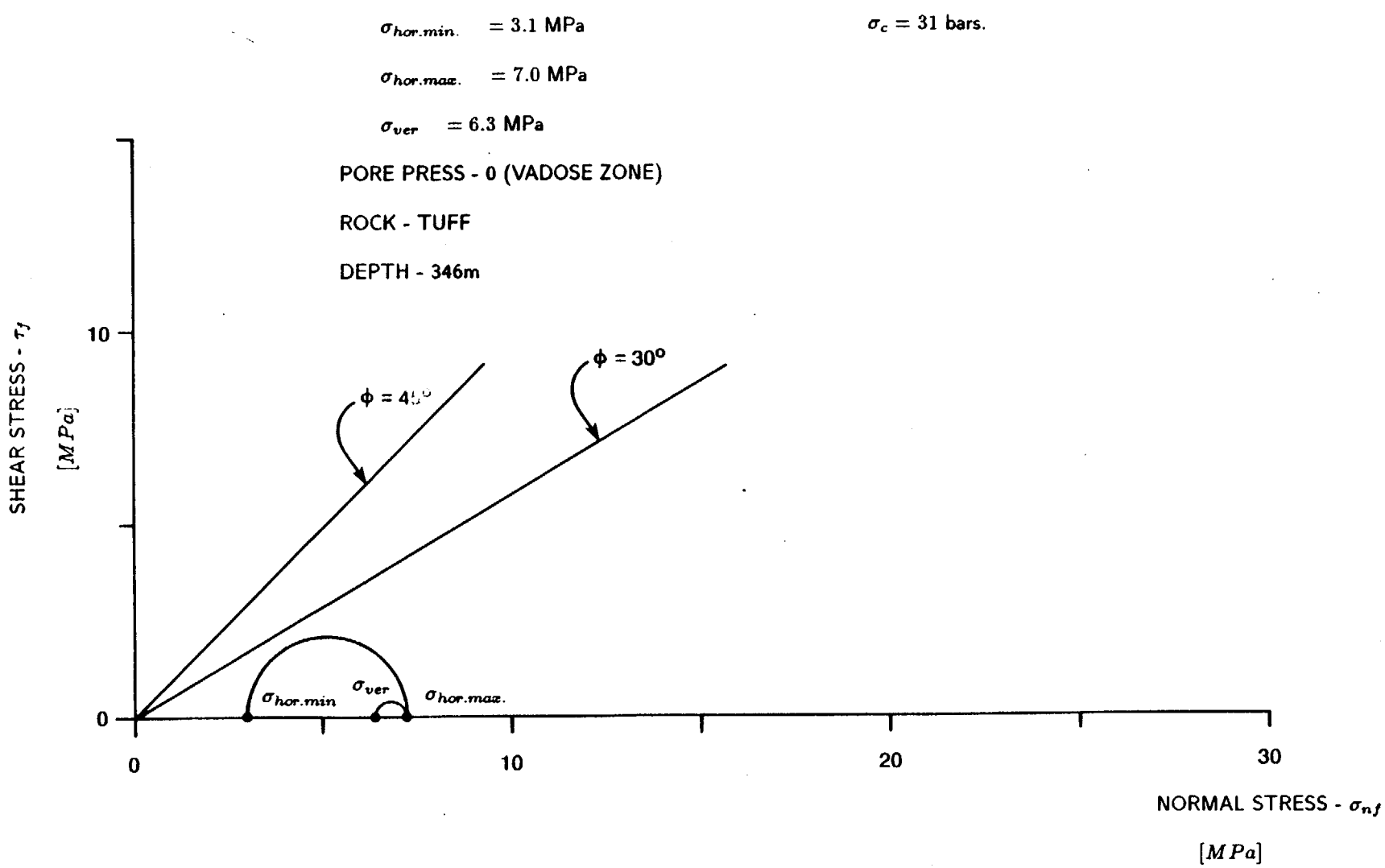
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



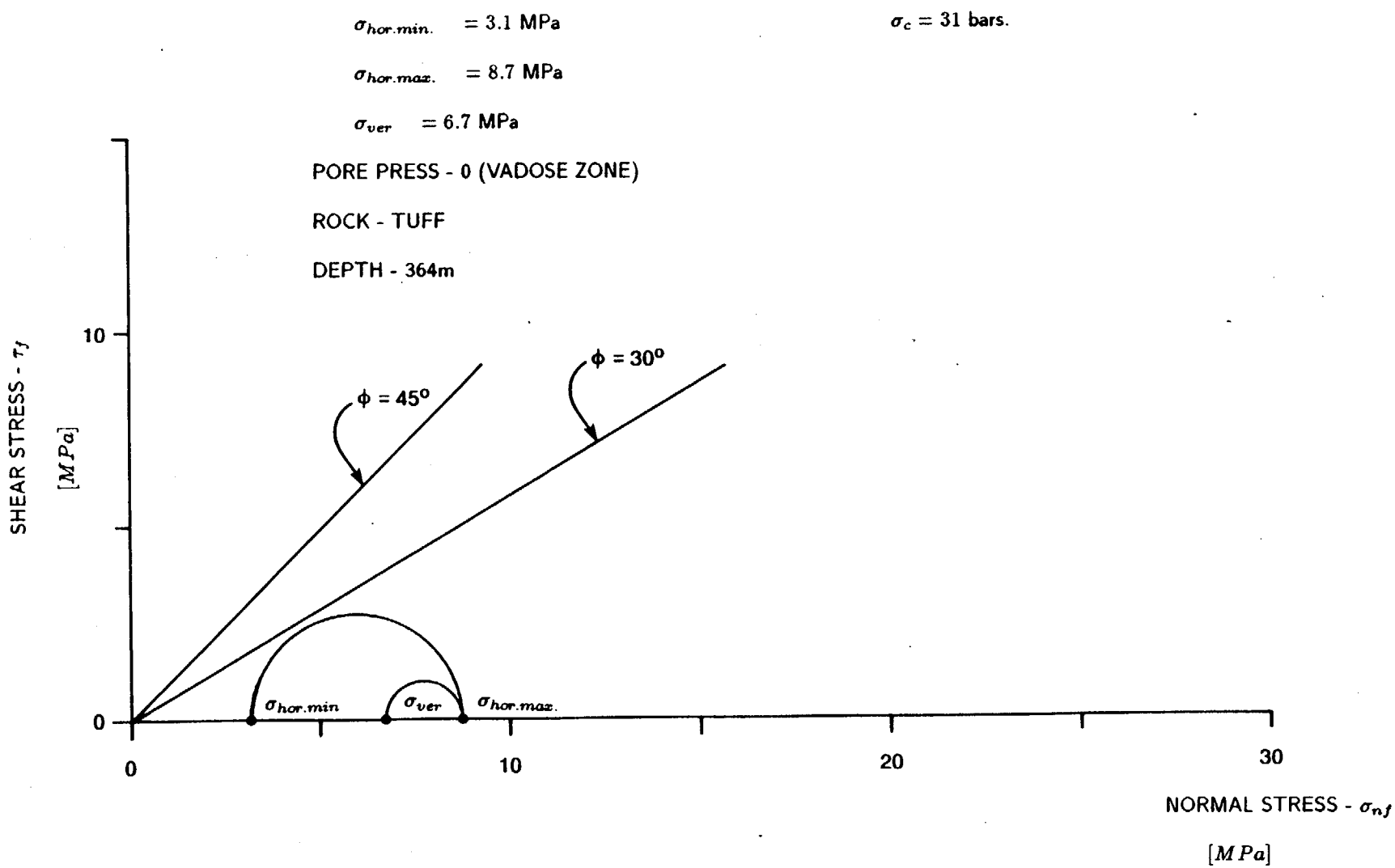
Mohr representation of in situ stress. U12n. tunnel. Rainier Mesa, Aqueduct Mesa.



Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.

$\sigma_{hor.min.}$ = 3.0 MPa

$\sigma_{hor.max.}$ = 9.0 MPa

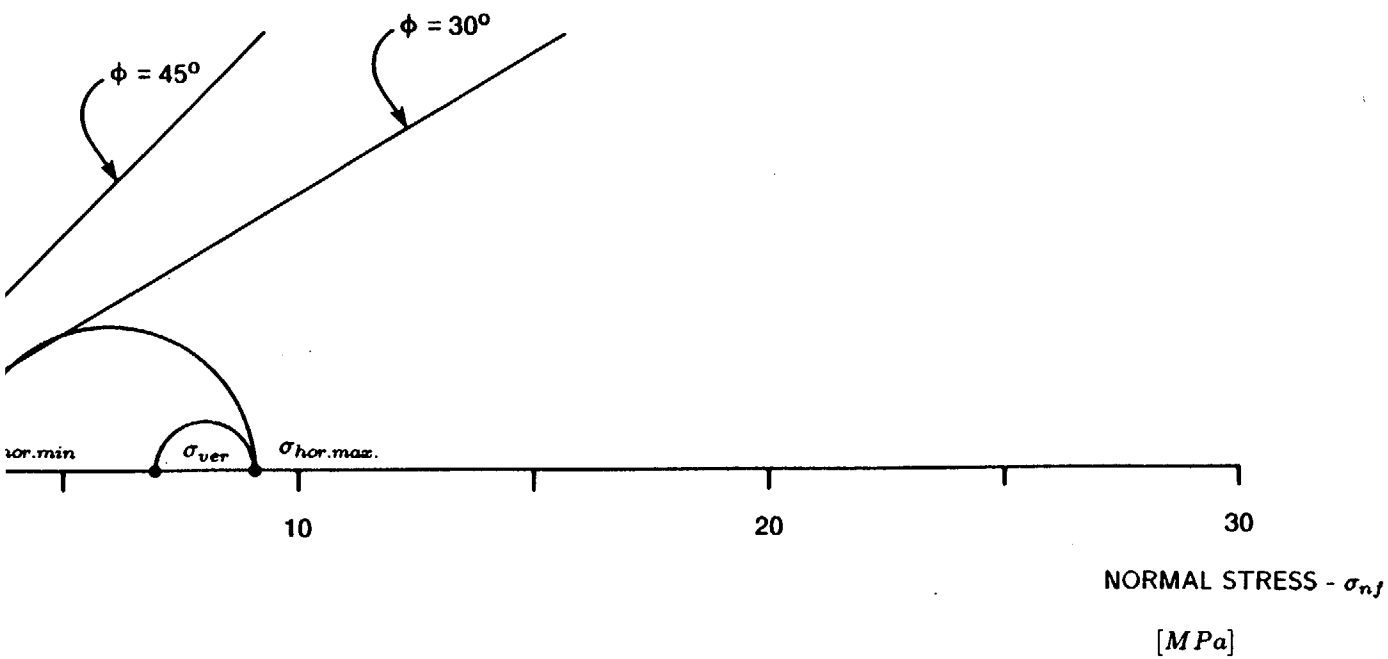
σ_{ver} = 7.0 MPa

σ_c = 30 bars.

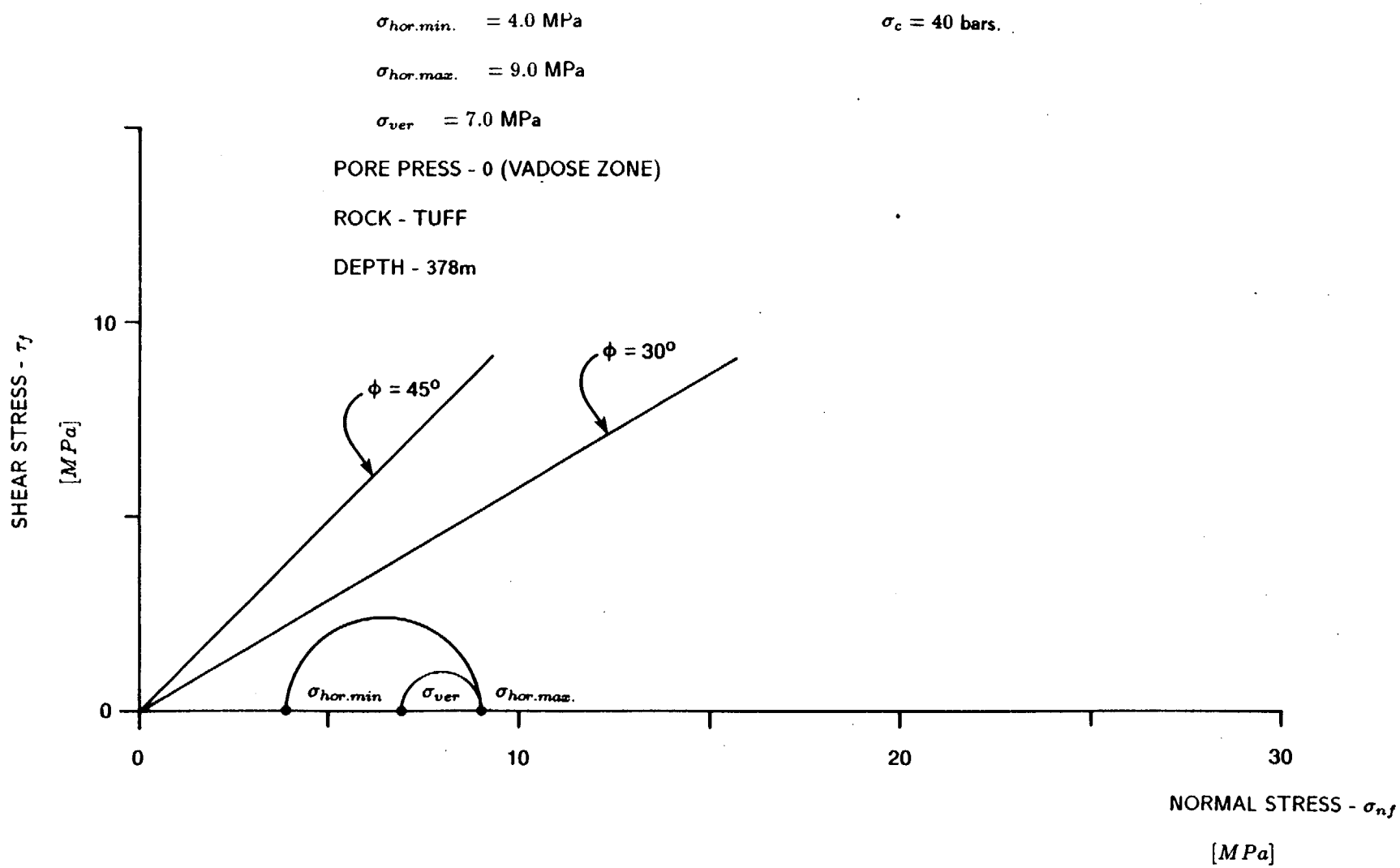
PORE PRESS - 0 (VADOSE ZONE)

ROCK - TUFF

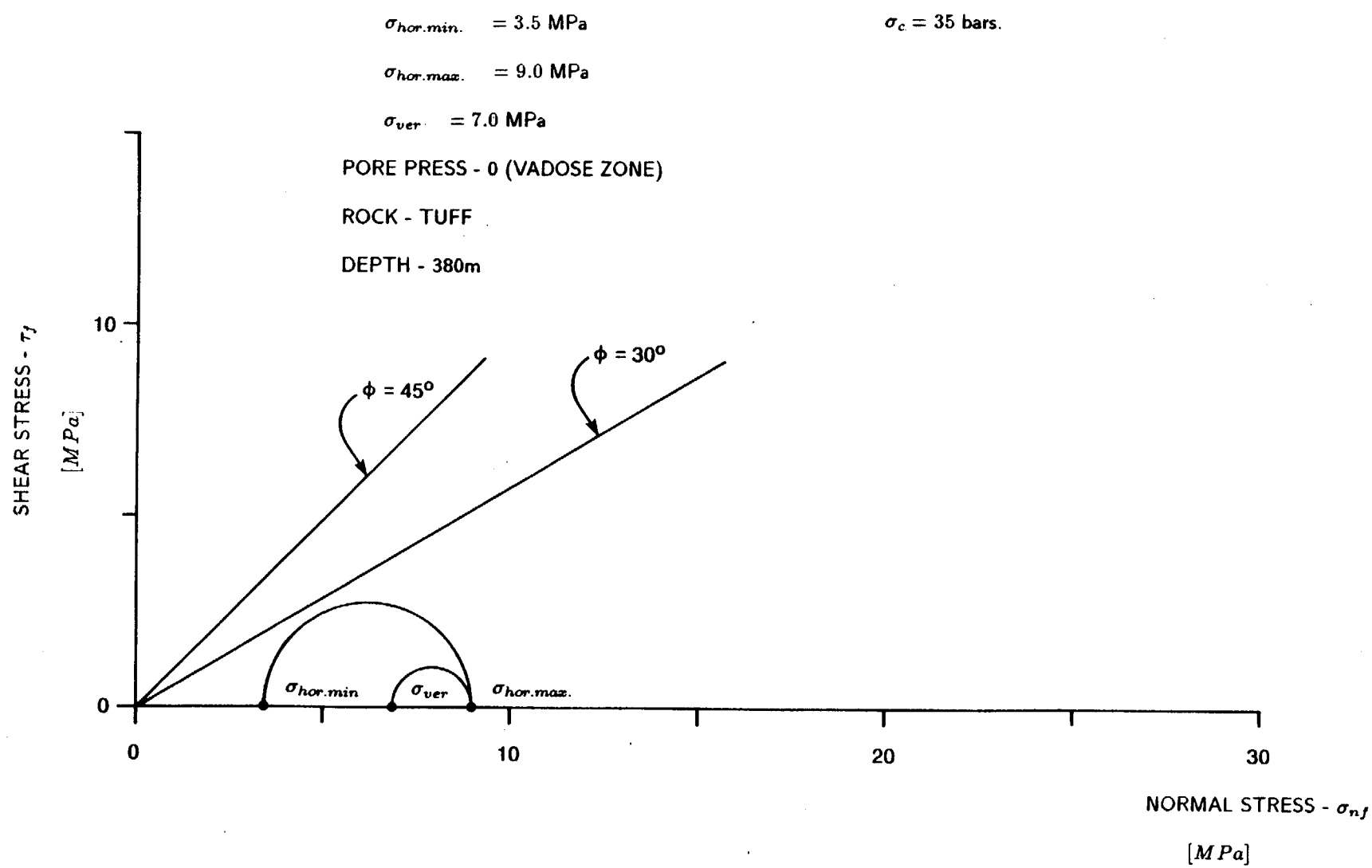
DEPTH - 378m



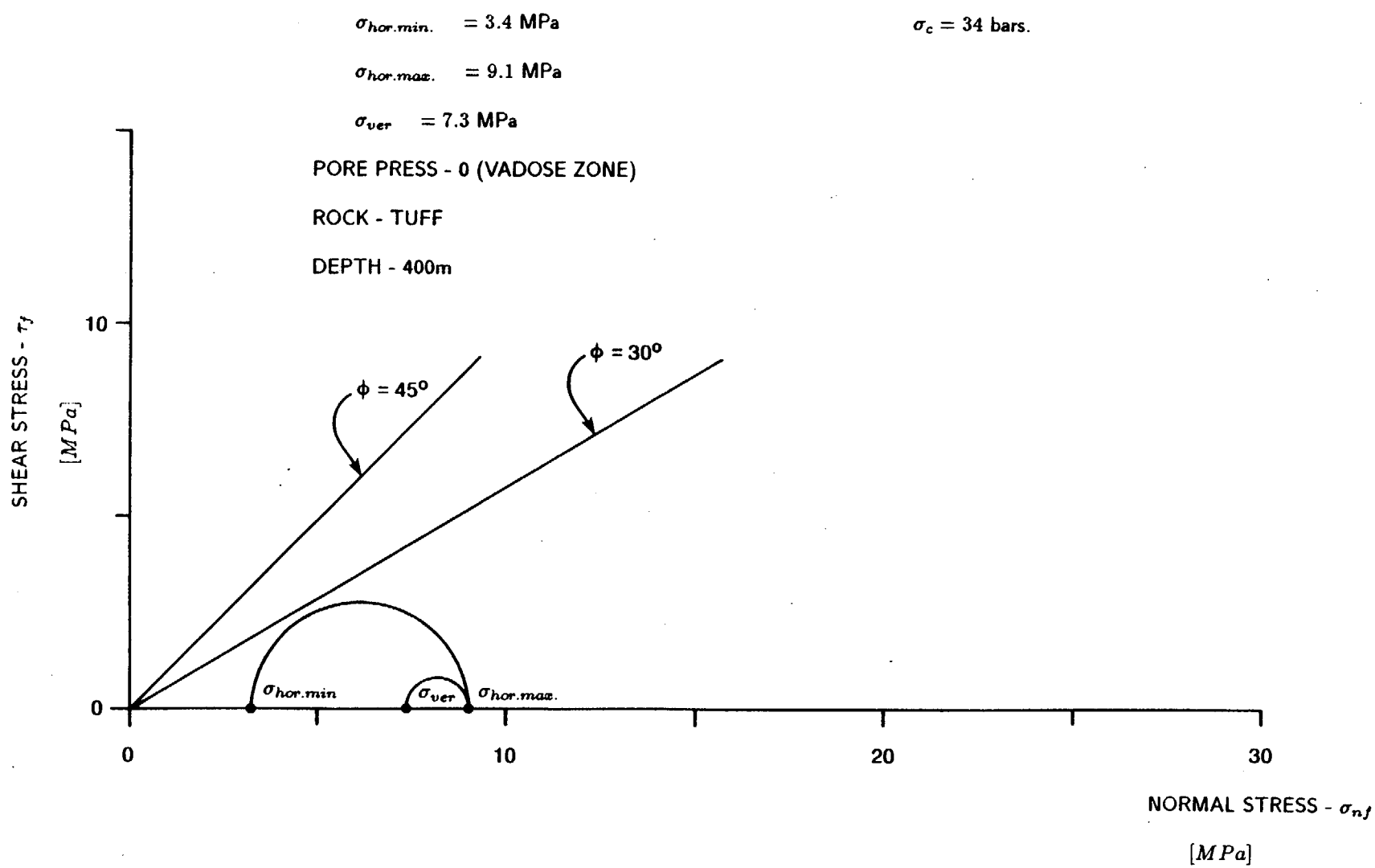
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



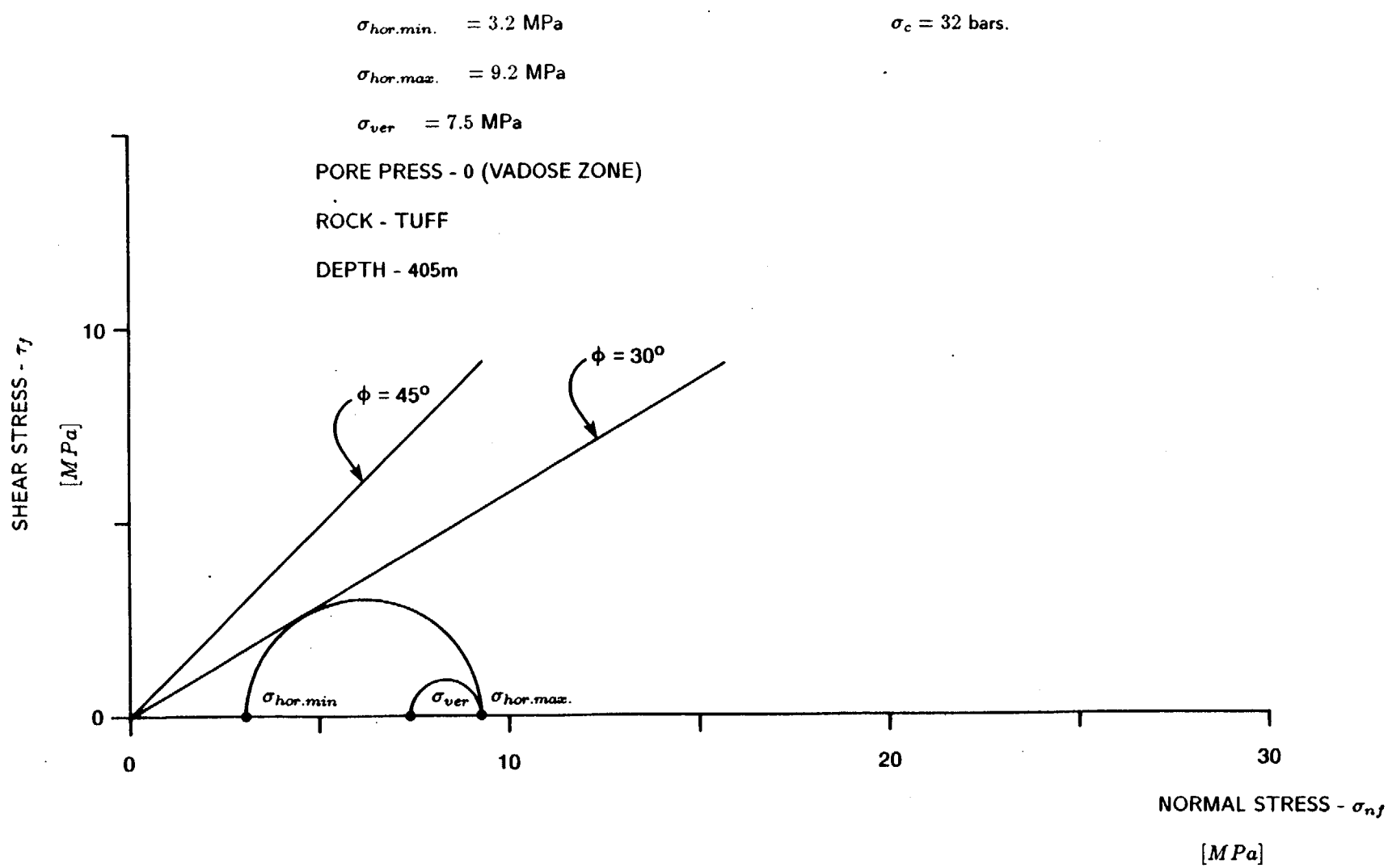
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



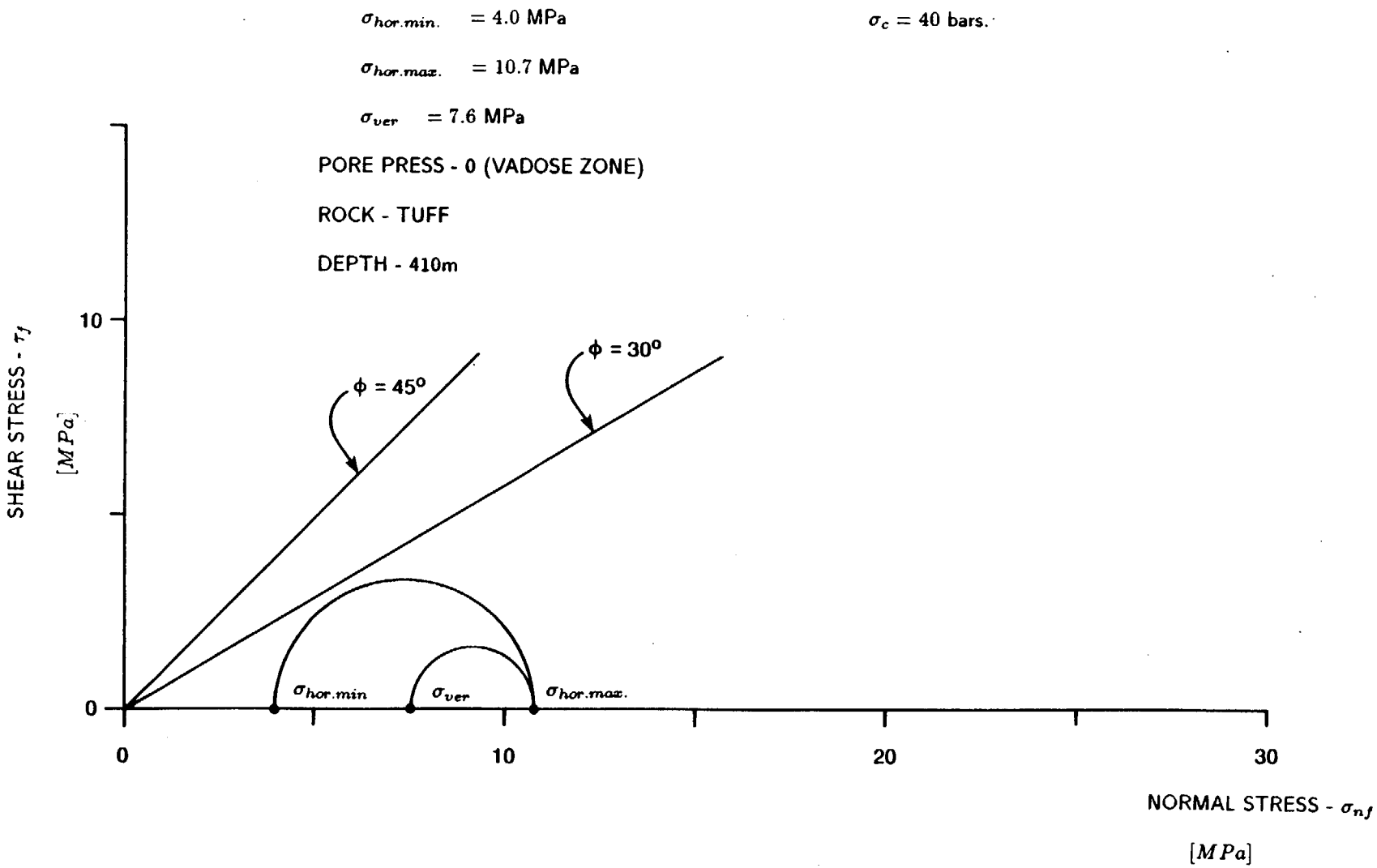
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



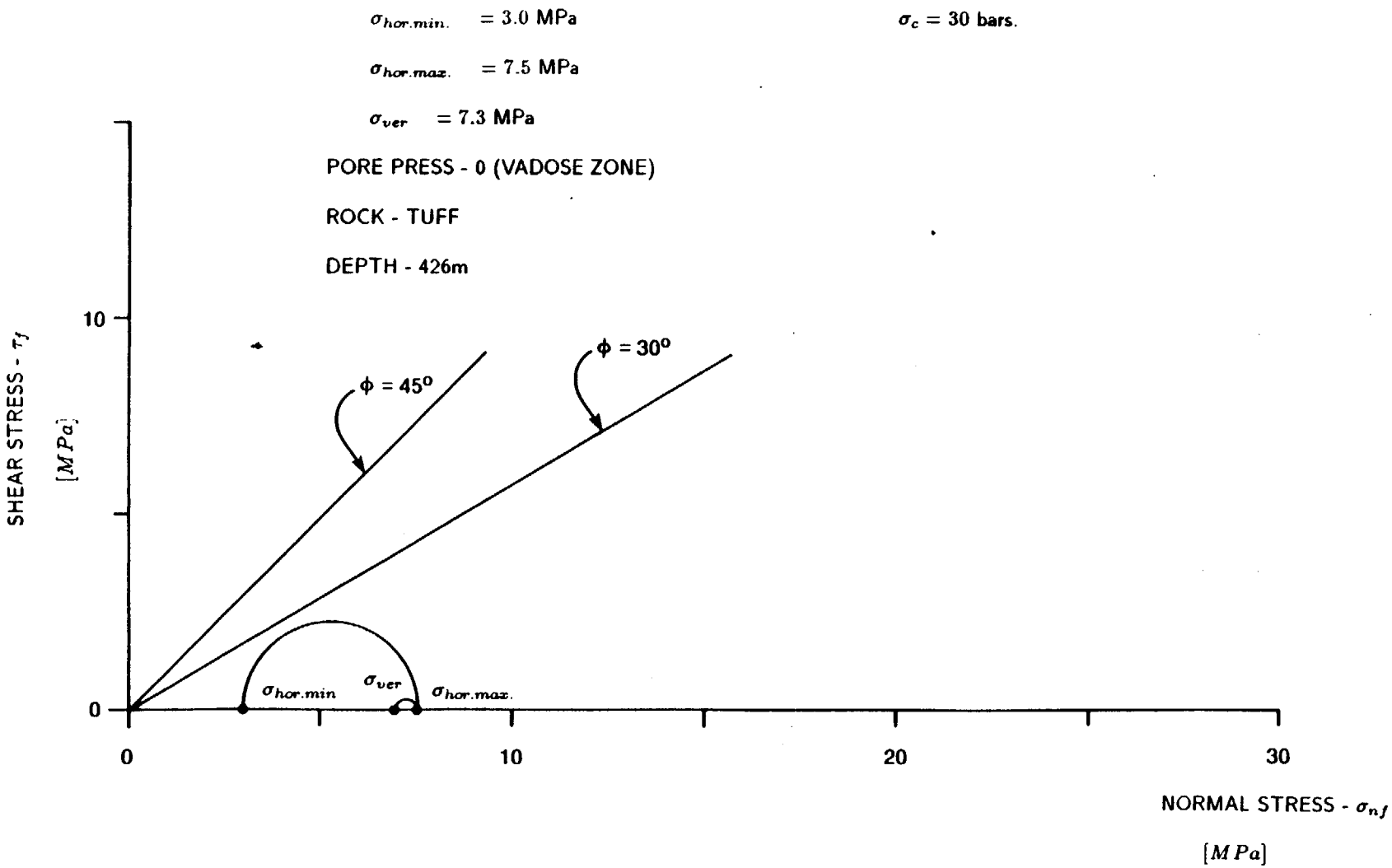
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



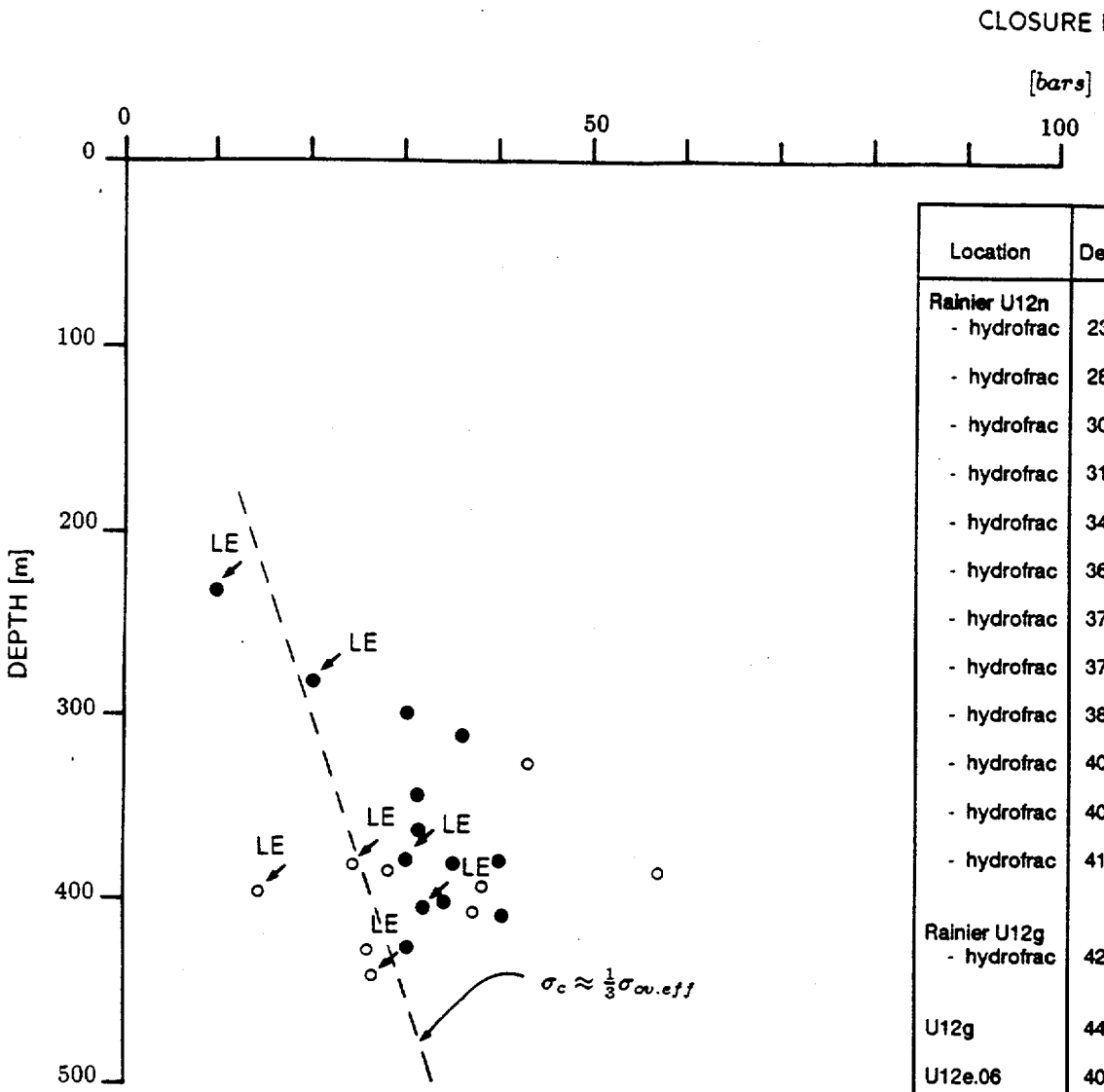
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



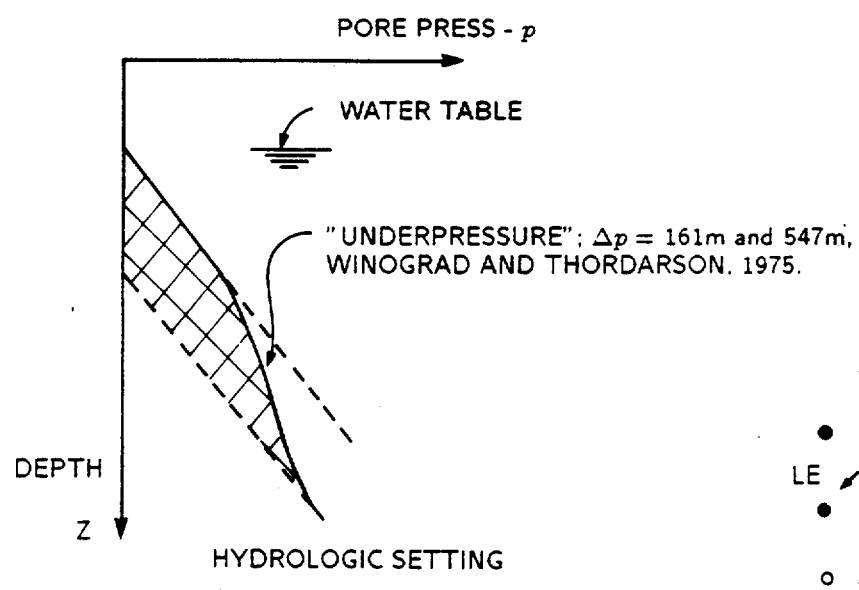
Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



Mohr representation of in situ stress. U12n tunnel. Rainier Mesa, Aqueduct Mesa.



Location	Depth	σc	Stress Conditions
Rainier U12n			
- hydrofrac	232	10	LE
- hydrofrac	284	22	LE
- hydrofrac	300	30	nLE
- hydrofrac	314	36	nLE
- hydrofrac	346	31	nLE
- hydrofrac	364	31	nLE
- hydrofrac	378	30	LE
- hydrofrac	378	40	nLE
- hydrofrac	380	35	nLE
- hydrofrac	400	34	nLE
- hydrofrac	405	32	LE
- hydrofrac	410	40	nLE
Rainier U12g			
- hydrofrac	426	30	nLE
U12g	442	26	LE
U12e.06	408	37	nLE
U12e	383	28	nLE
U12n.07	381	24	LE
U12n.10	398	14	LE
U12n.10A	388	57	nLE
U12n.10B	393	38	nLE
U12t.02	428	26	nLE
U12t.03	328	43	nLE



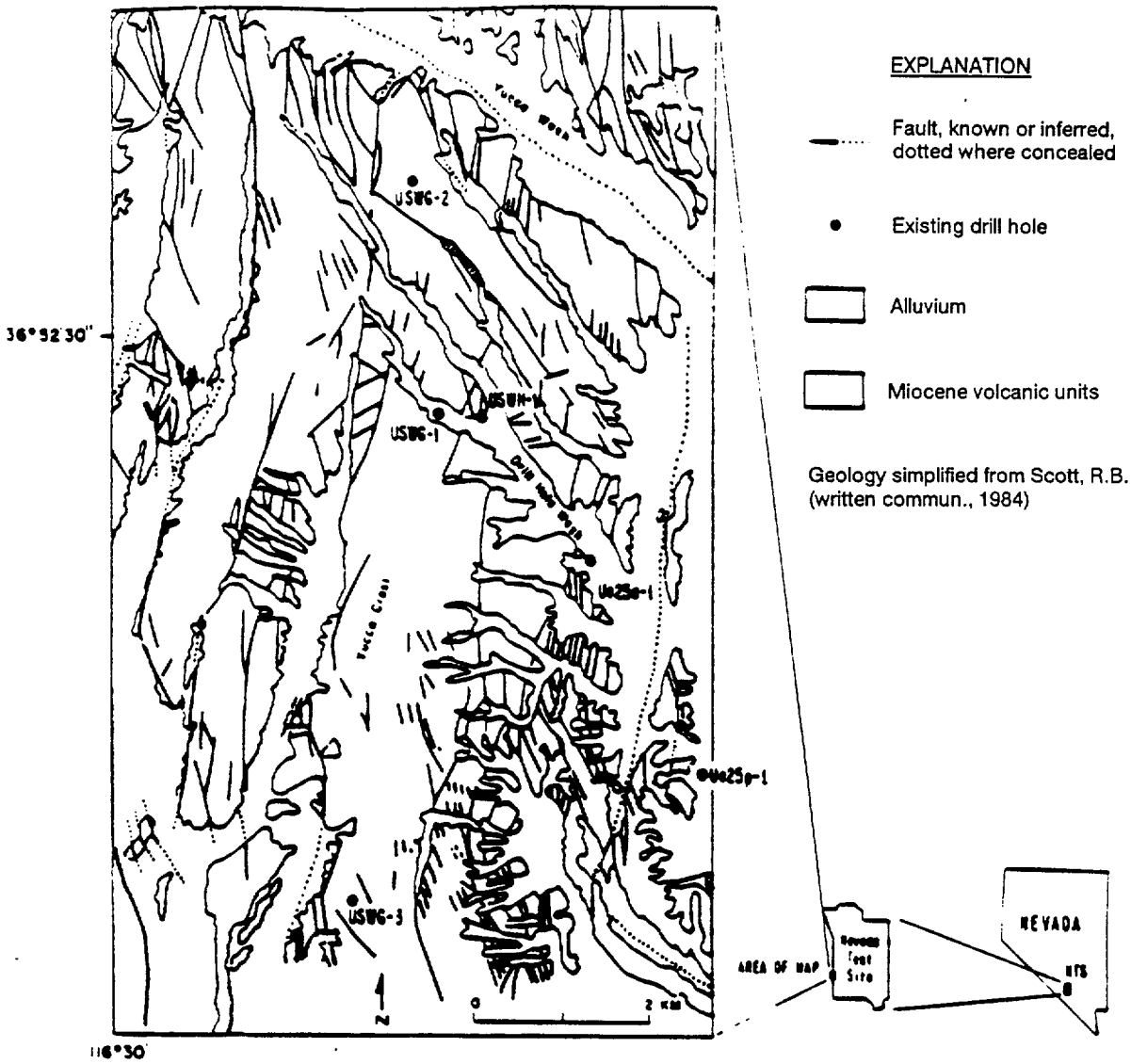
EXPLANATION:

● - σ_c BASED ON HYDROFRACTURE

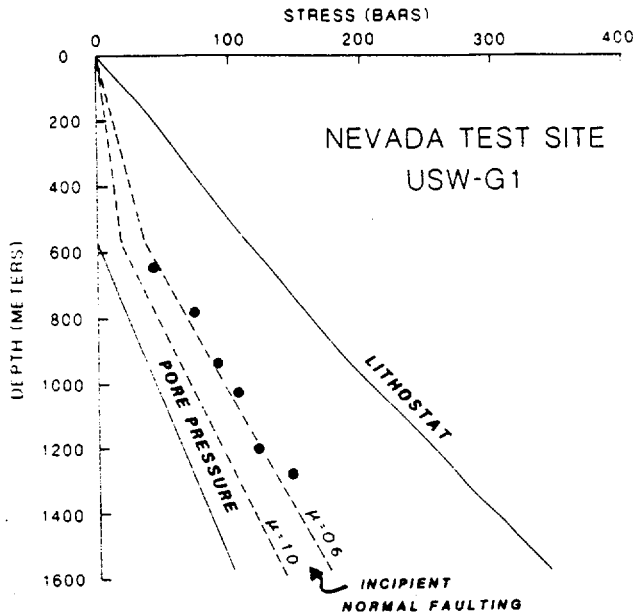
LE ● - LIMIT EQUILIBRIUM

○ - σ_c BASED ON OVERCORING

State of in situ stress. Summary. Rainier Mesa and Aqueduct Mesa.

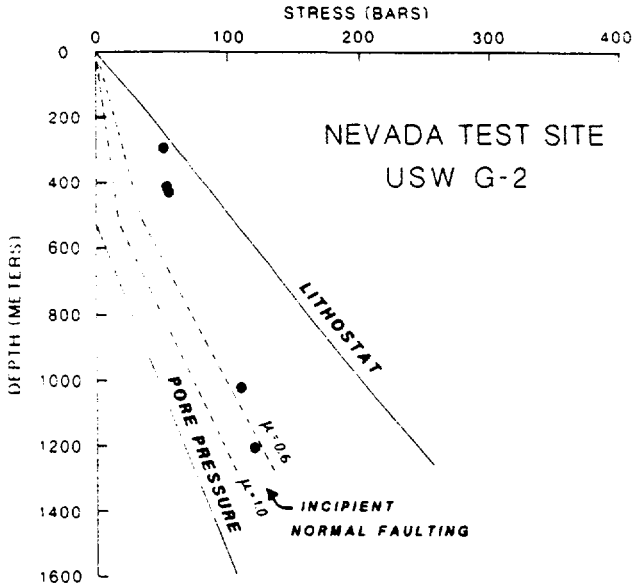


Map showing location of hydrofracture wells in the area of Yucca Mountain. From Stock et al., 1986.



Hydraulic Fracturing Data					Principal Stresses		
Depth, m	Breakdown Pressure, MPa	Shut-In Pumping Pressure, MPa	Hydrostatic Pressure, MPa	Pore Pressure,*† MPa	Minimum Horizontal Stress, MPa	Vertical Stress MPa*	Comments
				USW G-1			
646	8.3	4.2 ± 0.2	6.2	0.7	4.2 ± 0.2	12.9	Minimum horizontal stress from flat subhydrostatic pumping pressure attained during second cycle. S_h may thus be several bars too high due to pressure gradient in fracture.
792	10.2	7.2 ± 0.2	7.9	2.2	7.2 ± 0.2	15.9	Same as above.
945	13.2	9.0 ± 0.2	9.2	3.6	9.0 ± 0.2	19.2	Same as above.
1038	13.5	10.6 ± 0.2	10.3	4.5	10.6 ± 0.2	21.4	Minimum horizontal stress from stable instantaneous shut-in pressures attained in final cycles.
1218	18.8	12.1 ± 0.2	12.0	6.3	12.1 ± 0.2	25.5	Same as above.
1288	23.8	14.8 ± 0.2	12.8	7.0	14.8 ± 0.2	27.2	Same as above.

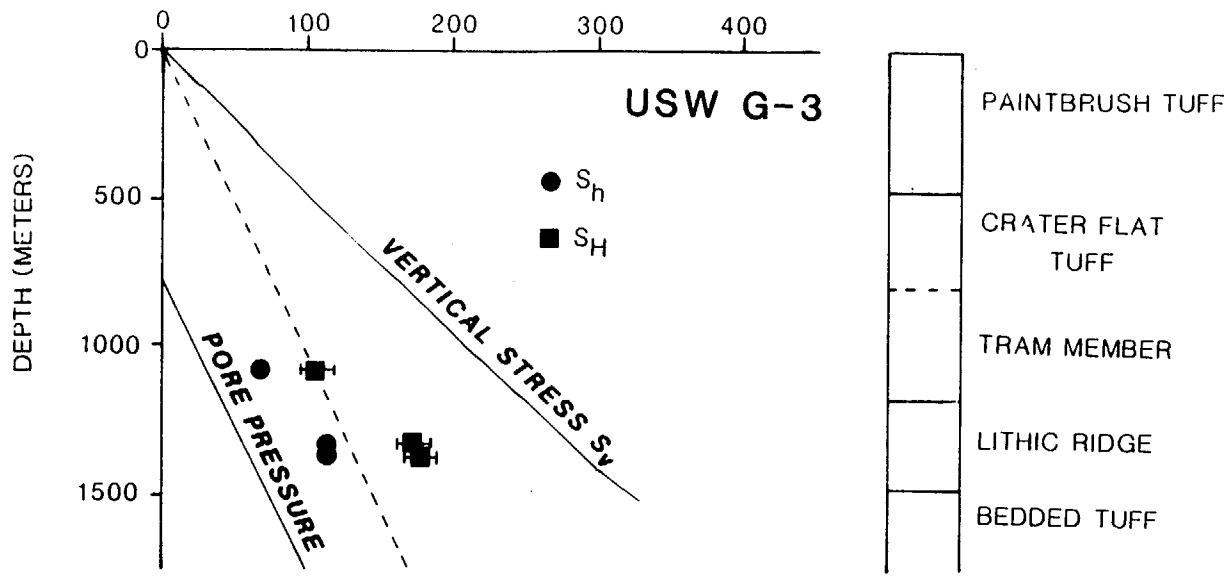
Results of in situ stress determinations in Well USW G-1. Yucca Mountain. From Stock et al., 1985.



Hydraulic Fracturing Data					Principal Stresses		
Depth, m	Breakdown Pressure, MPa	Shut-In Pumping Pressure, MPa	Hydrostatic Pressure, MPa	Pore Pressure,*† MPa	Minimum Horizontal Stress, MPa	Vertical Stress MPa*	Comments
				USW G-2			
295	5.1	5.1 ± 0.1	2.9	0.0	5.1 ± 0.1	6.1	Reopening preexisting fracture of unknown orientation: shut-in pumping pressure is upper bound on S_h.
418	5.4	5.4 ± 0.1	4.1	0.0	5.4 ± 0.1	8.4	Same as above.
432	5.5	5.5 ± 0.1	4.2	0.0	5.5 ± 0.1	8.7	Same as above.
1026	16.3	11.1 ± 0.2	10.1	4.9	11.1 ± 0.2	20.8	Minimum horizontal stress from stable pumping pressure on multiple cycles.
1209	18.2	12.0 ± 0.2	11.8	6.7	12.0 ± 0.2	25.5	Minimum horizontal stress from flat pumping pressure attained on second cycle. S_h thus may be several bars too high due to pressure gradient in fracture.

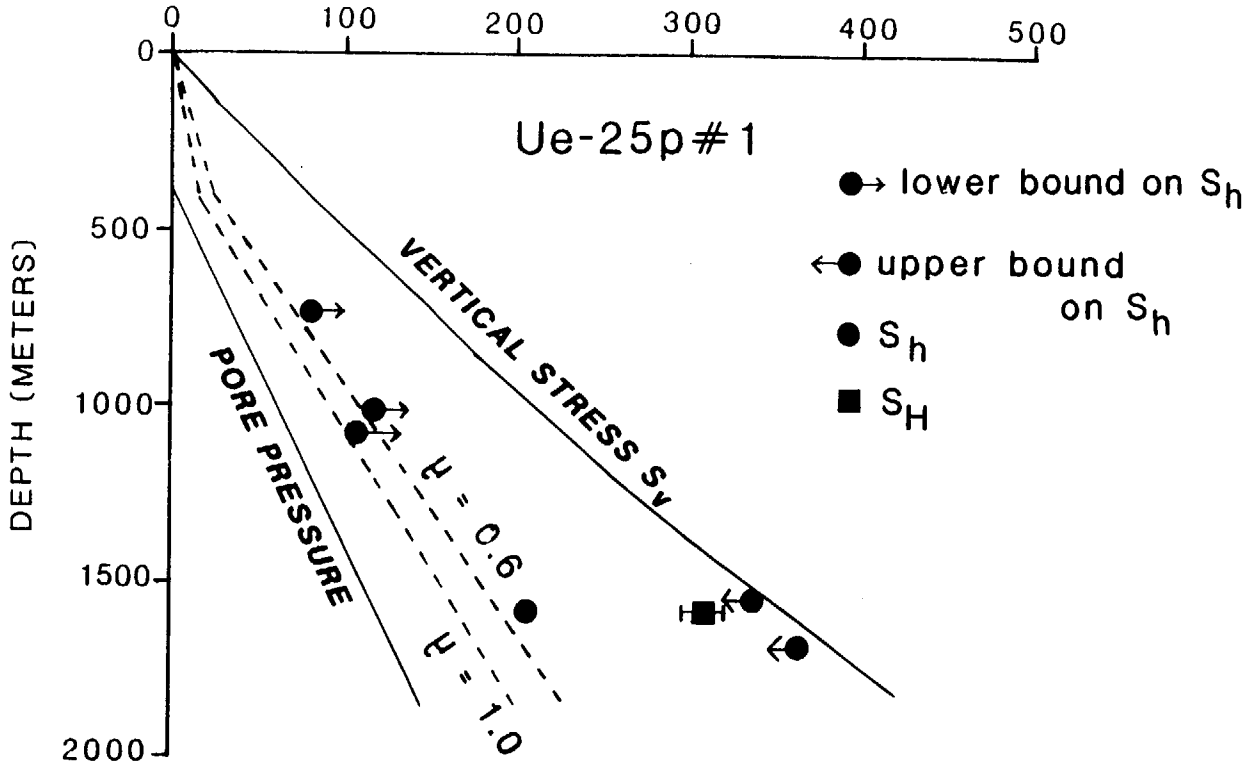
*Calculated for the appropriate density and depth.
†Based on water table at 576 m depth in USW G-1 and 526 m depth in USW G-2.

Results of in situ stress determinations in Well USW G-2. Yucca Mountain. From Stock et al., 1985.



Hole	Logged depth (m)	Breakdown pressure[1] (bars)	Shut-in pumping pressure (bars)	Hydro-static pressure (bars)	Pore[2] pressure (bars)	S_h (bars)	S_v [3] (bars)	T[4] (bars)	S_H (bars)	Comments
G-3	1,074	79	68	105	31	68±2	206	13	107±10	
G-3	1,338	173	115	131	56	115±2	258	59	175±9	Interpretation based on first two cycles only.
G-3	1,356	168	114	133	57	114±2	263	64	181±8	

Results of in situ stress determinations in Well USW G-3. Yucca Mountain. From Stock et al., 1986.



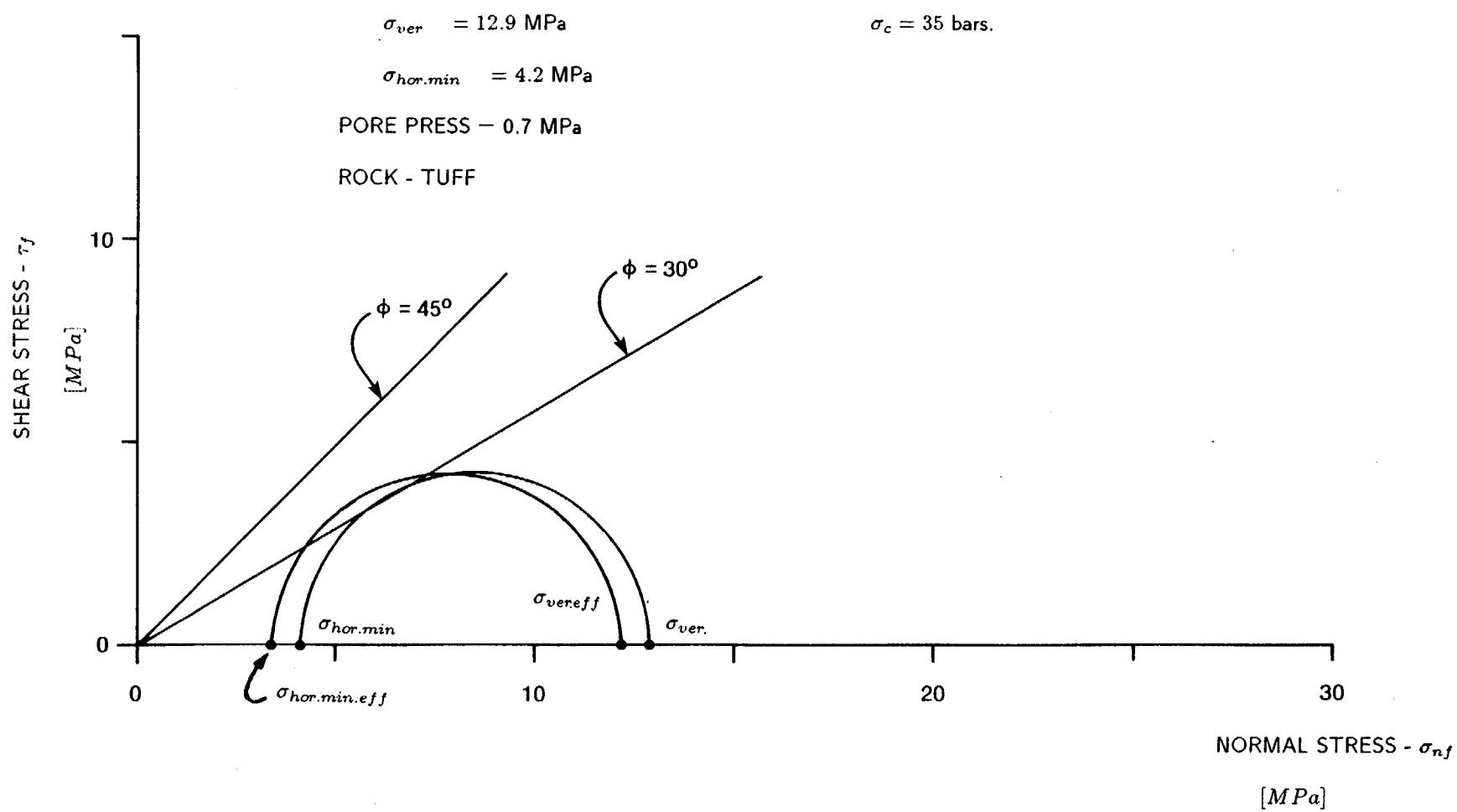
Hole	Logged depth (m)	Breakdown pressure[1] (bars)	Shut-in pumping pressure (bars)	Hydro-static pressure (bars)	Pore[2] pressure (bars)	S_h (bars)	S_v [3] (bars)	T[4] (bars)	S_H (bars)	Comments
P1	1,564	none[1]	337	153	115	337±2	353			Reopening preexisting fracture
P1	1,573	236	207	154	116	207±2	356	41	310±11	
Pa1	1,693	none[1]	366	166	128	365±10	388			Reopening preexisting fracture

1. No clear breakdown pressures seen

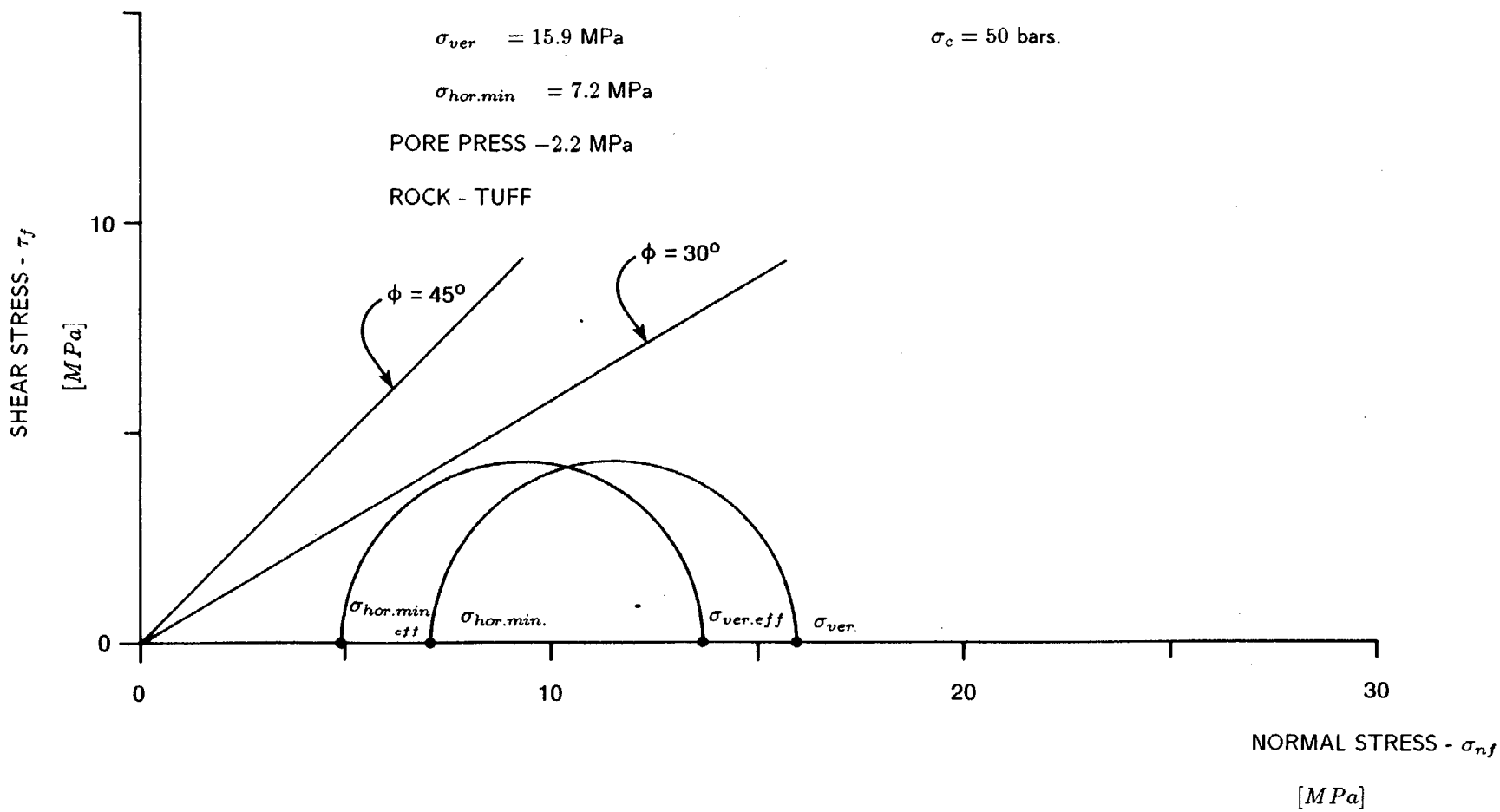
Results of in situ stress determinations in Well UE-25p#1. Yucca Mountain. From Stock et al., 1986.

Borehole	Depth (m)	Breakdown Pressure (Bars)	Pore Pressure (Bars)	Vertical Stress (Bars)	Min. Horizontal Stress (Bars)	Max. Horizontal Stress (Bars)
UE-25p#1	731	92	34	151	73	127
UE-25p#1	1001	153	61	211	111	180
UE-25p#1	1131	179	73	243	129	208
UE-25p#1	1564		115	353	337± 2	
UE-25p#1	1573	236	116	356	207± 2	311±11
UE-25p#1	1693		128	388	365±10	

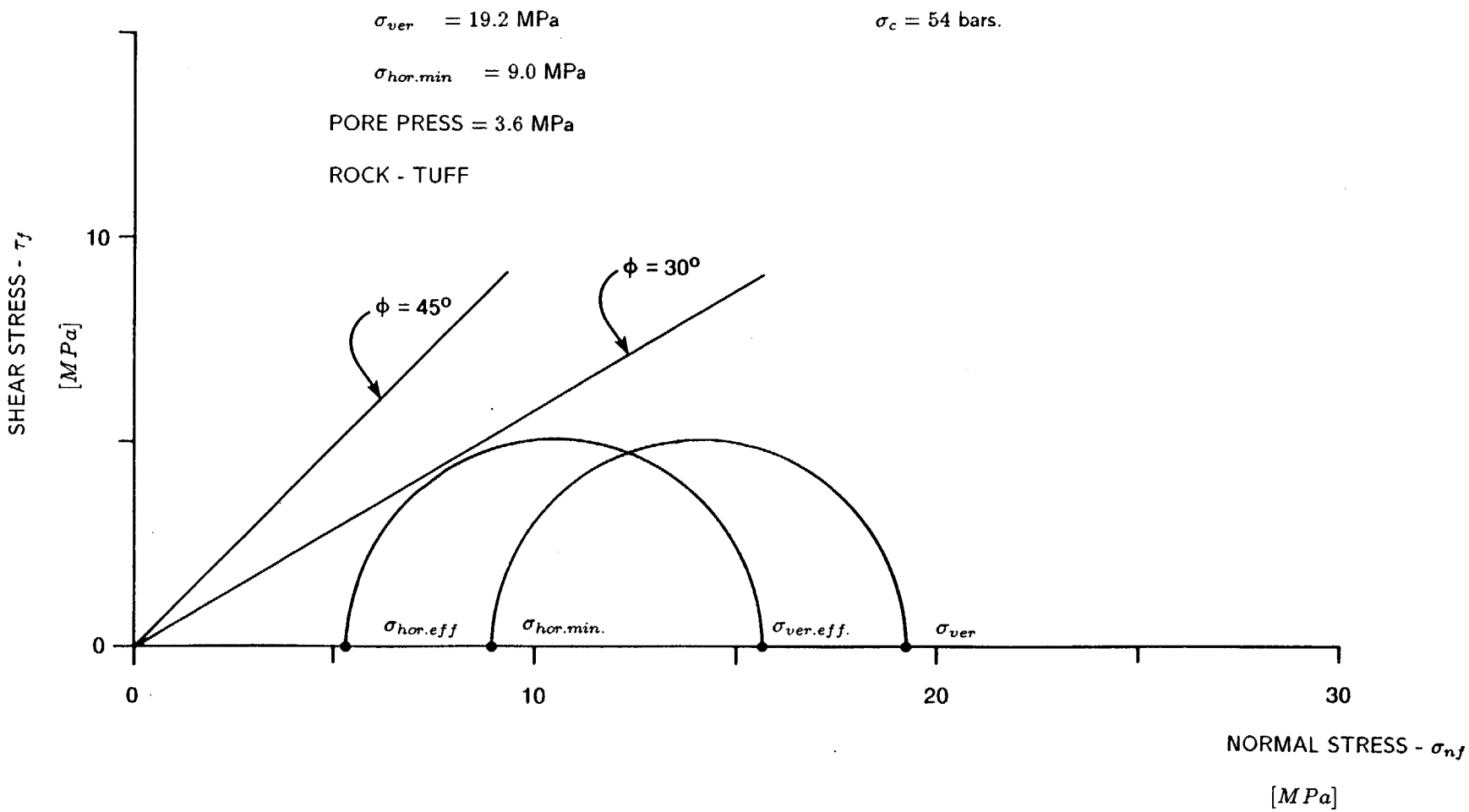
Results of in situ stress determinations in Well UE-25p#1. Yucca Mountain. From Stock et al., 1982.



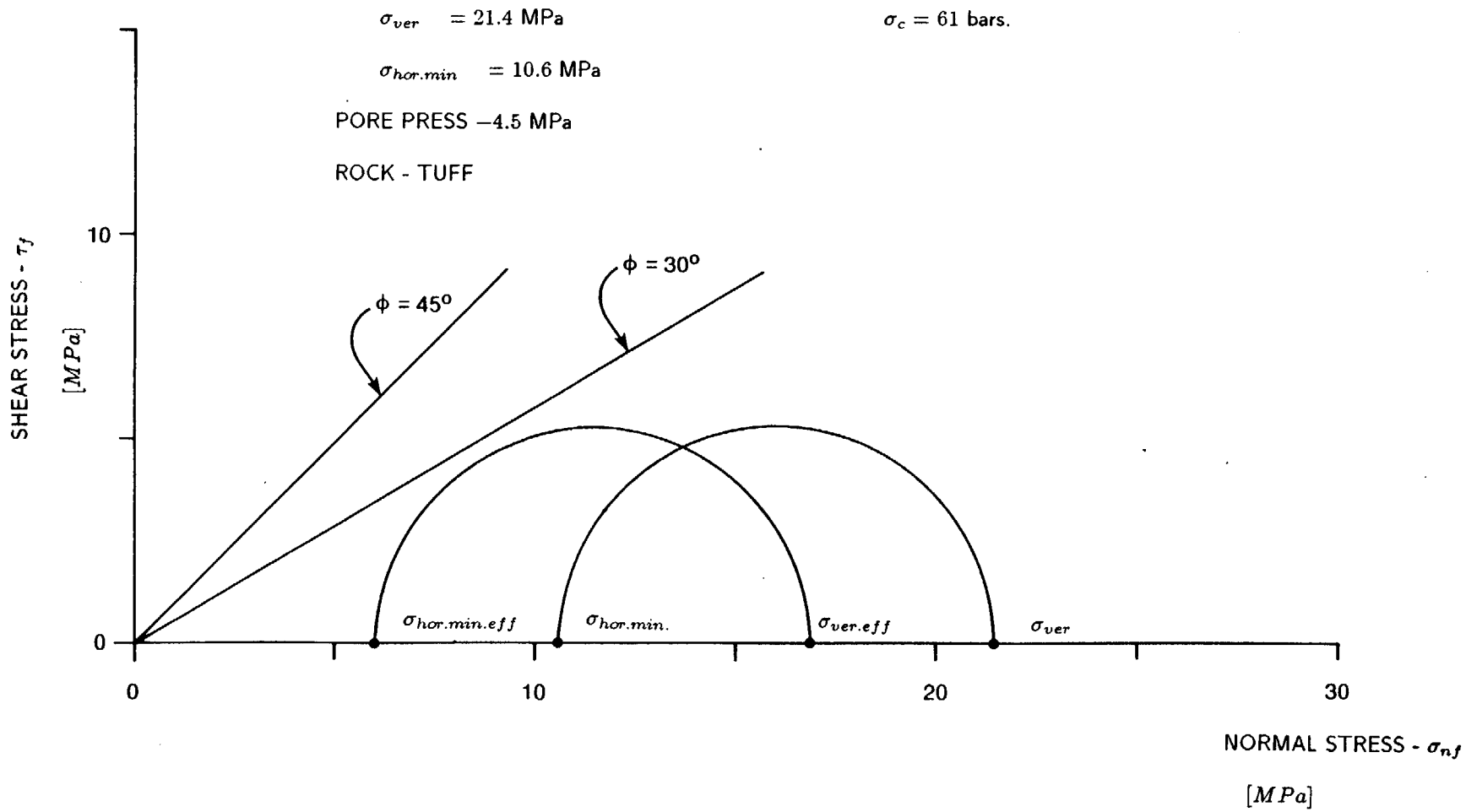
Mohr representation of in situ stress. Borehole G-1, depth 646 m. Yucca Mountain.



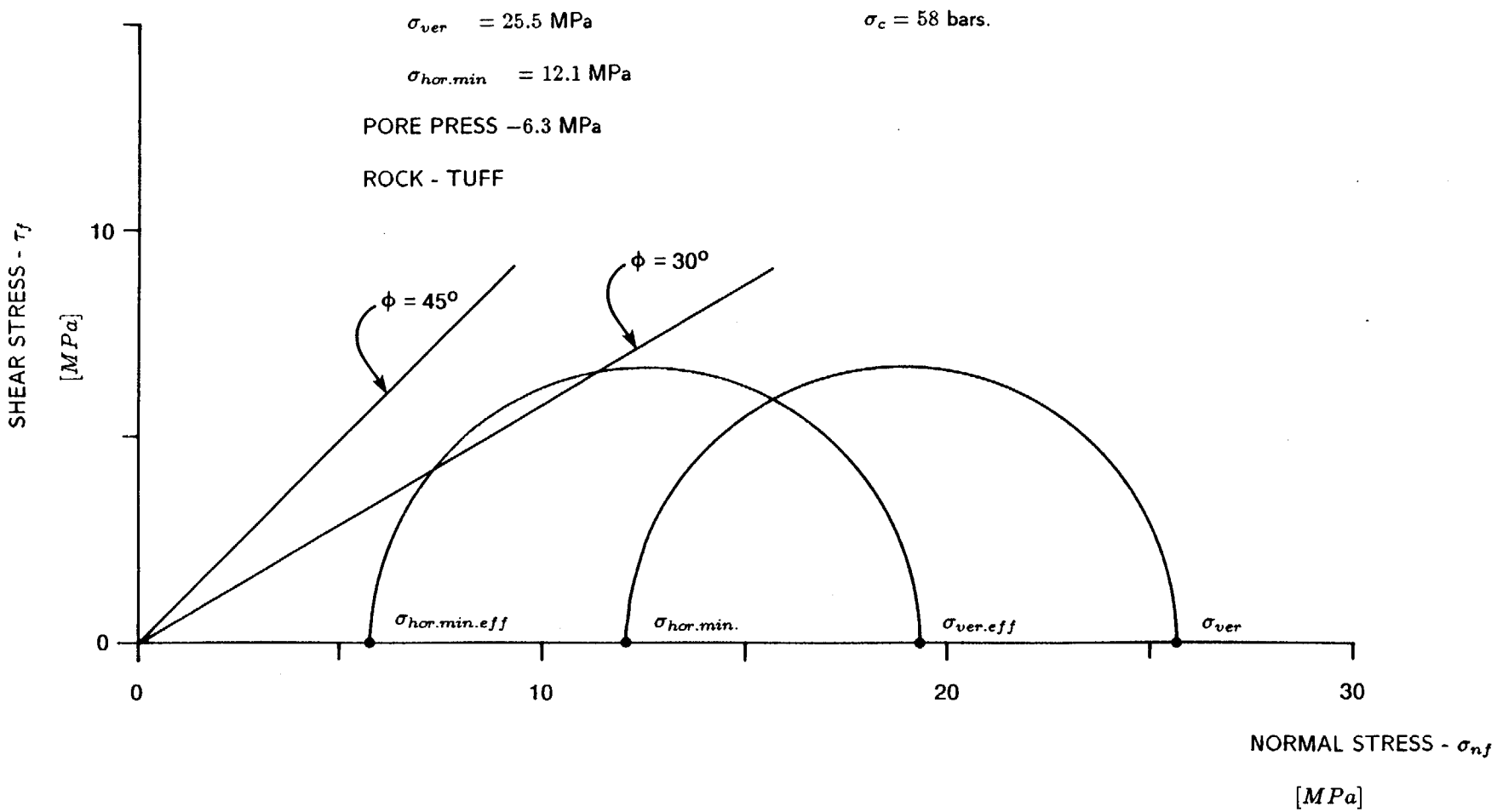
Mohr representation of in situ stress. Borehole G-1, depth 792 m. Yucca Mountain.



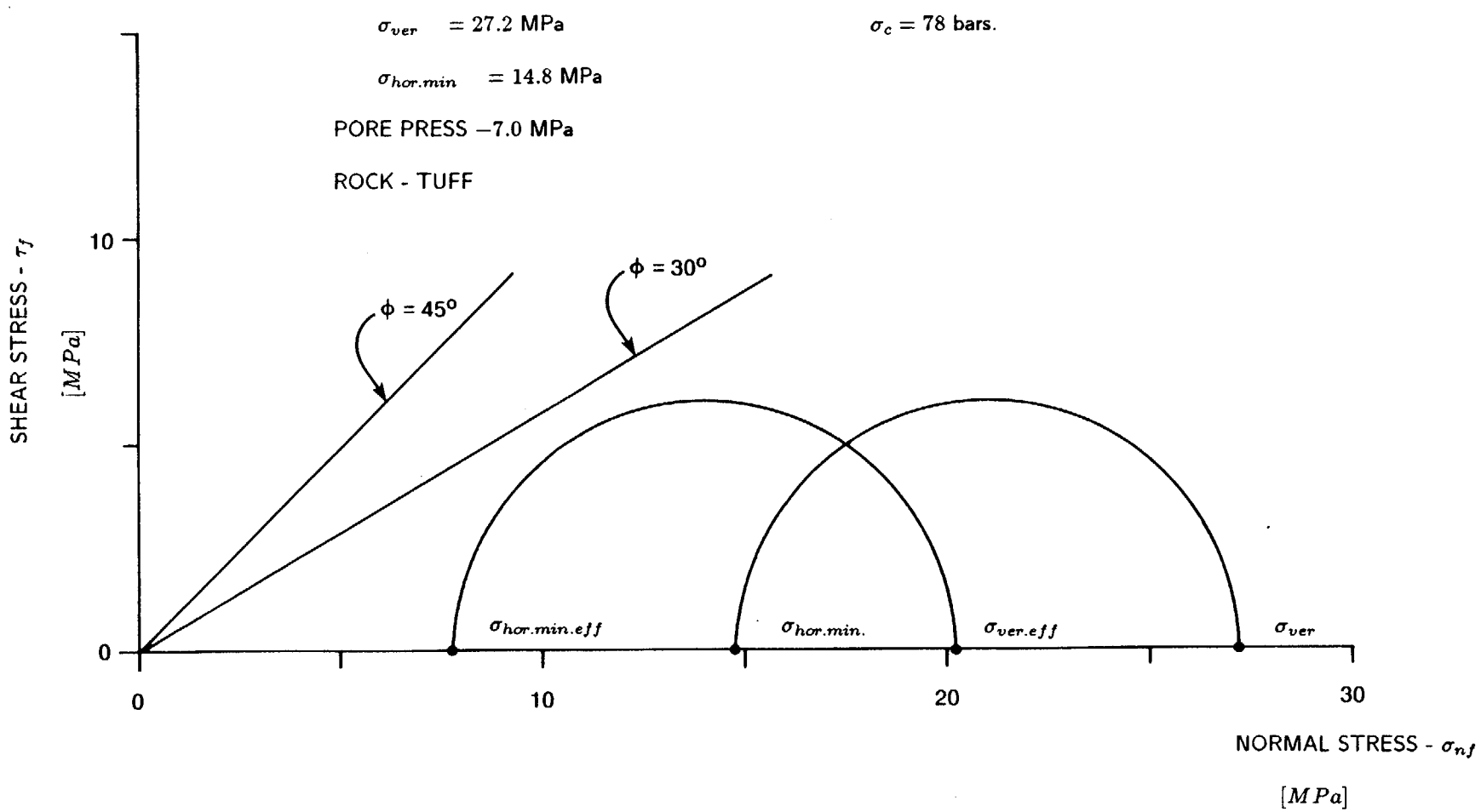
Mohr representation of in situ stress. Borehole G-1, depth 945 m. Yucca Mountain.



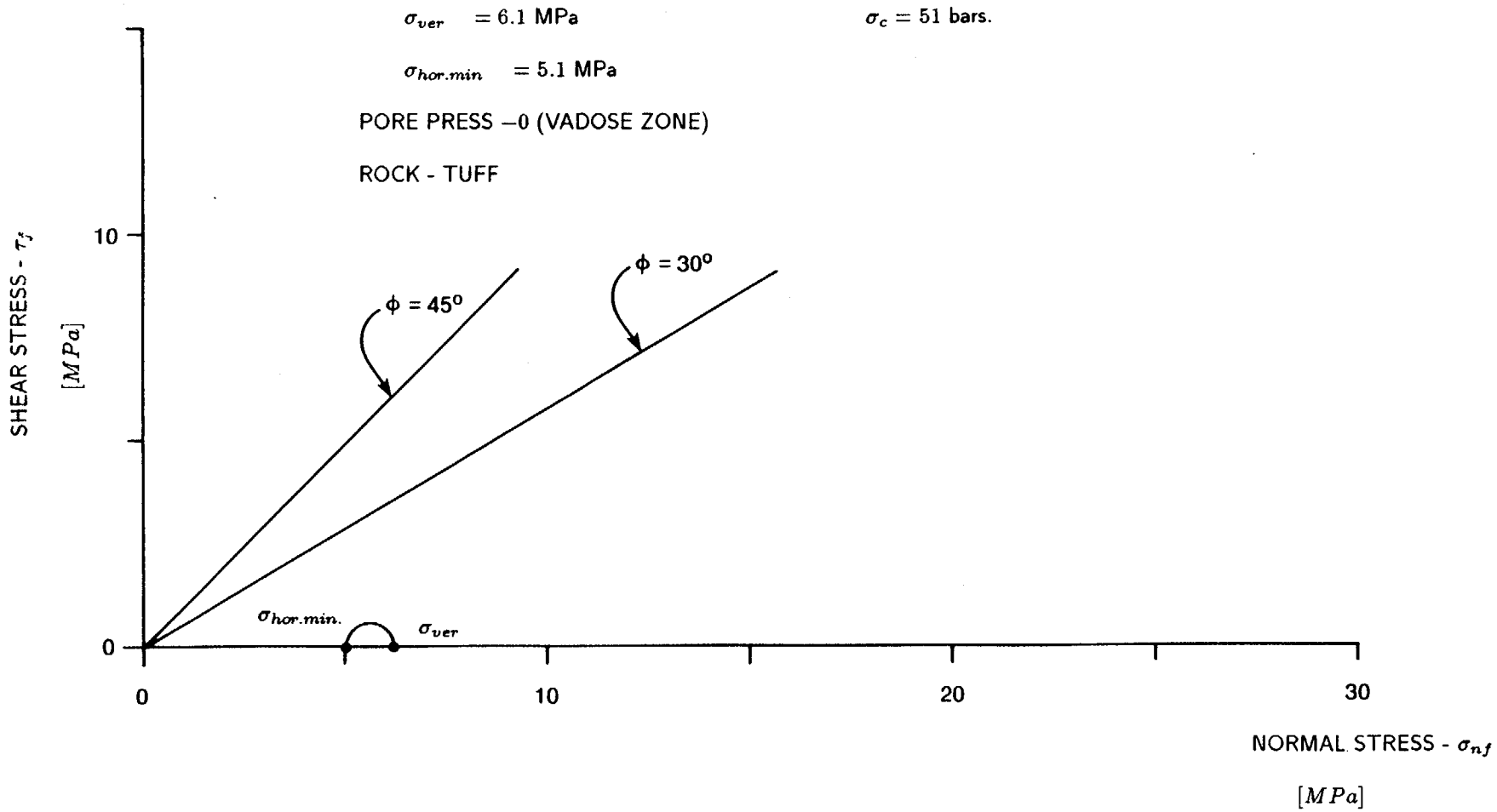
Mohr representation of in situ stress. Borehole G-1, depth 1038 m. Yucca Mountain.



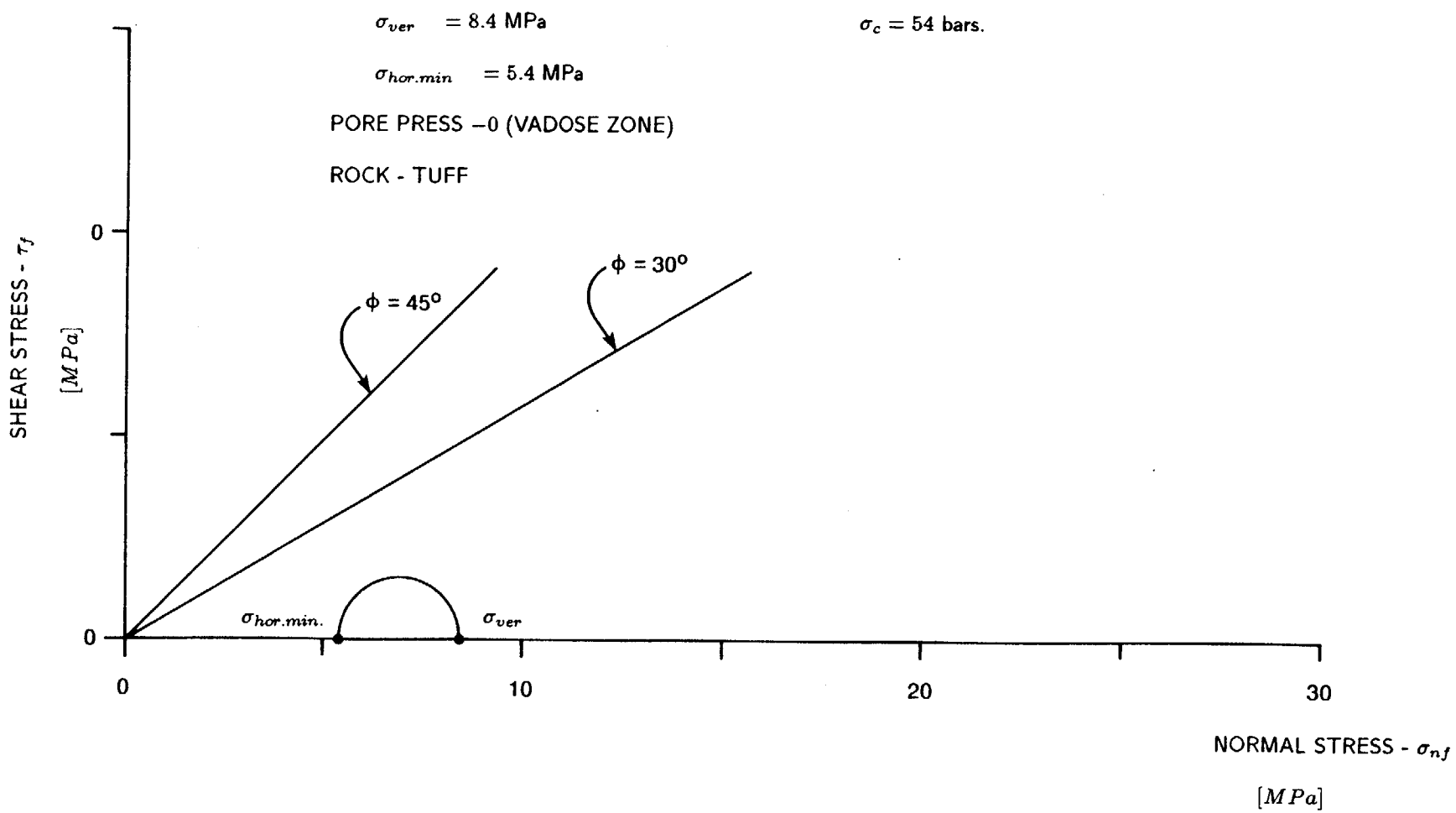
Mohr representation of in situ stress. Borehole G-1, depth 1218 m. Yucca Mountain.



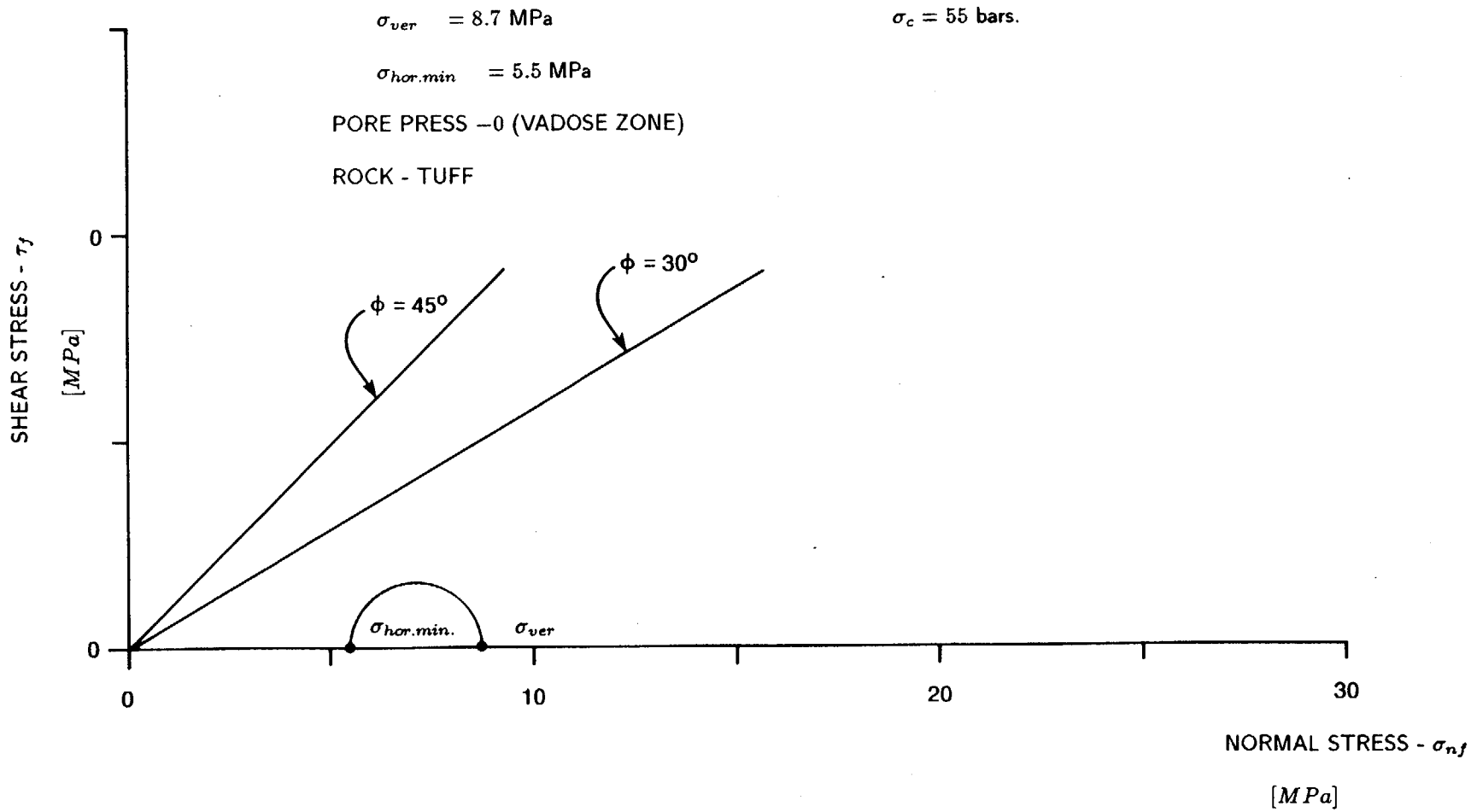
Mohr representation of in situ stress. Borehole G-1, depth 1288 m. Yucca Mountain.



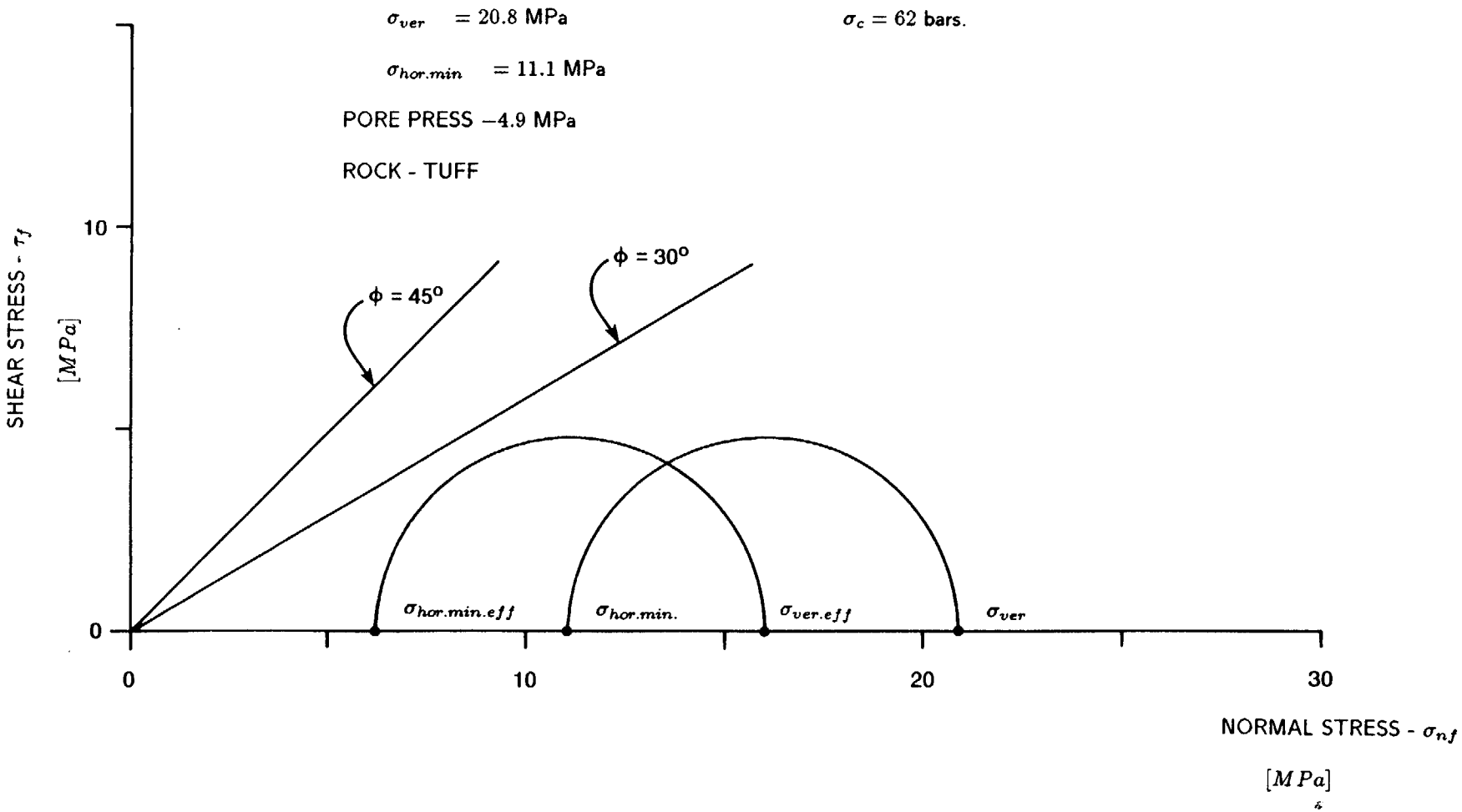
Mohr representation of in situ stress. Borehole G-2, depth 295 m. Yucca Mountain.



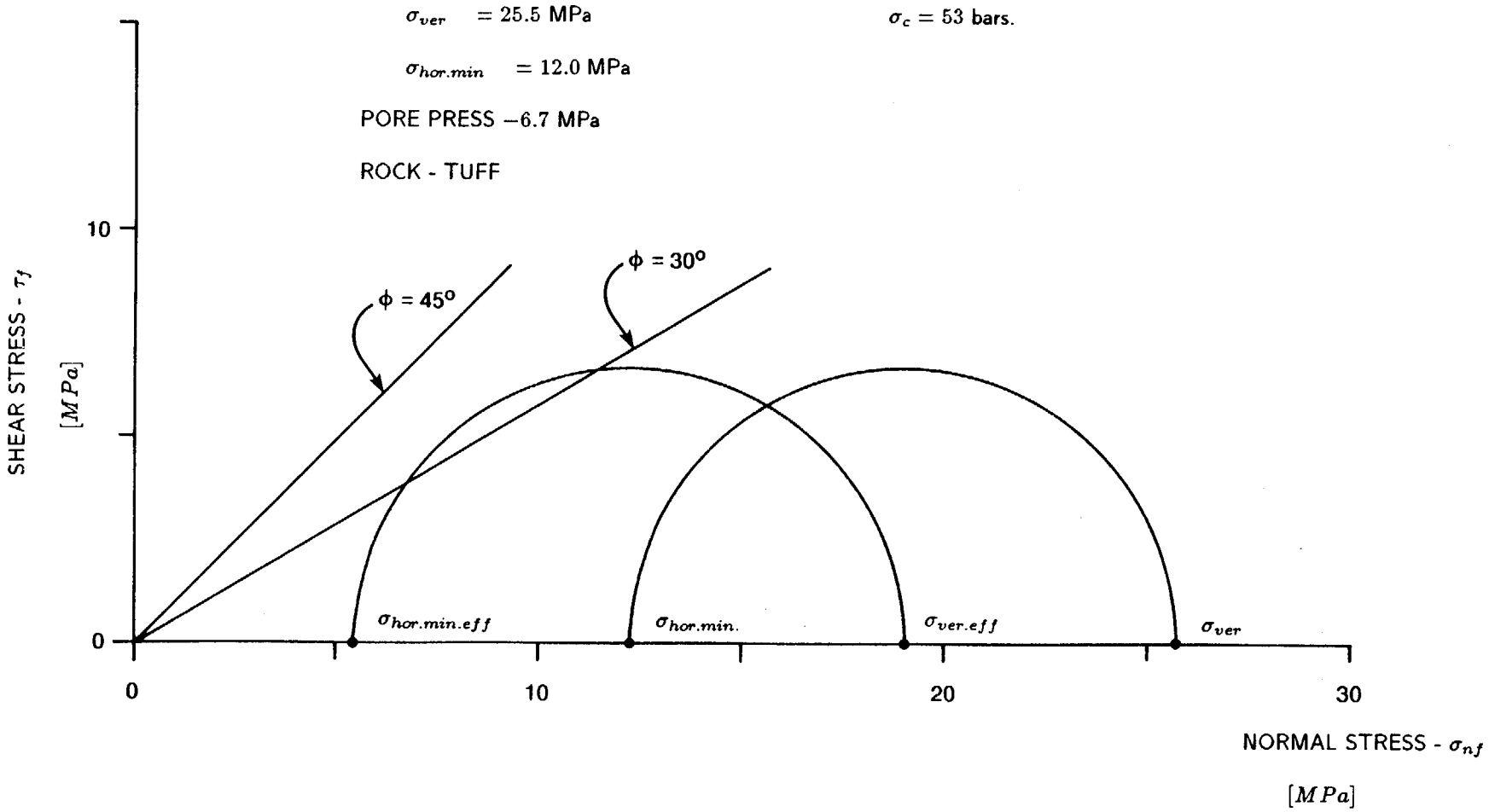
Mohr representation of in situ stress. Borehole G-2, depth 418 m. Yucca Mountain.



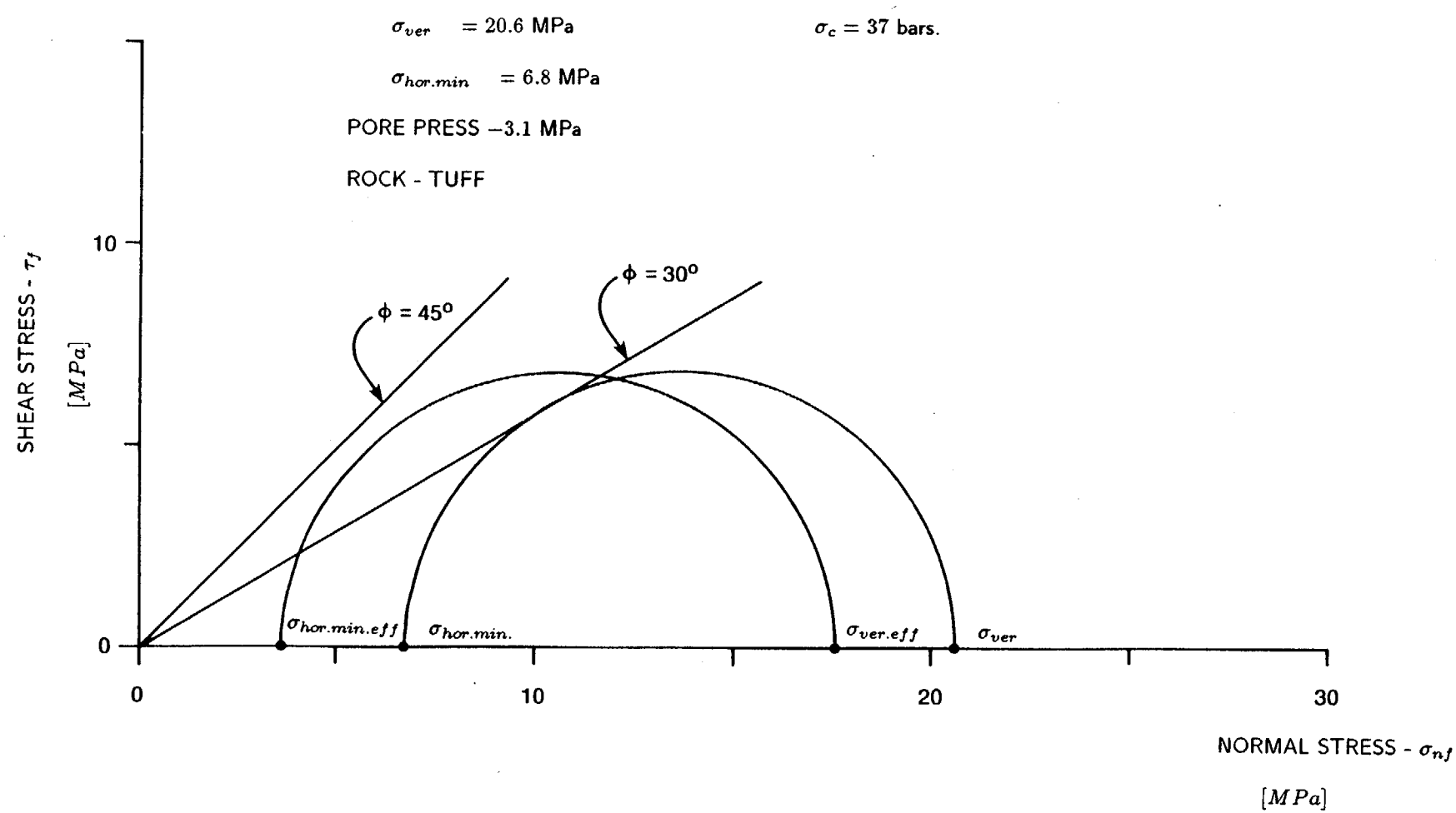
Mohr representation of in situ stress. Borehole G-2, depth 432 m. Yucca Mountain.



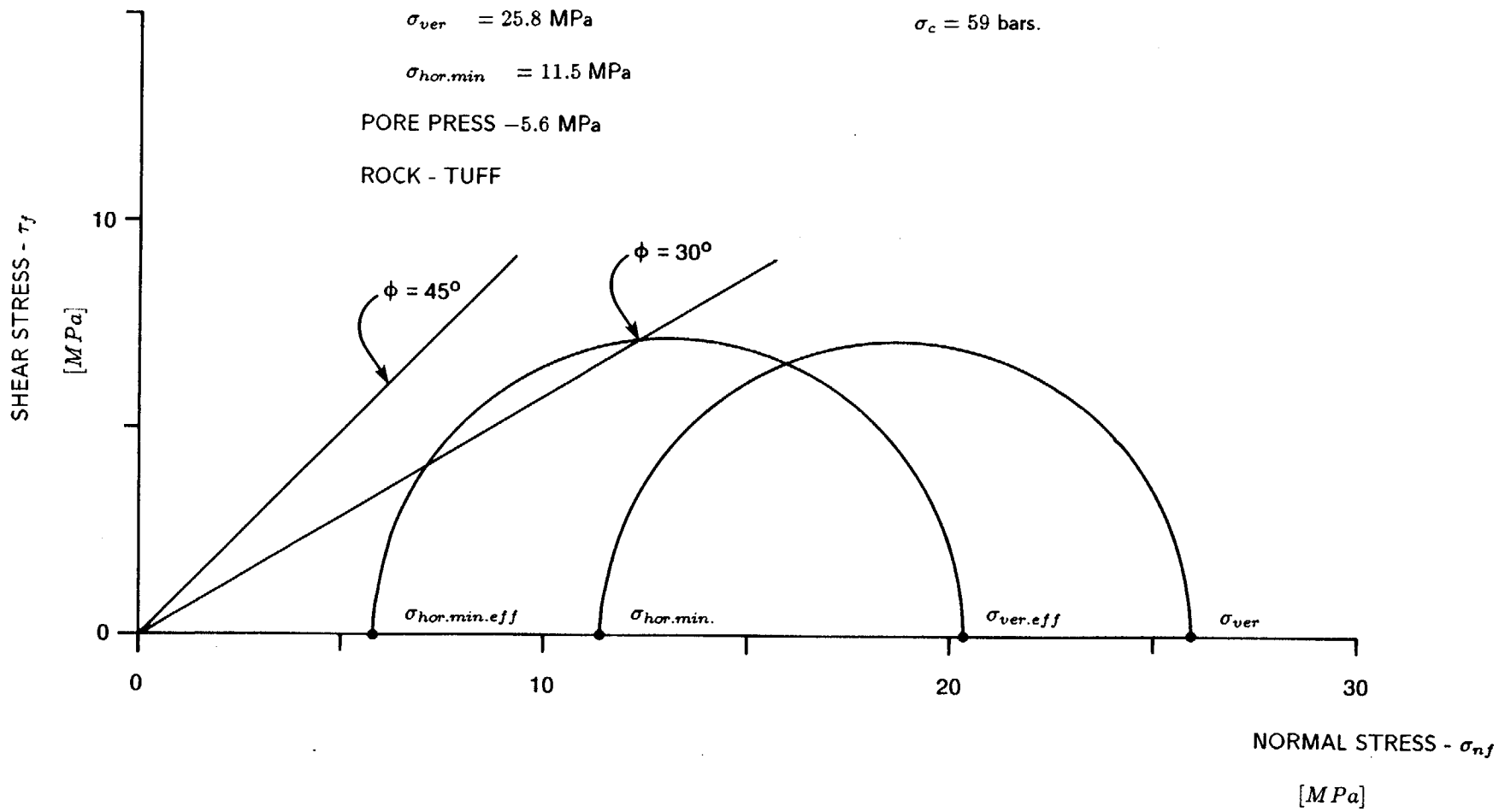
Mohr representation of in situ stress. Borehole G-2, depth 1026 m. Yucca Mountain.



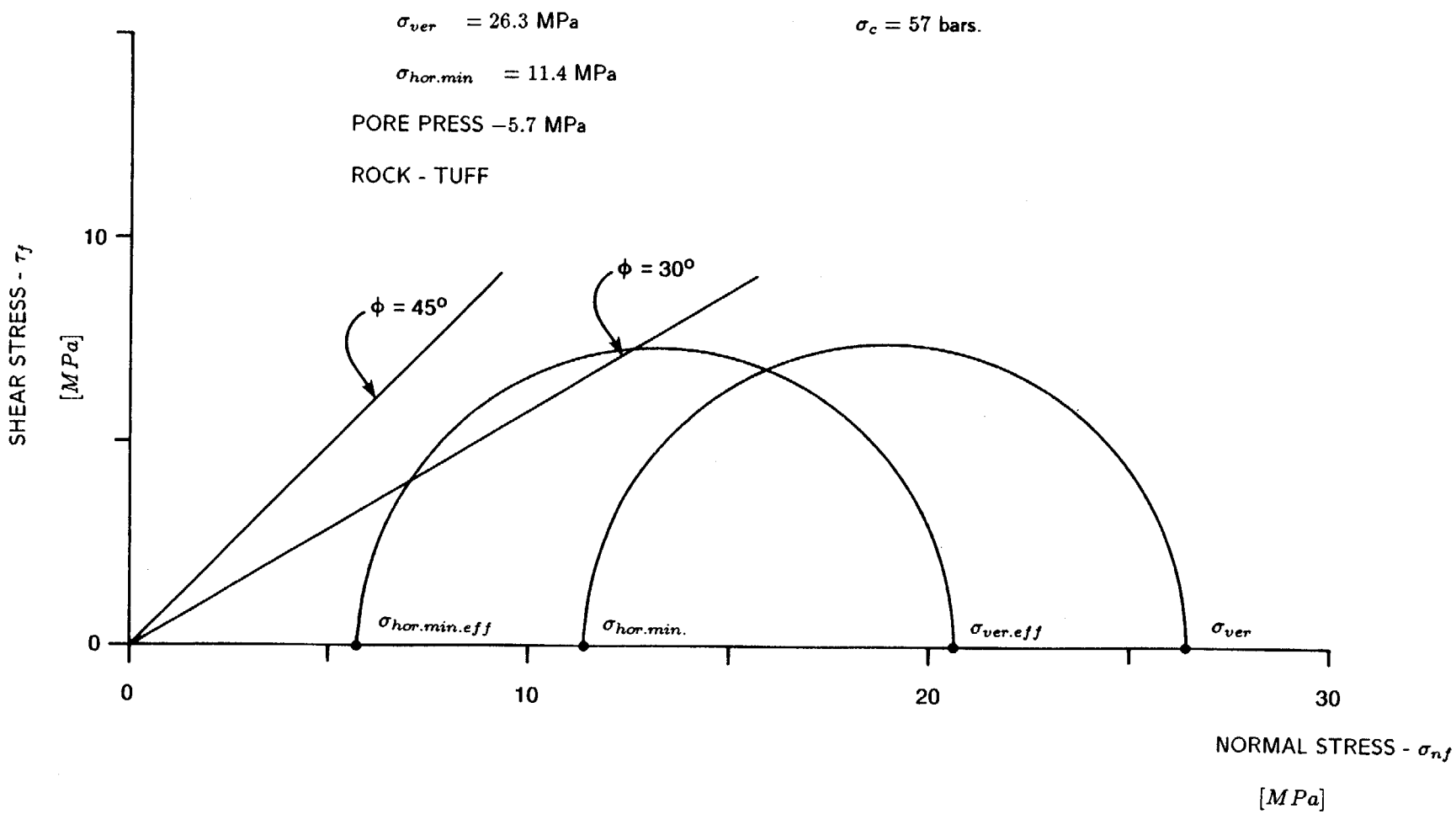
Mohr representation of in situ stress. Borehole G-2, depth 1209 m. Yucca Mountain.



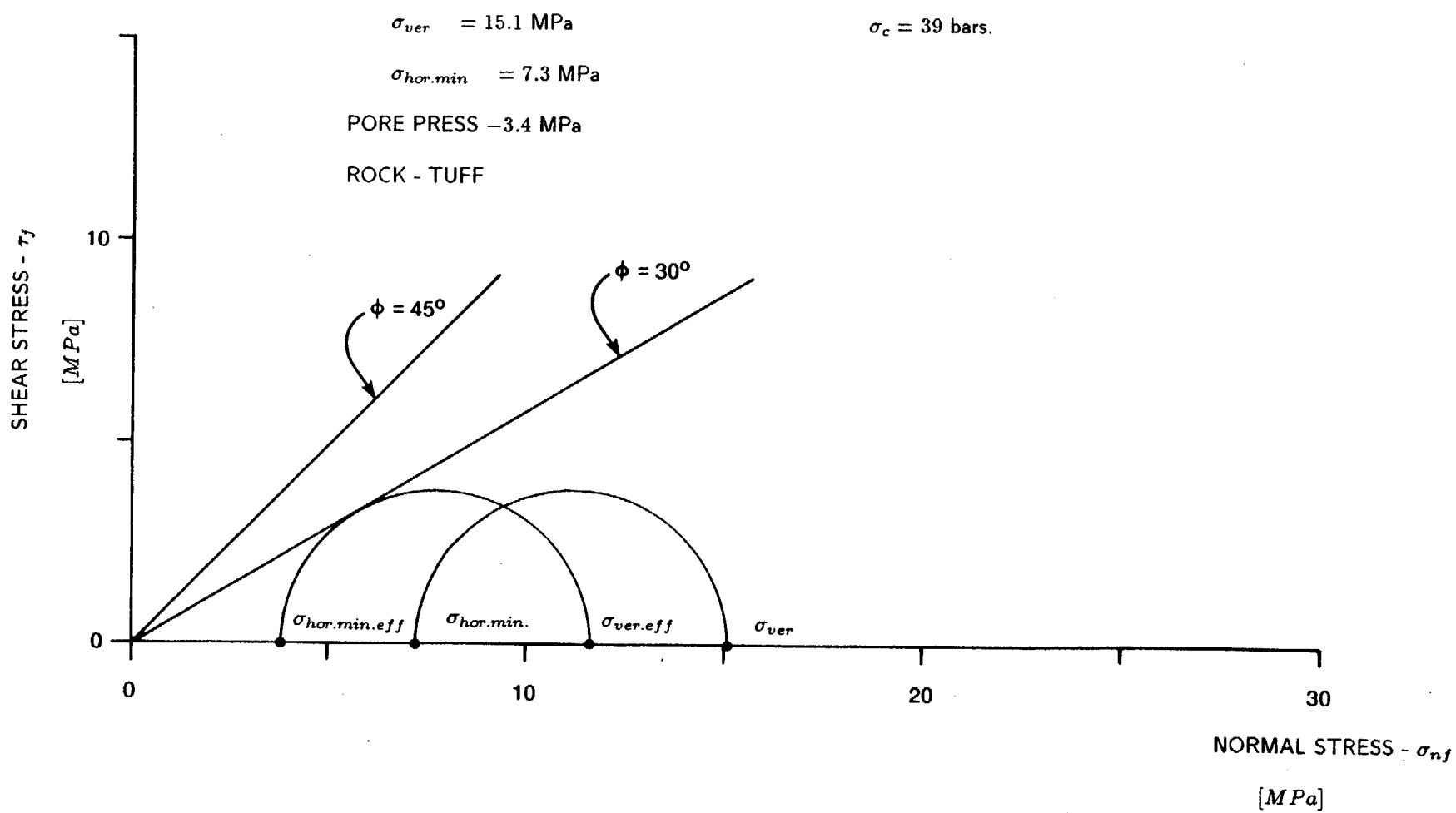
Mohr representation of in situ stress. Borehole G-3, depth 1074 m. Yucca Mountain.



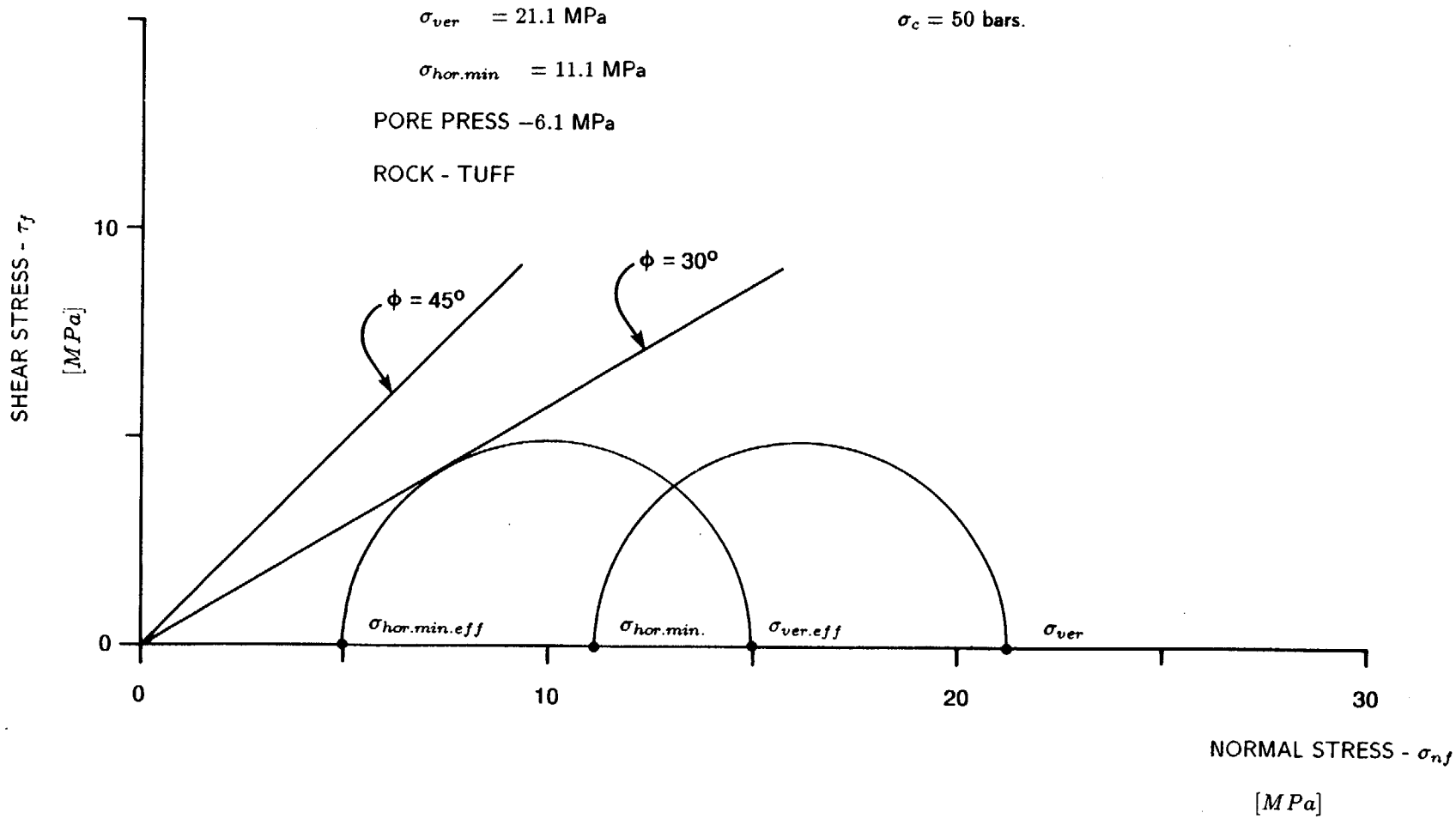
Mohr representation of in situ stress. Borehole G-3, depth 1338 m. Yucca Mountain.



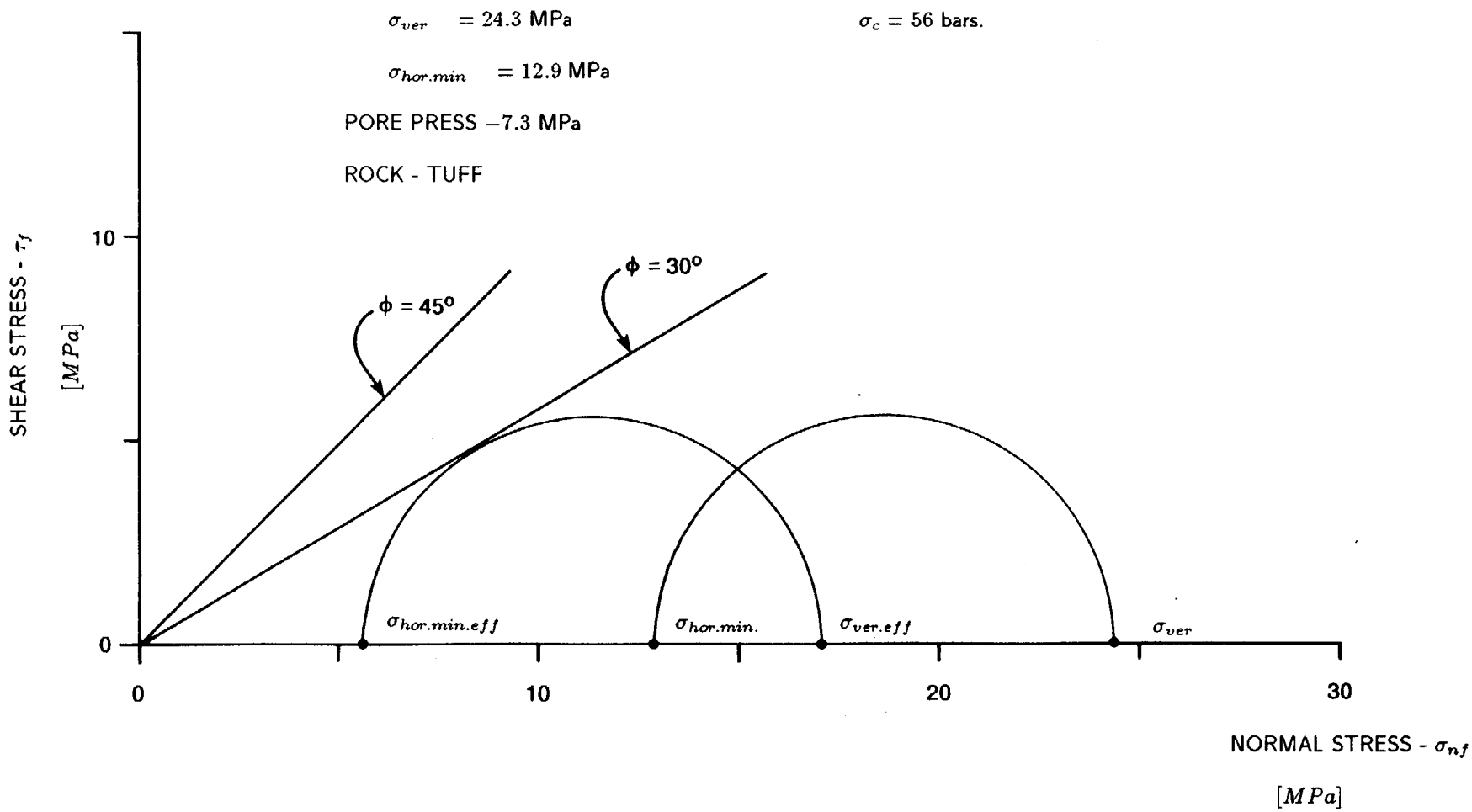
Mohr representation of in situ stress. Borehole G-3, depth 1356 m. Yucca Mountain.



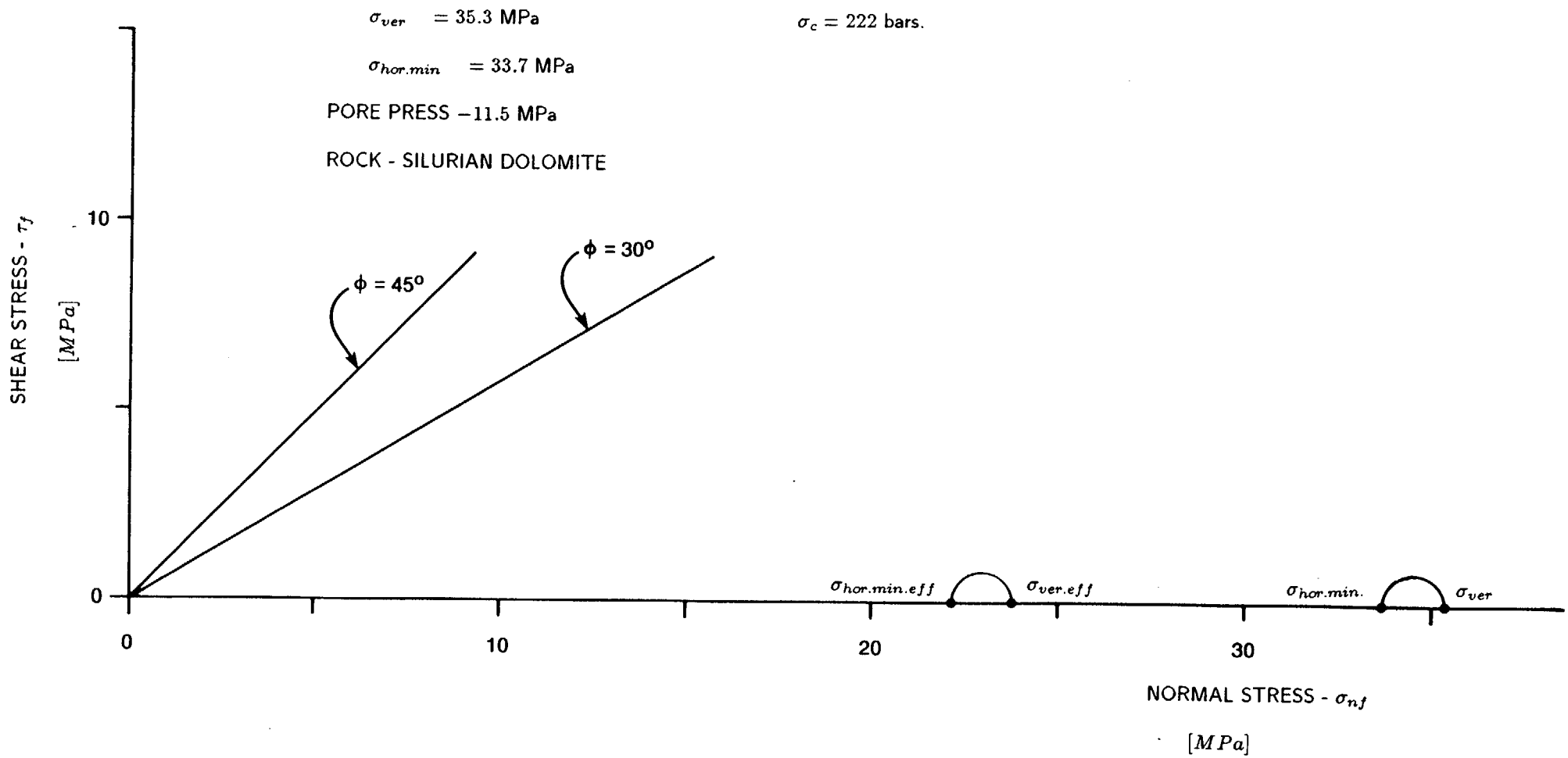
Mohr representation of in situ stress. Borehole UE-25p#1, depth 731 m. Yucca Mountain.



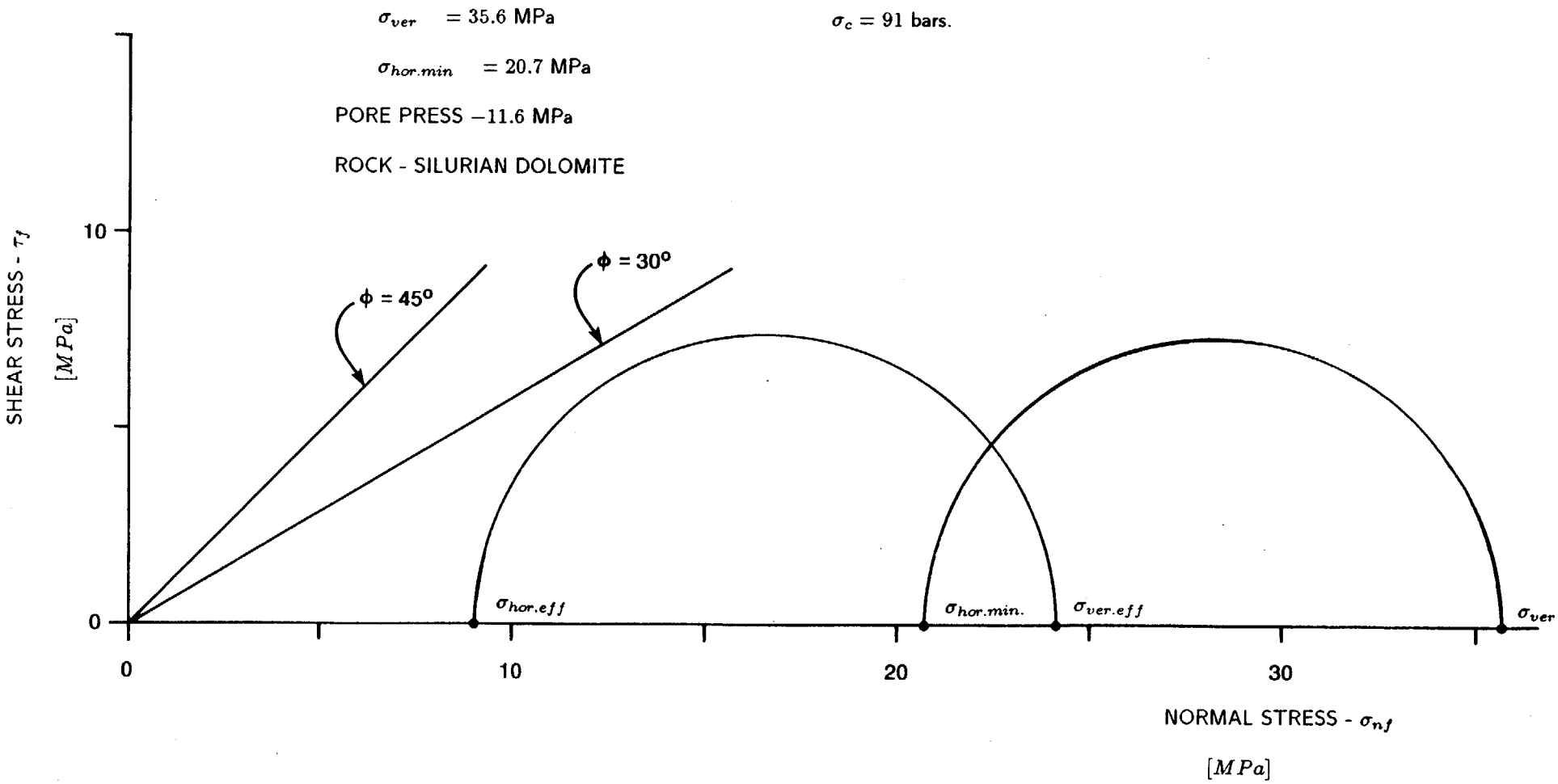
Mohr representation of in situ stress. Borehole UE-25p#1, depth 1001 m. Yucca Mountain.



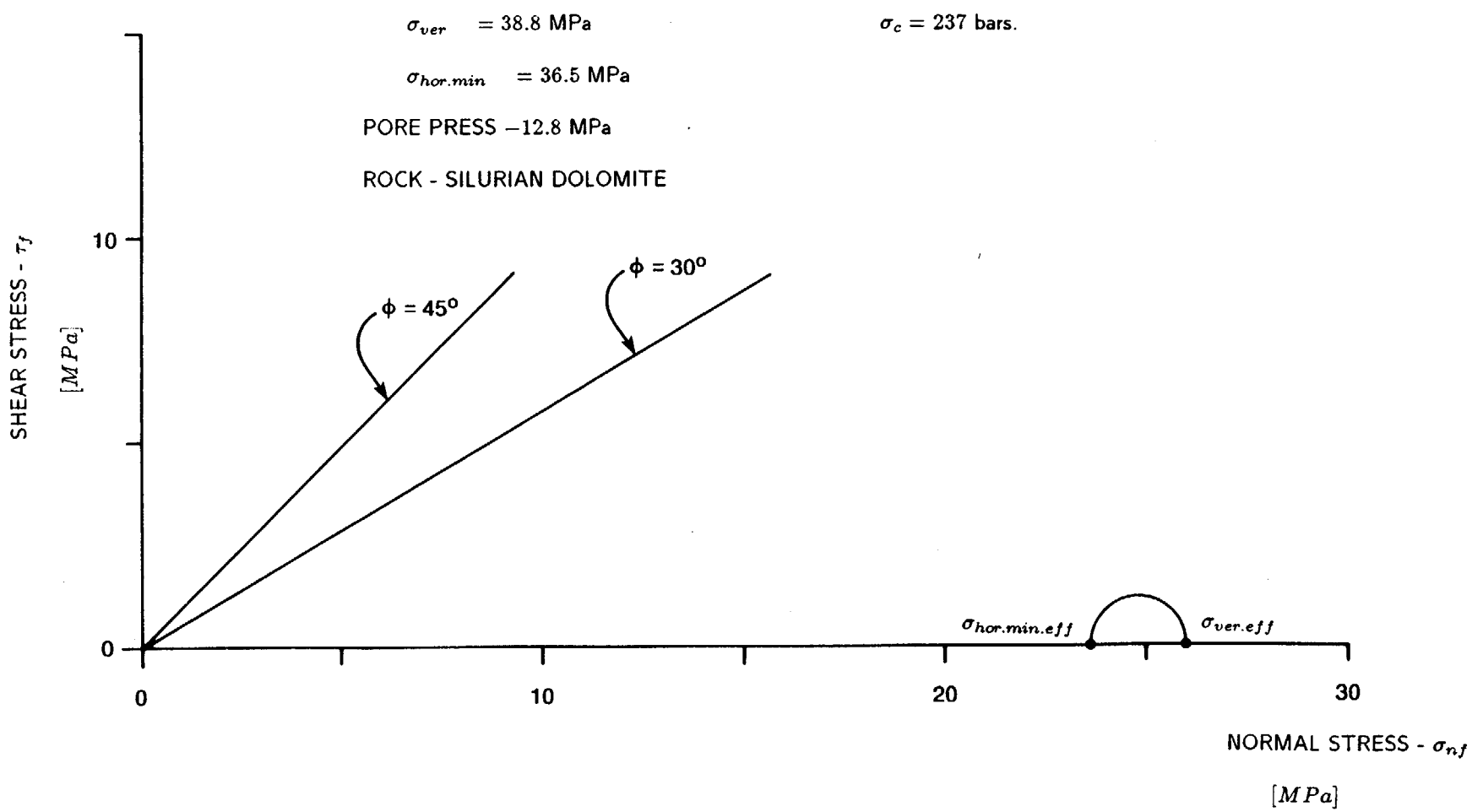
Mohr representation of in situ stress. Borehole UE-25p#1, depth 1131 m. Yucca Mountain.



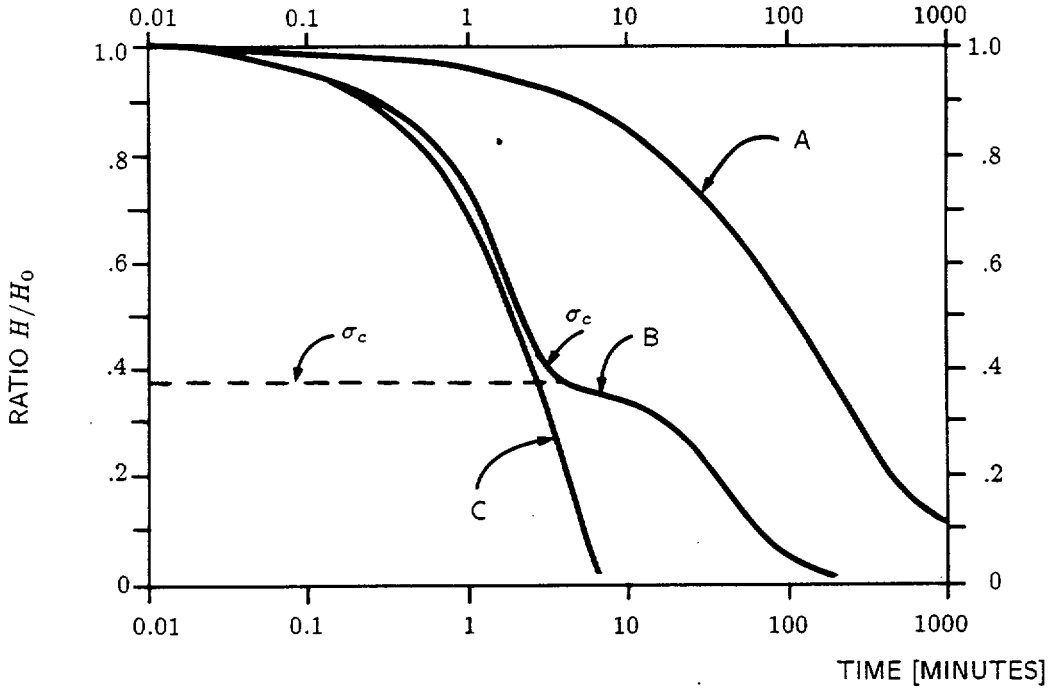
Mohr representation of in situ stress. Borehole UE-25p#1, depth 1564 m. Yucca Mountain.



Mohr representation of in situ stress. Borehole UE-25p#1, depth 1573 m. Yucca Mountain.



Mohr representation of in situ stress. Borehole UE-25p#1, depth 1693 m. Yucca Mountain.



EXPLANATION:

H - HYDRAULIC PRESSURE AT TIME t;

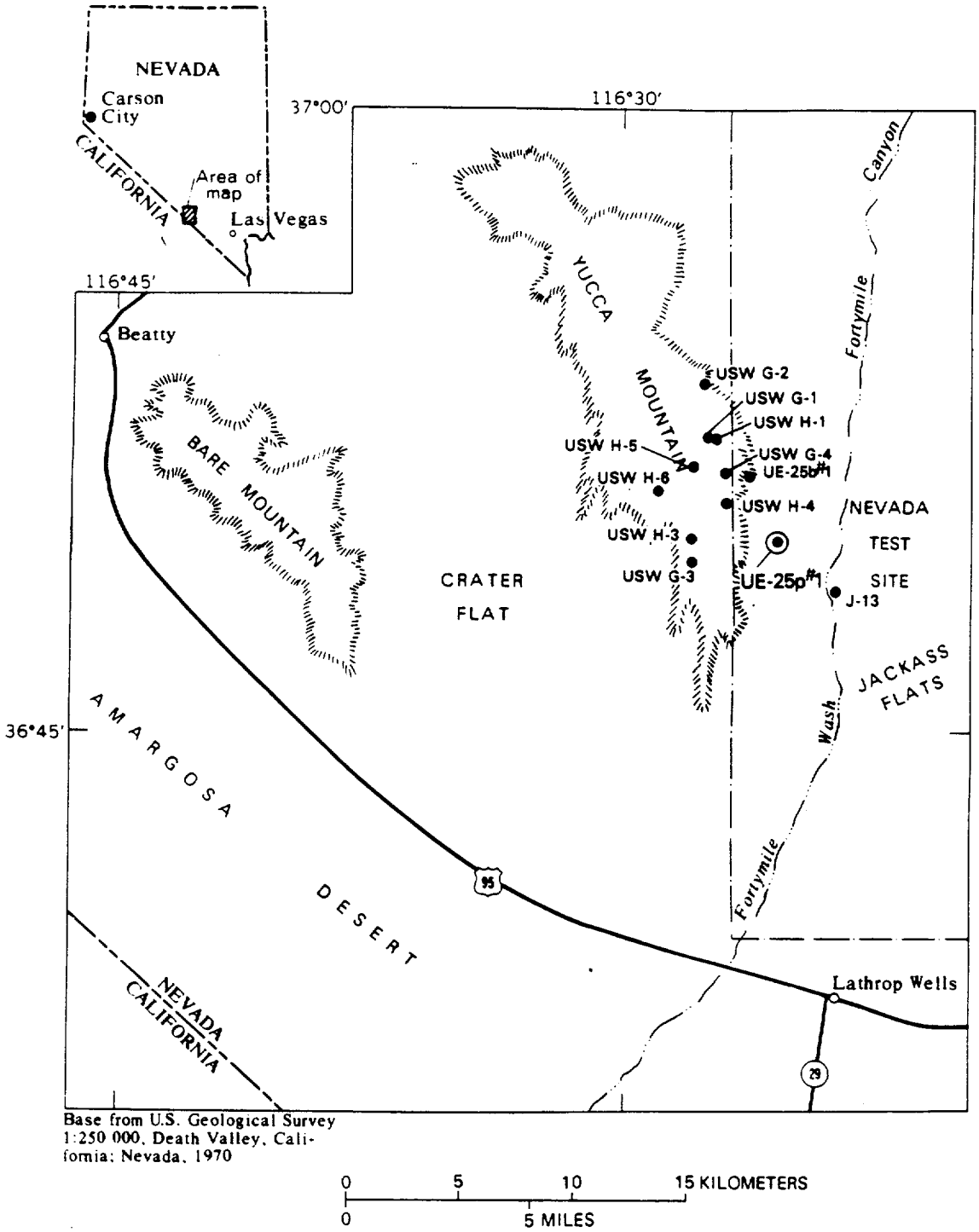
H_0 - HYDRAULIC PRESSURE AT THE START OF A TEST;

A - HYDRAULIC PRESSURE DECAY CURVE FOR $H_0 < \sigma_c$;

B - HYDRAULIC PRESSURE DECAY CURVE FOR $0 < \sigma_c < H_0$; AND

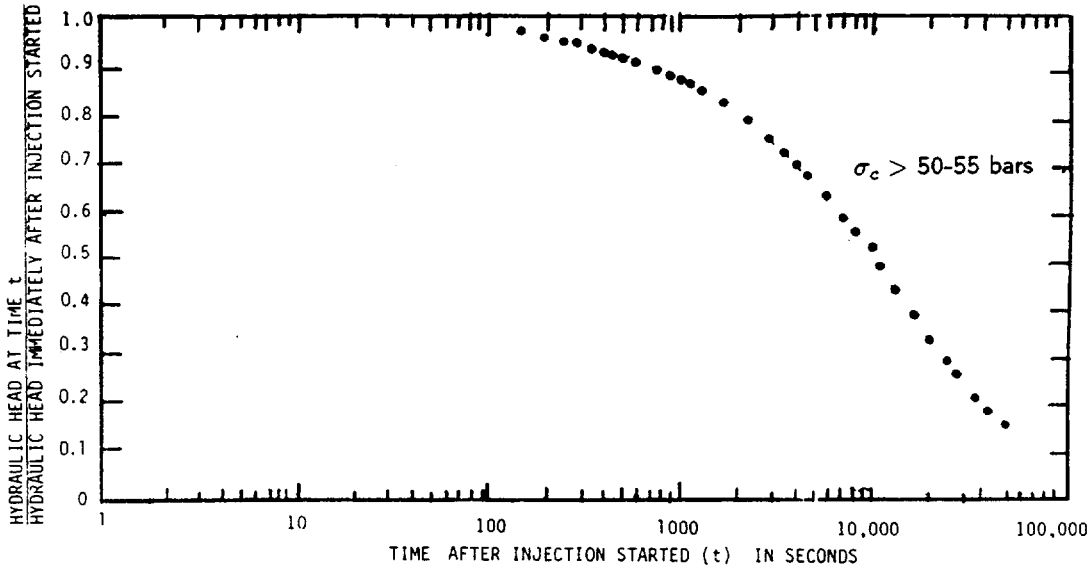
C - HYDRAULIC PRESSURE DECAY CURVE FOR $\sigma_c \rightarrow 0$.

Interpretation key for the Cooper-Bredehoeft injection tests performed in the Yucca Mountain area.



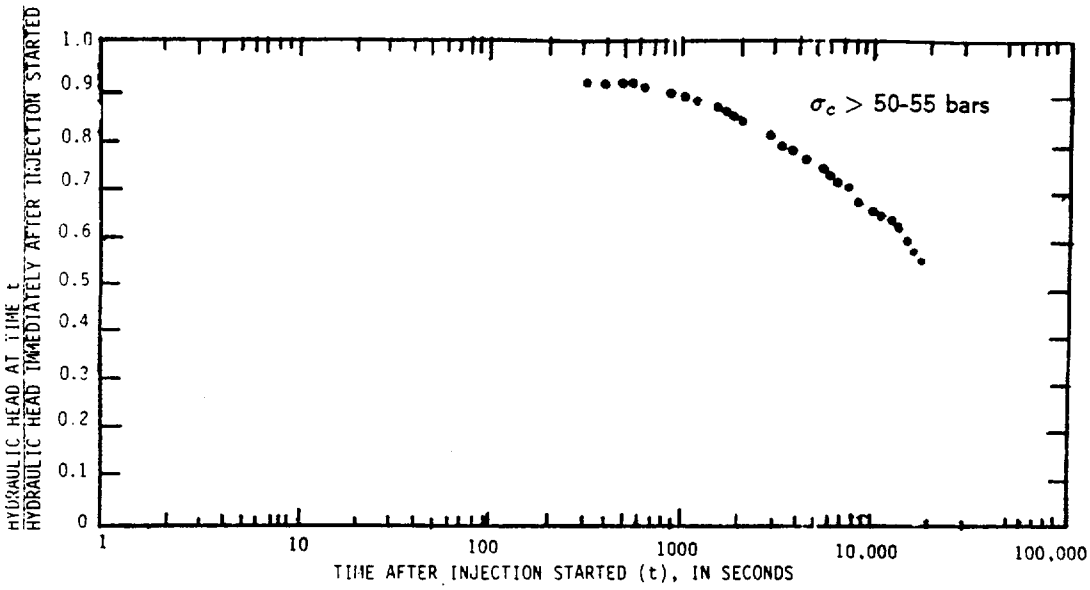
Base from U.S. Geological Survey 1:250 000, Death Valley, California; Nevada, 1970

Location of wells where the Cooper-Bredehoeft injection tests were performed. From Craig and Johnson, 1984.

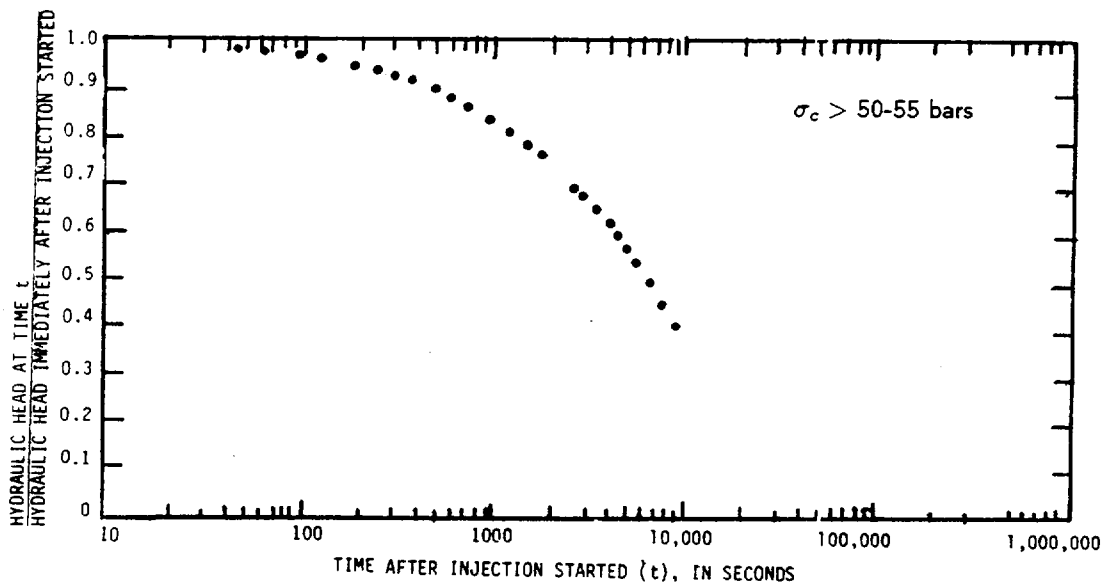


--Injection-test data for depth interval from 811 to 1,829 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-1. From Rush et al., 1983.

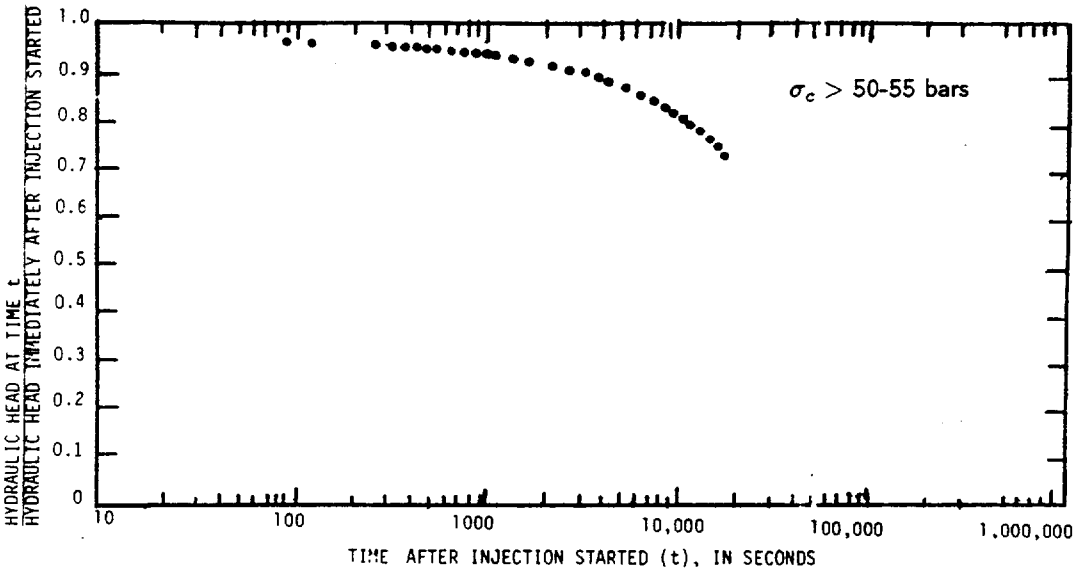


--Injection-test data for depth interval from 926 to 1,829 meters.

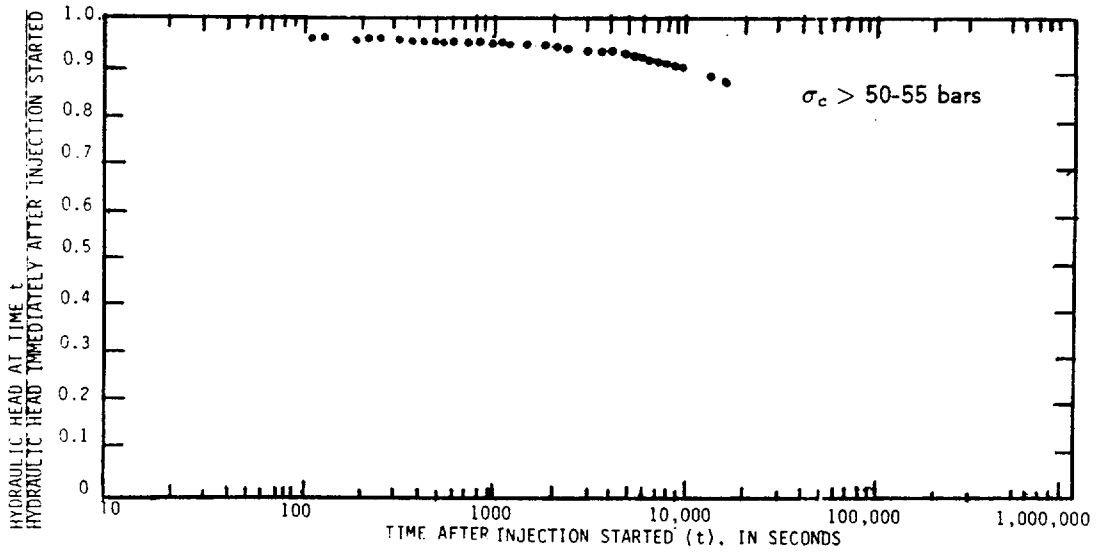


Injection-test data for depth interval from 1,200 to 1,829 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-1. From Rush et al., 1983.

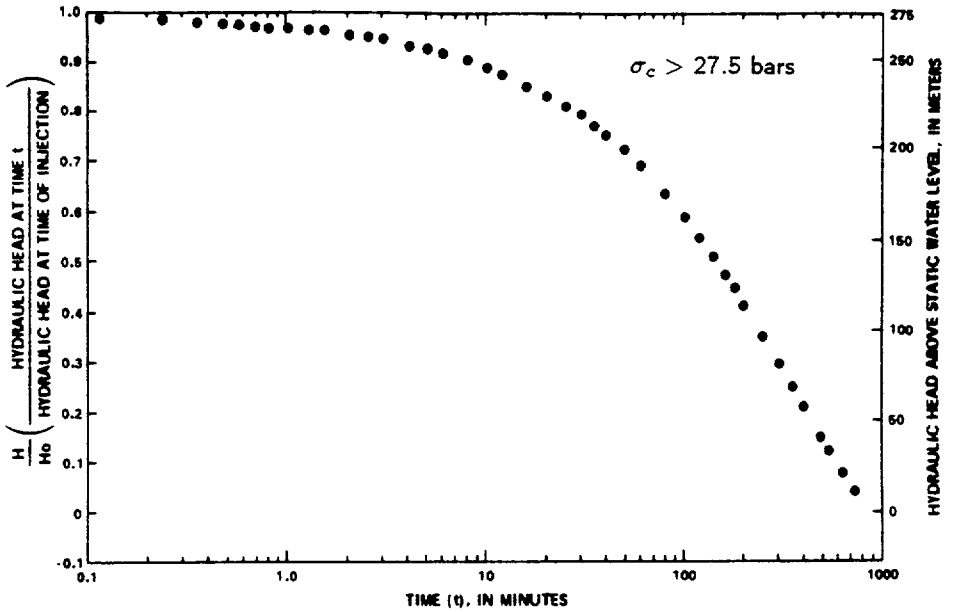


-Injection-test data for depth interval from 1,407 to 1,829 meters.

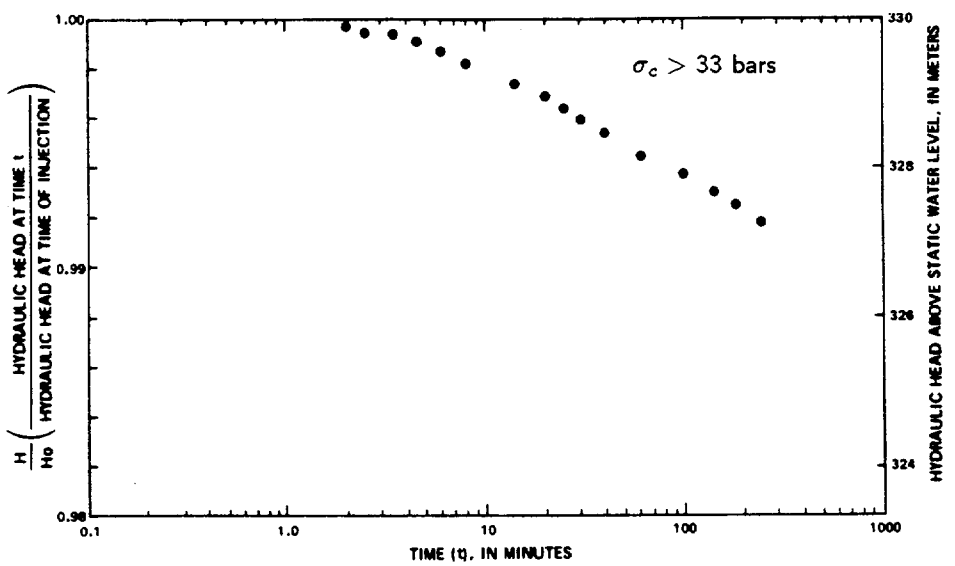


Injection-test data for depth interval from 1,621 to 1,829 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-1. From Rush et al., 1983.

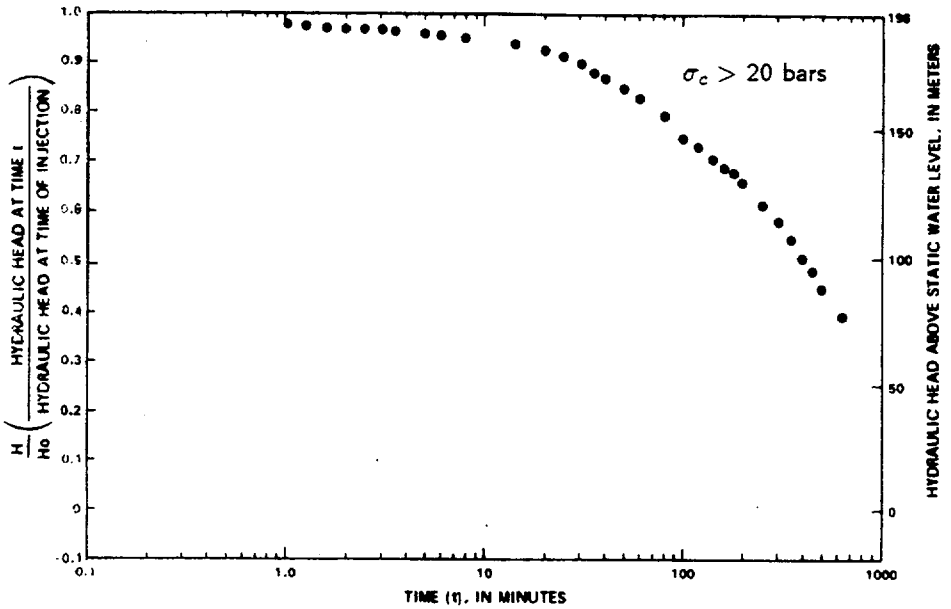


-Packer-injection test 3A, depth interval from 649 to 683 meters.



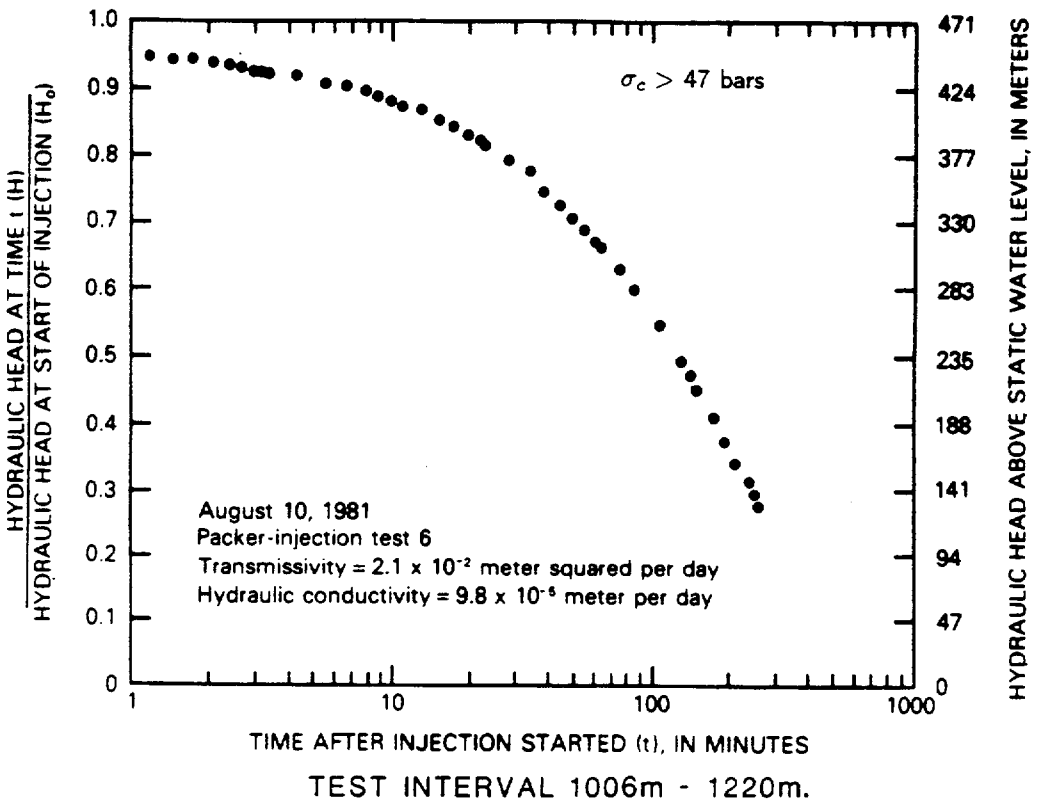
Packer-injection test 9, depth interval from 1,118 to 1,152 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.



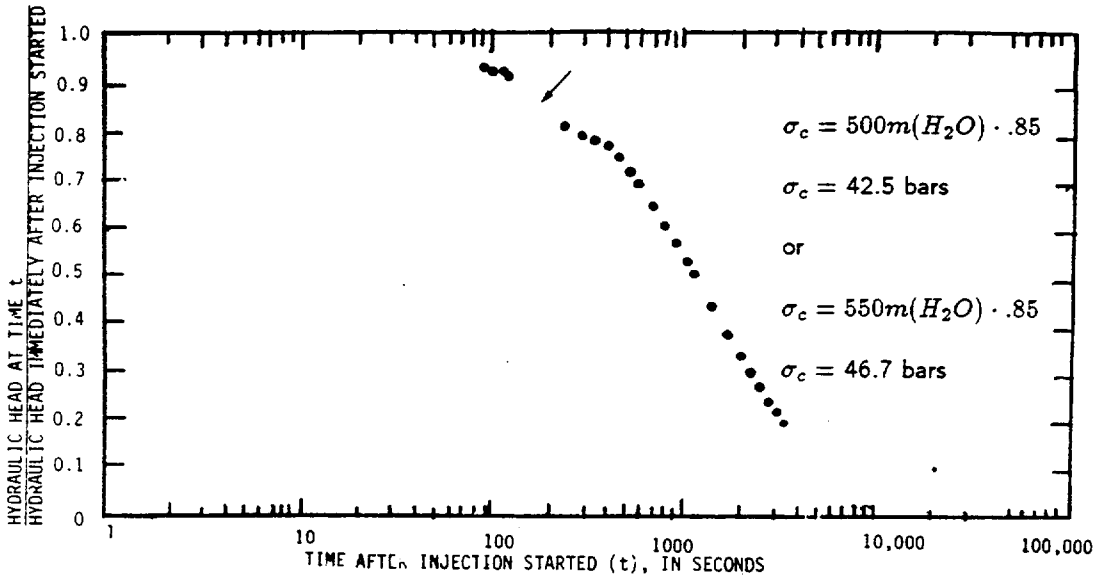
Packer-injection test 10, depth interval from 1,155 to 1,220 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.



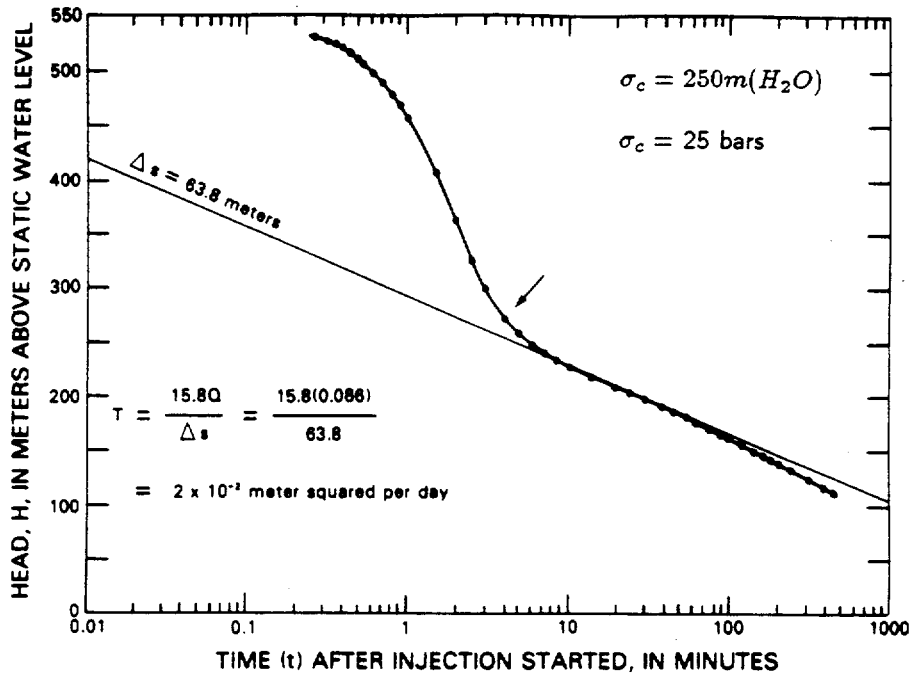
TEST INTERVAL 1006m - 1220m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.



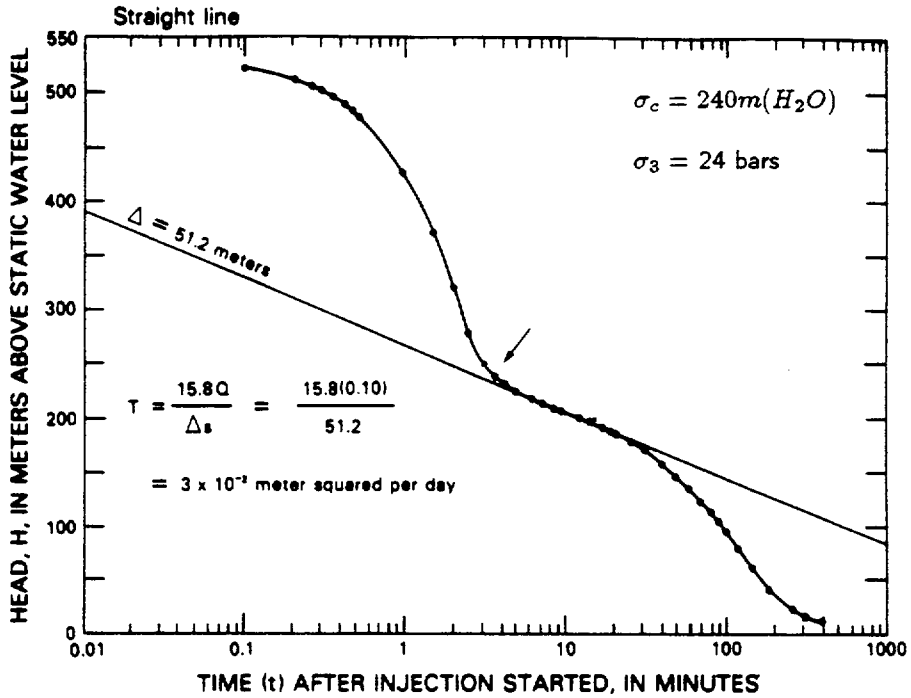
--Injection-test data for depth interval from 687 to 697 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-1. From Rush et al., 1983.

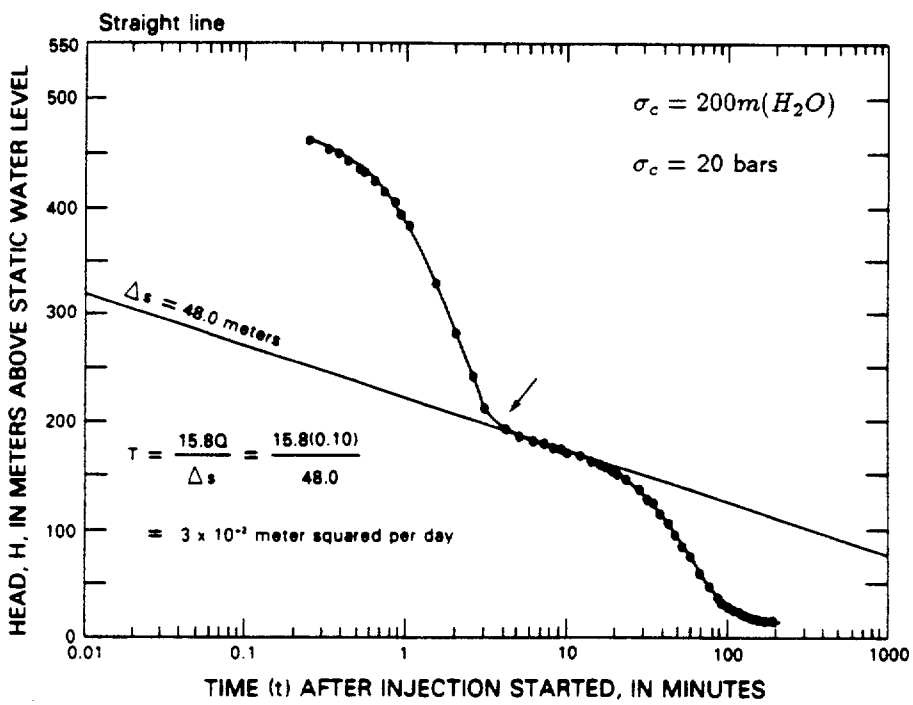


TEST INTERVAL 851m - 917m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-3. From Thordarson et al., 1985.

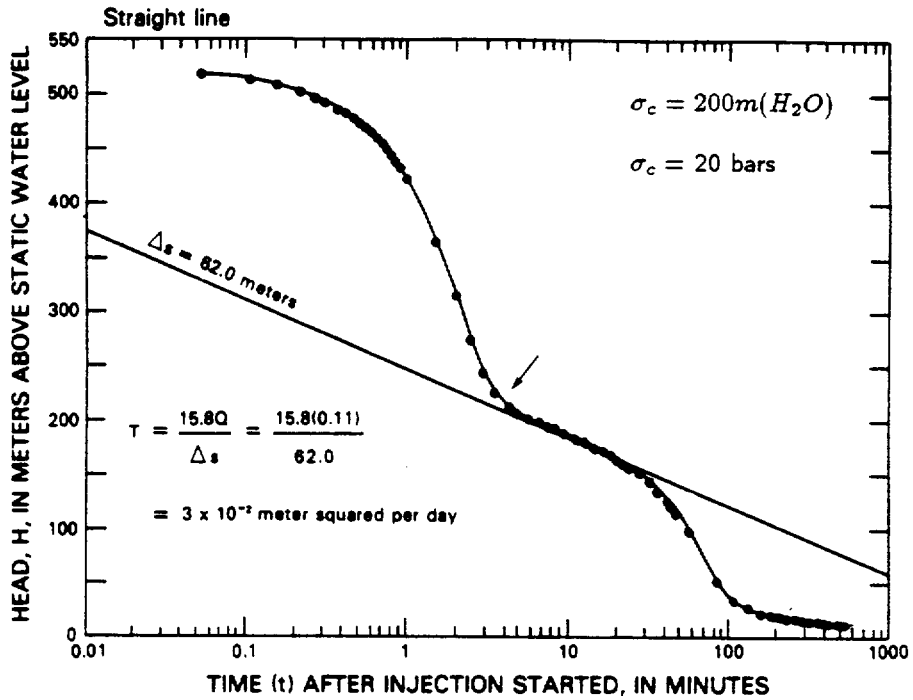


TEST INTERVAL 911m - 972m.

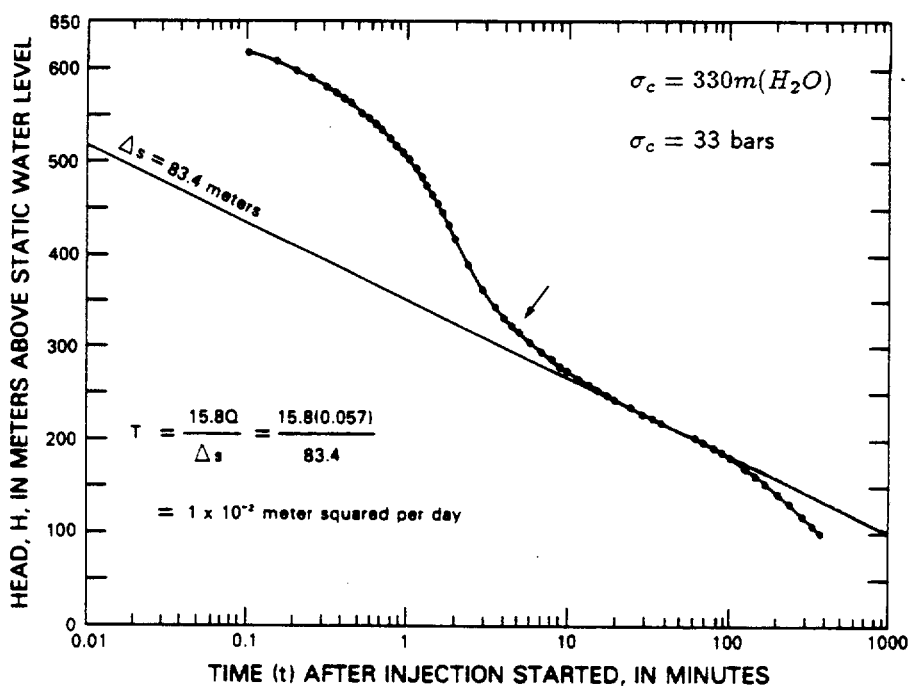


TEST INTERVAL 972m - 1219m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-3. From Thordarson et al., 1985.

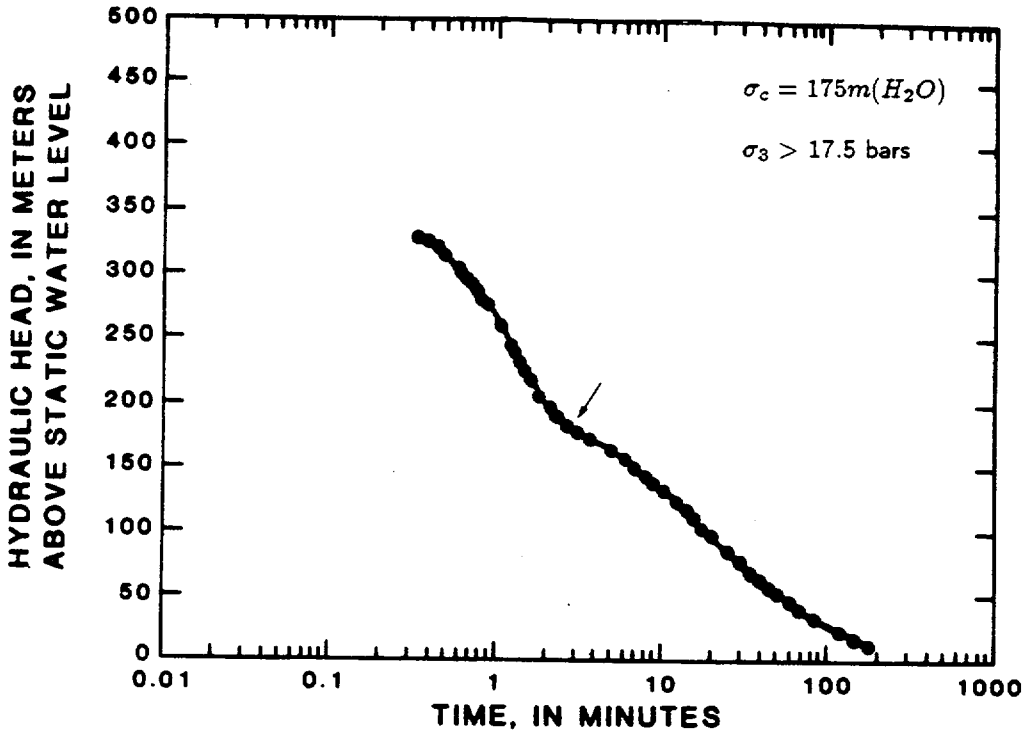


TEST INTERVAL 1063m - 1124m.

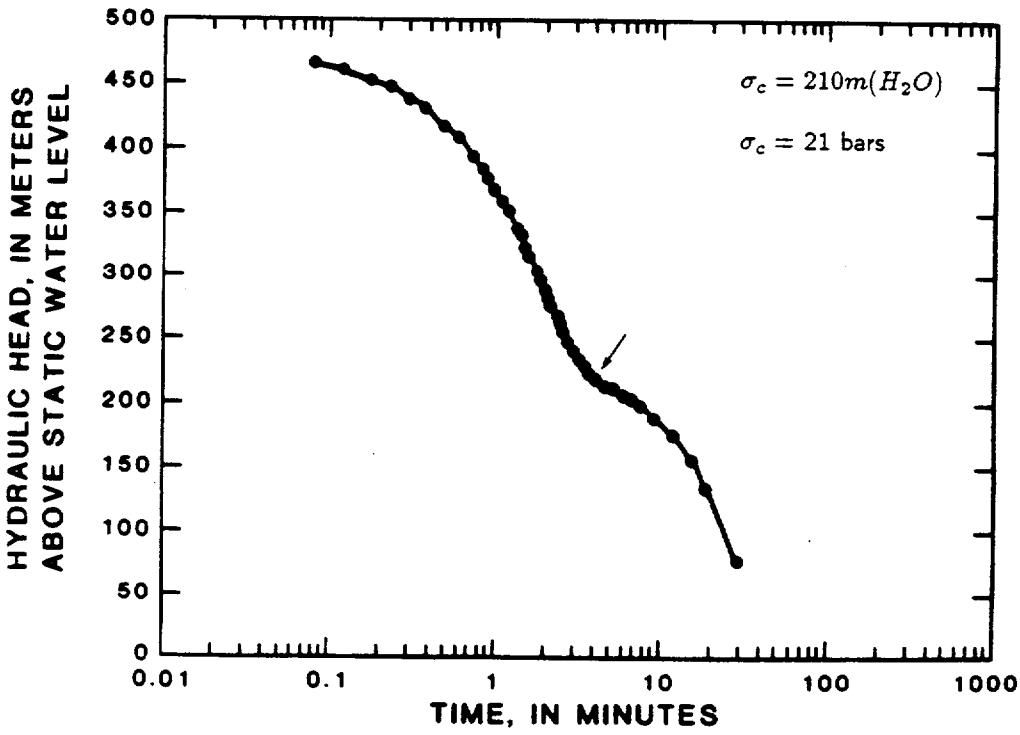


TEST INTERVAL 1126m - 1219m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-3. From Thordarson et al., 1985.

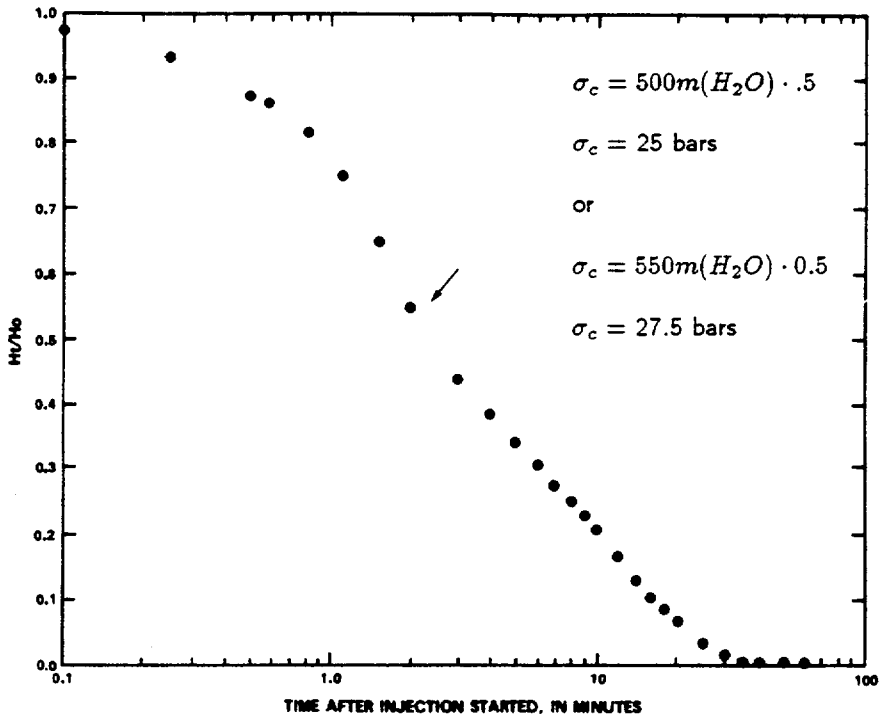


TEST INTERVAL 555m - 604m.



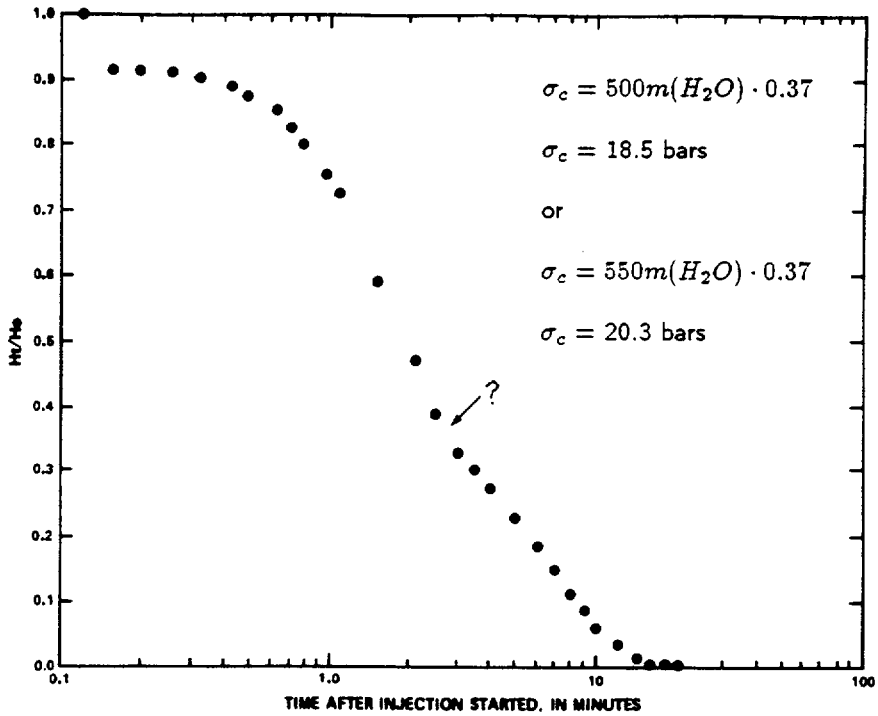
TEST INTERVAL 604m - 652m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.



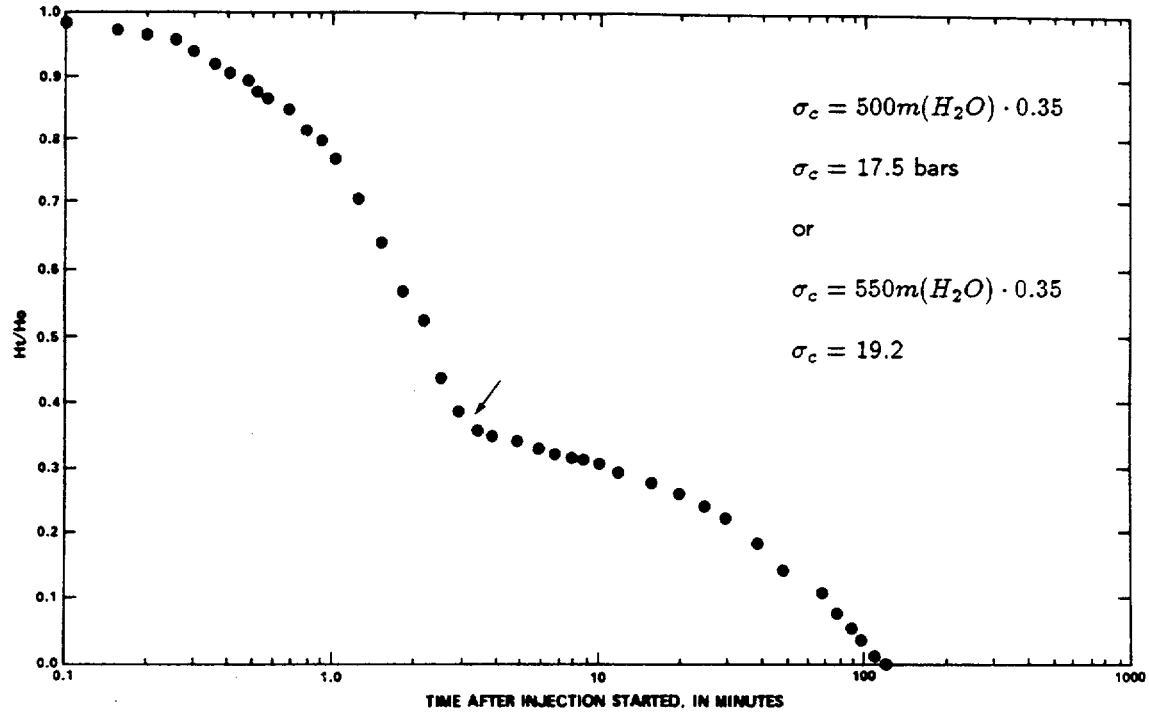
Packer-injection test for depth interval from 790 to 796 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.

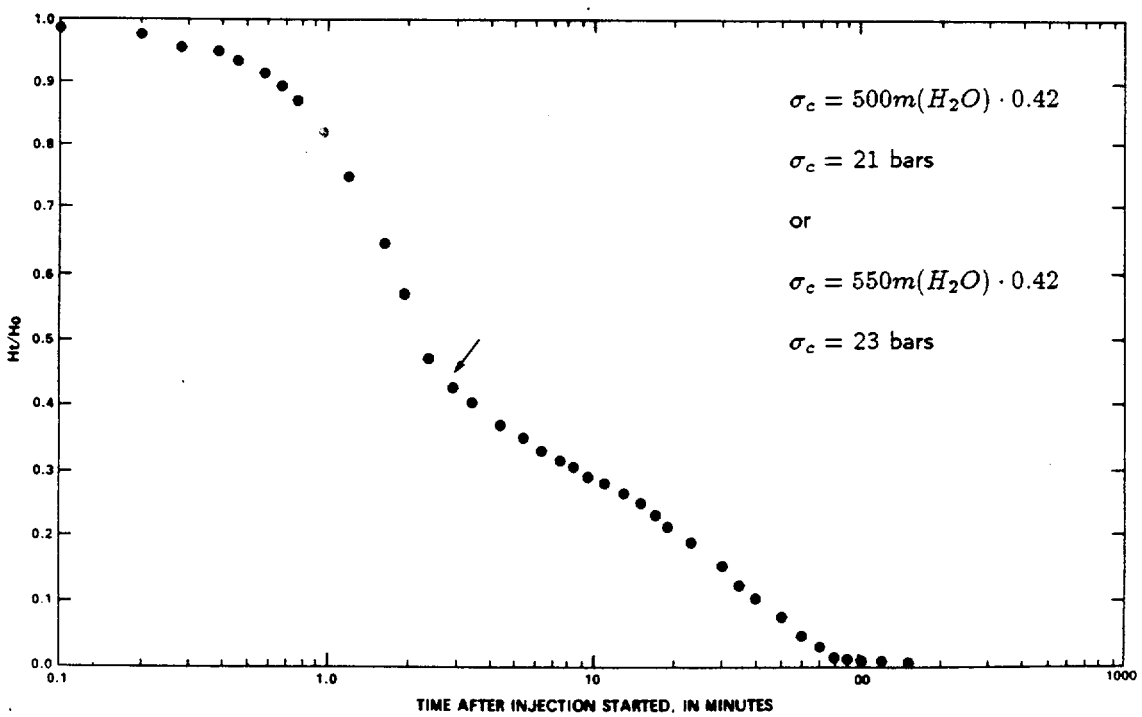


-Packer injection test for depth interval from 815 to 834 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.

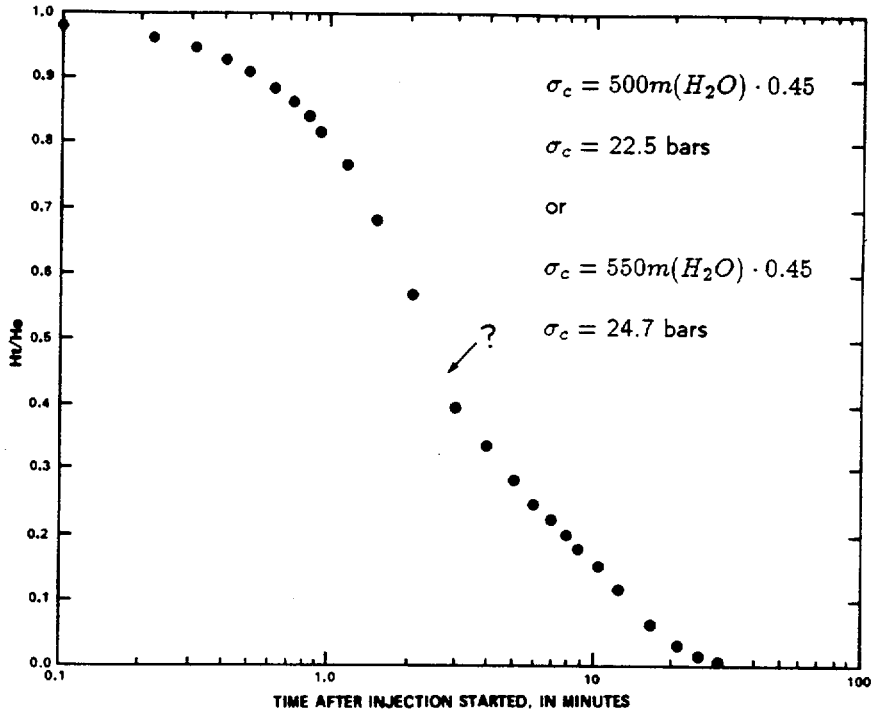


-Packer-injection test for depth interval from 949 to 1,010 meters.



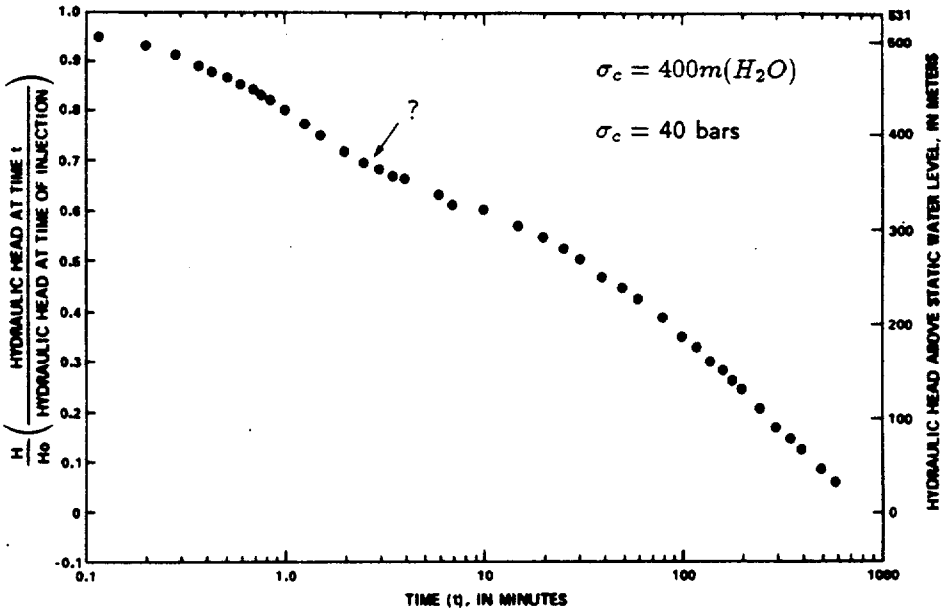
Packer-injection test for depth interval form 1,015 to 1,033 meters
(first test).

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.



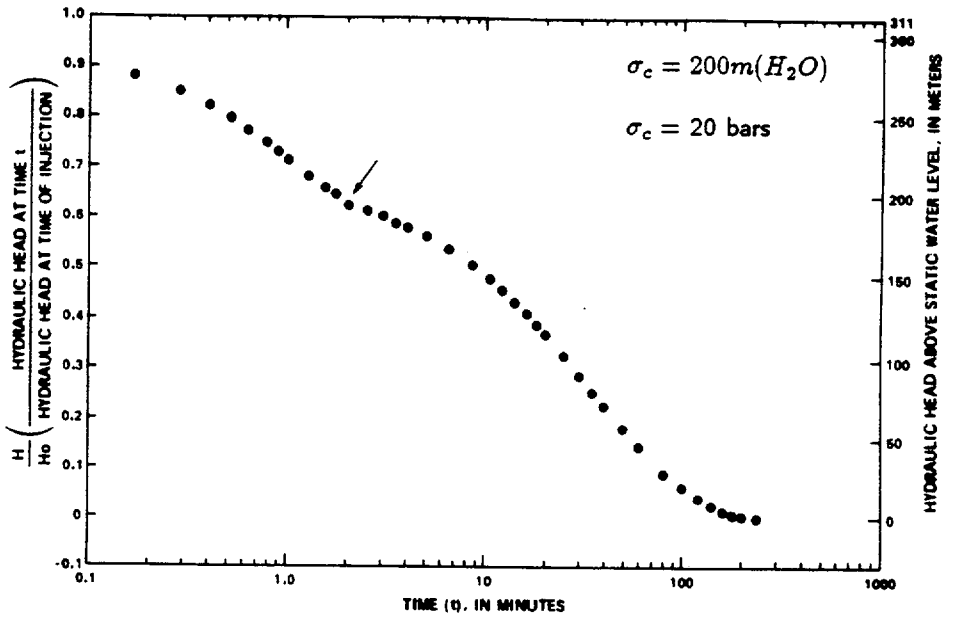
Packer-injection test for depth interval from 1,052 to 1,219 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.

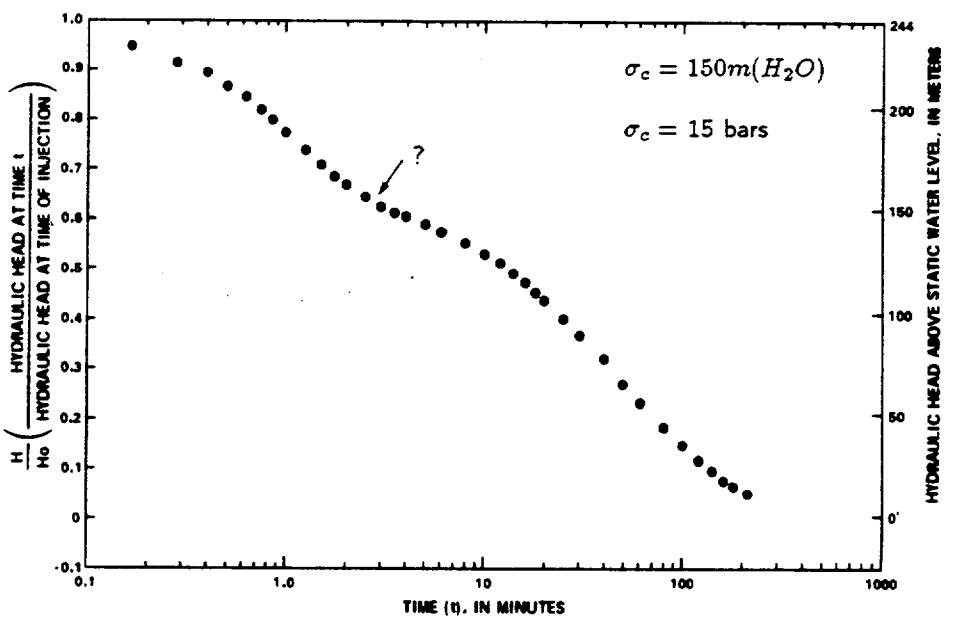


-Packer-injection test 3, depth interval from 649 to 683 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.

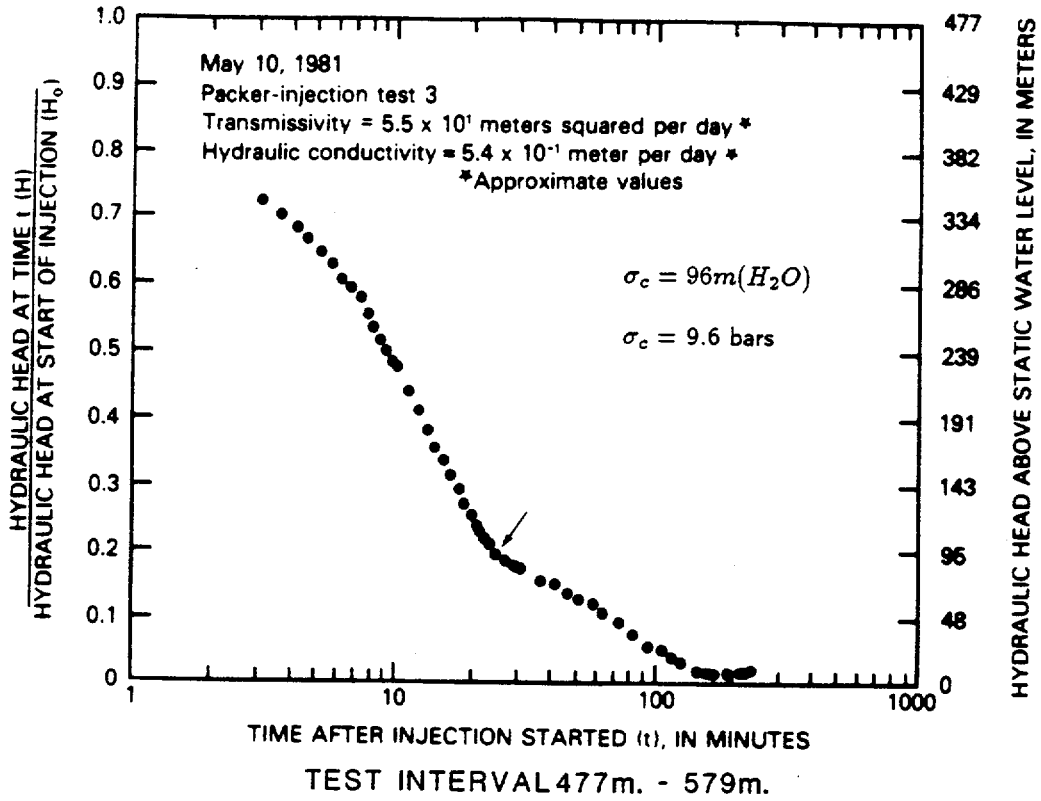


-Packer-injection test 7, depth interval from 835 to 869 meters.



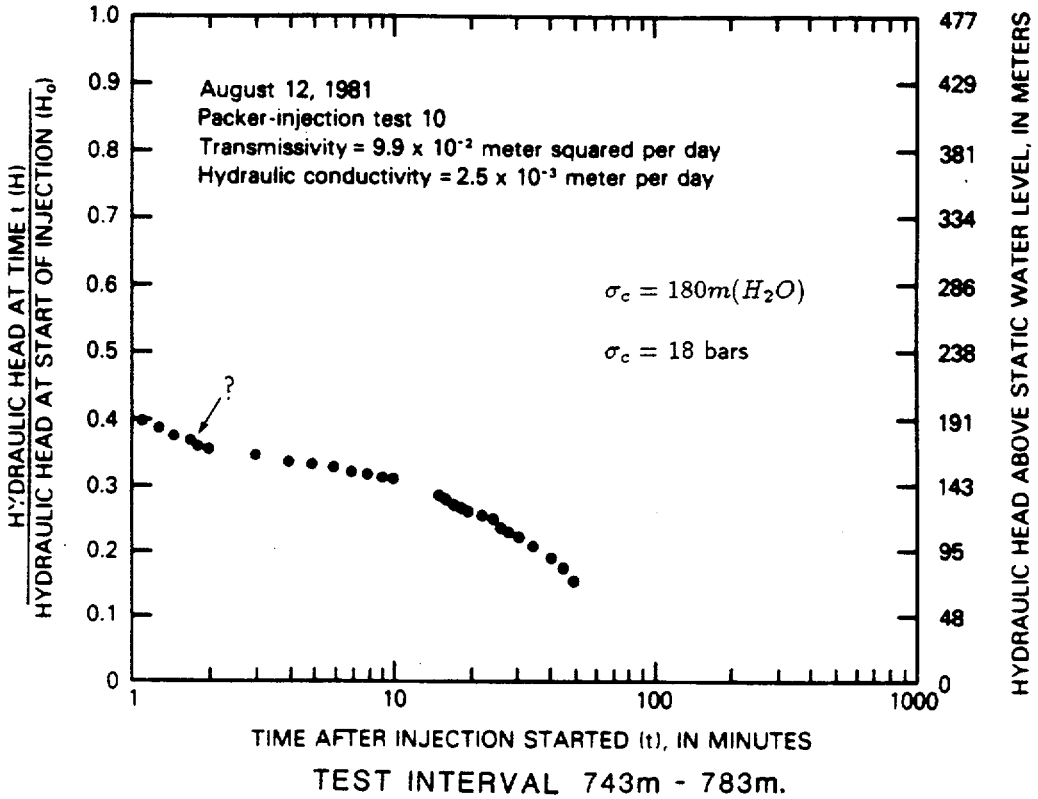
Packer-injection test 8, depth interval from 871 to 1,220 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.



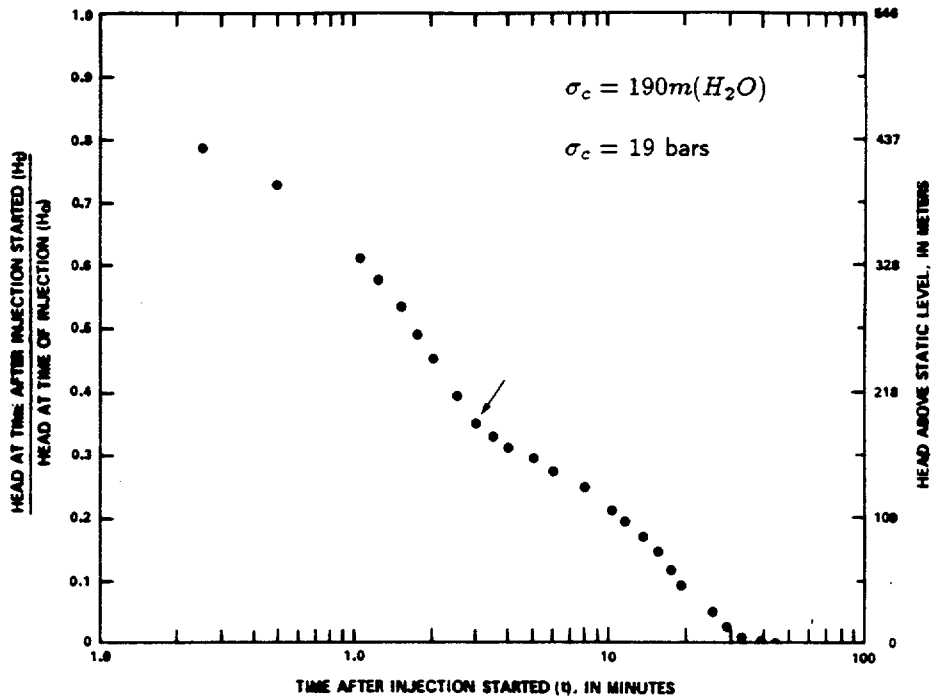
TEST INTERVAL 477m. - 579m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1983.

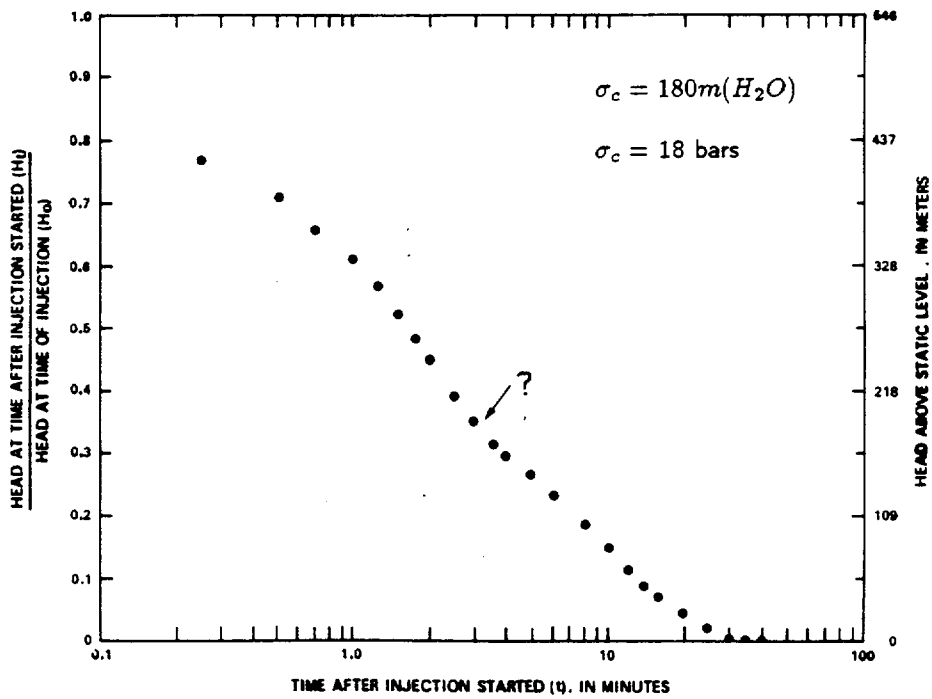


TEST INTERVAL 743m - 783m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1983.

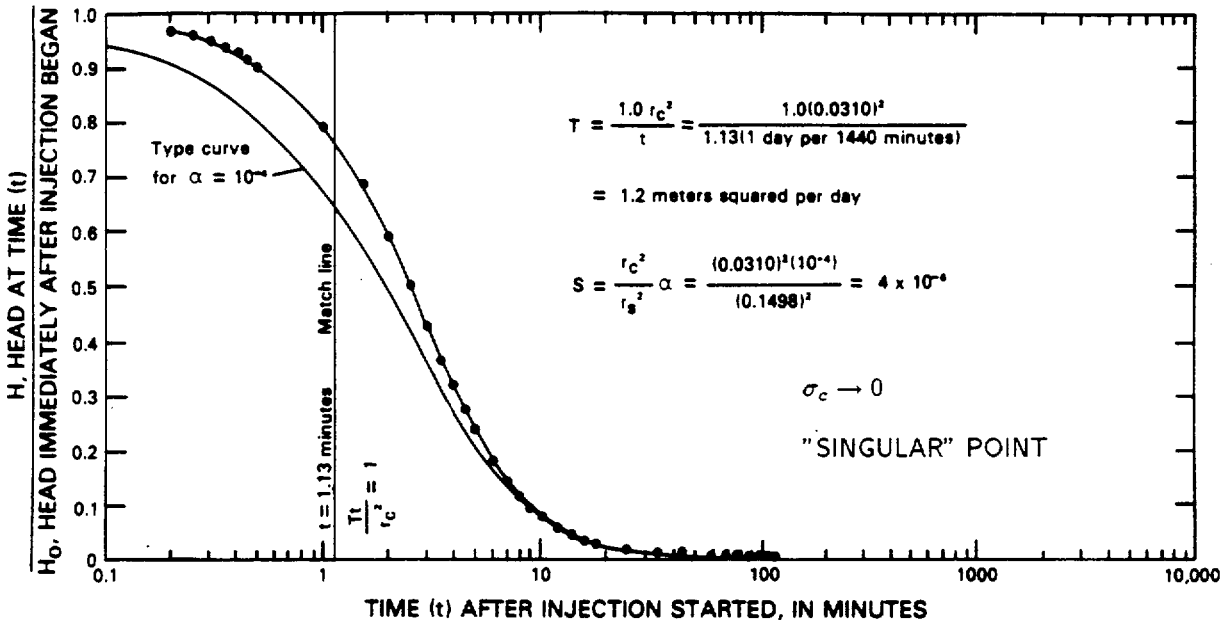


-Packer-injection test for depth interval from 792 to 838 meters.



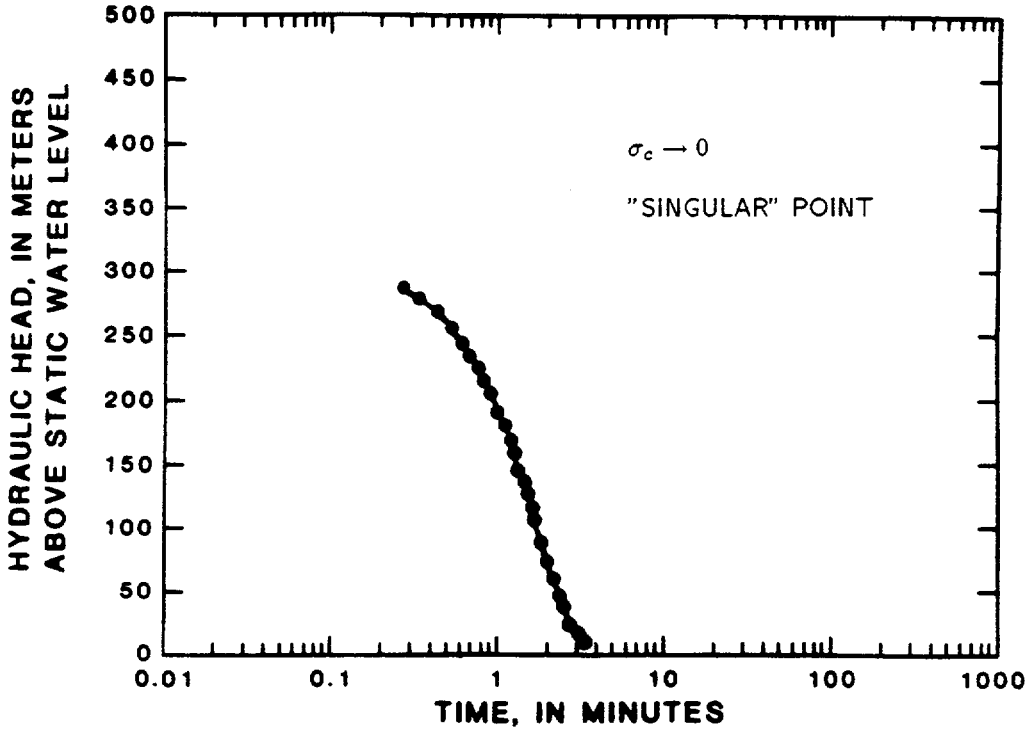
Packer-injection test for depth interval from 802 to 826 meters (first test).

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley (1984).



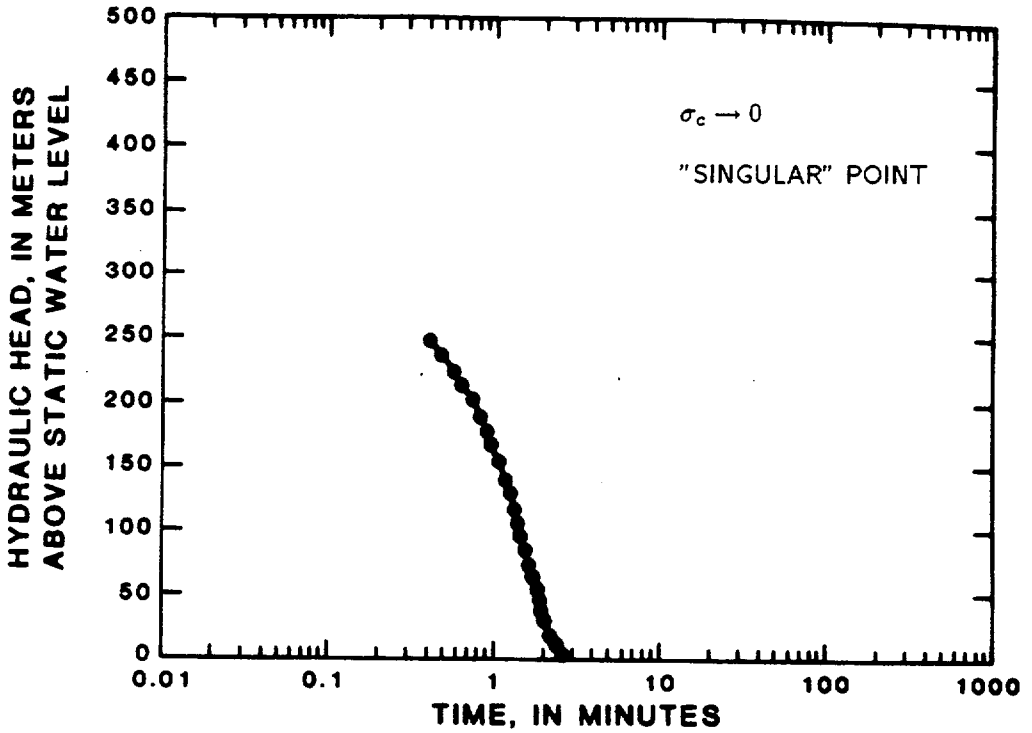
TEST INTERVAL 792m - 850m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-3. From Thordarson et al., 1985.

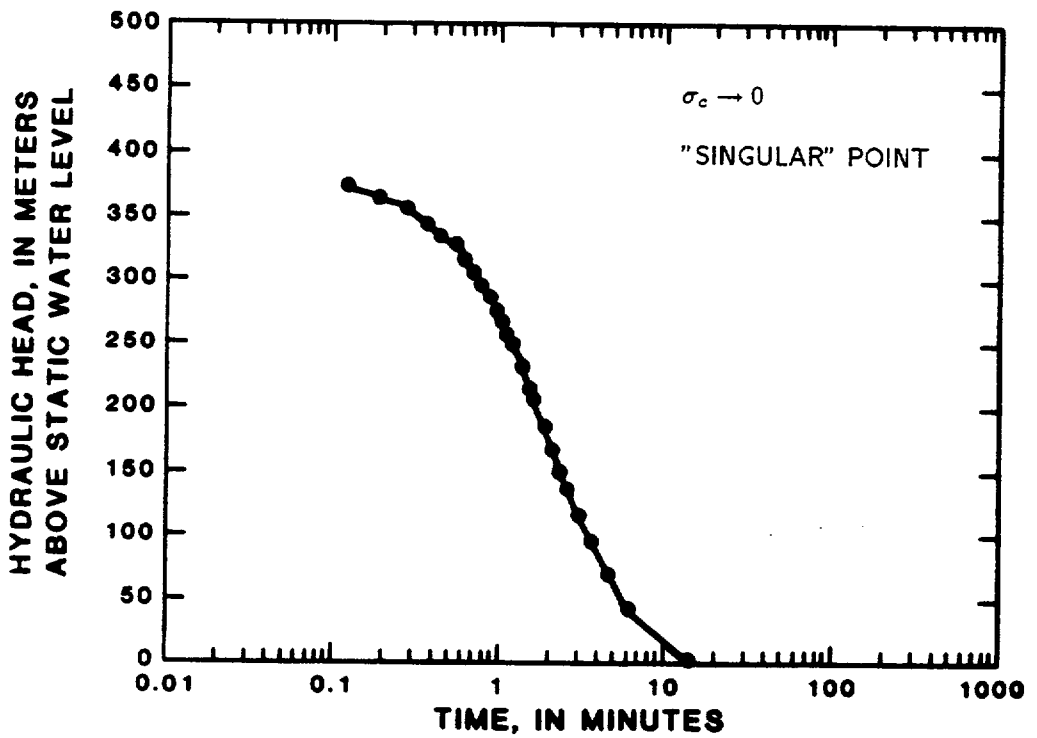


TEST INTERVAL 652m - 701m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.

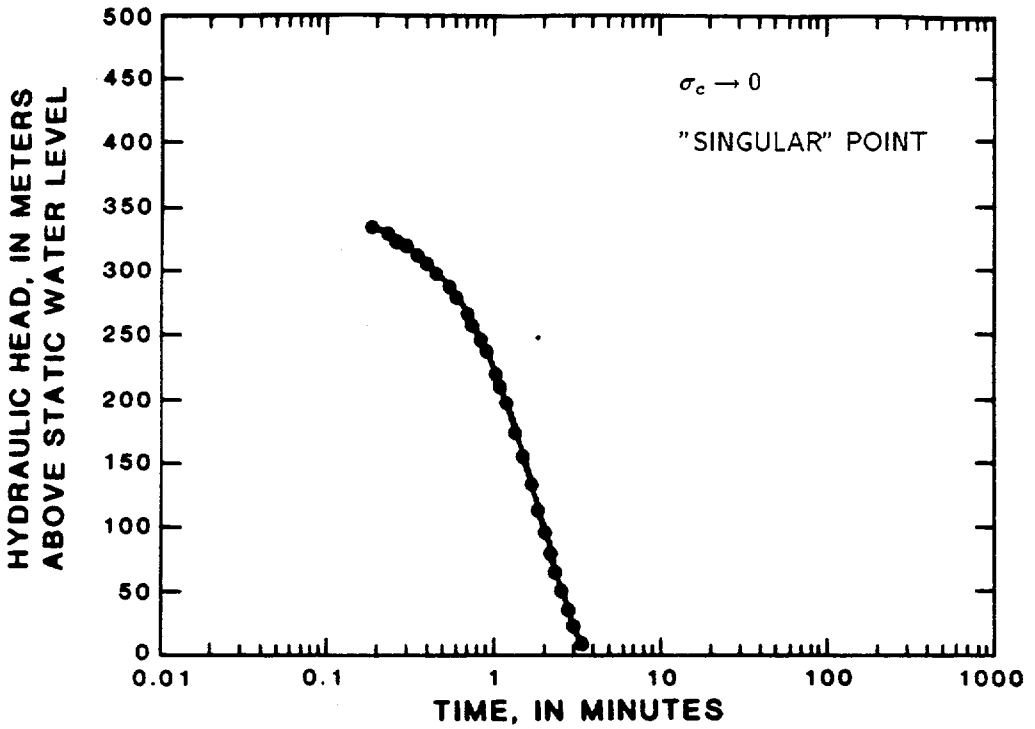


TEST INTERVAL 703m. - 735m.

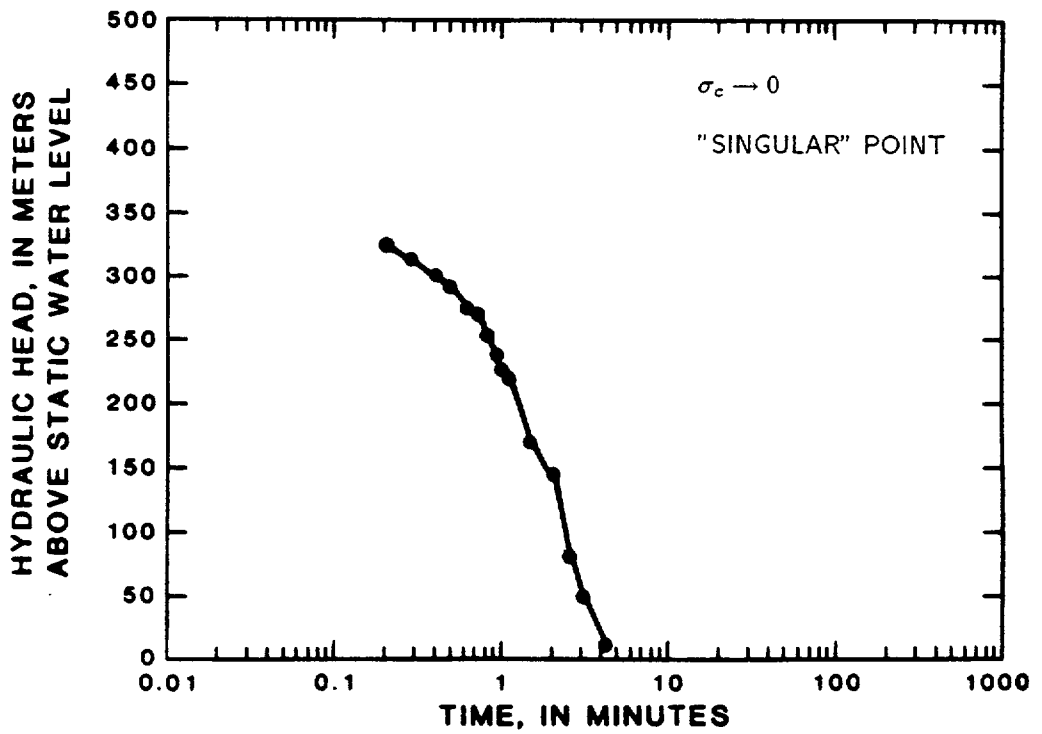


TEST INTERVAL 735m - 767m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.

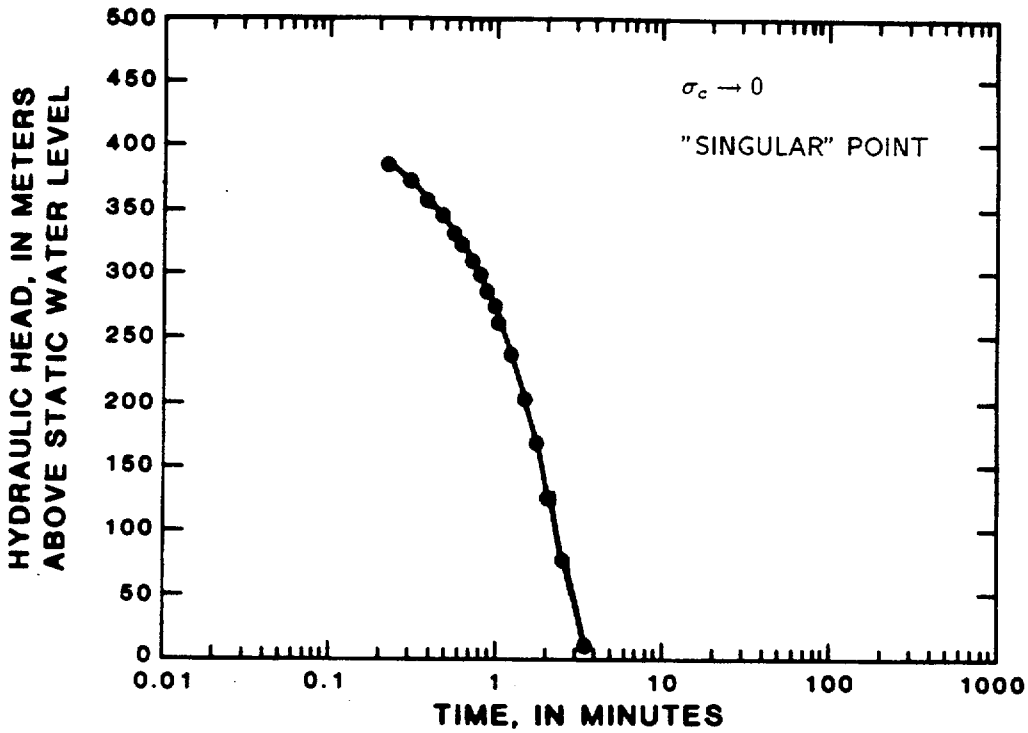


TEST INTERVAL 783m - 832m.

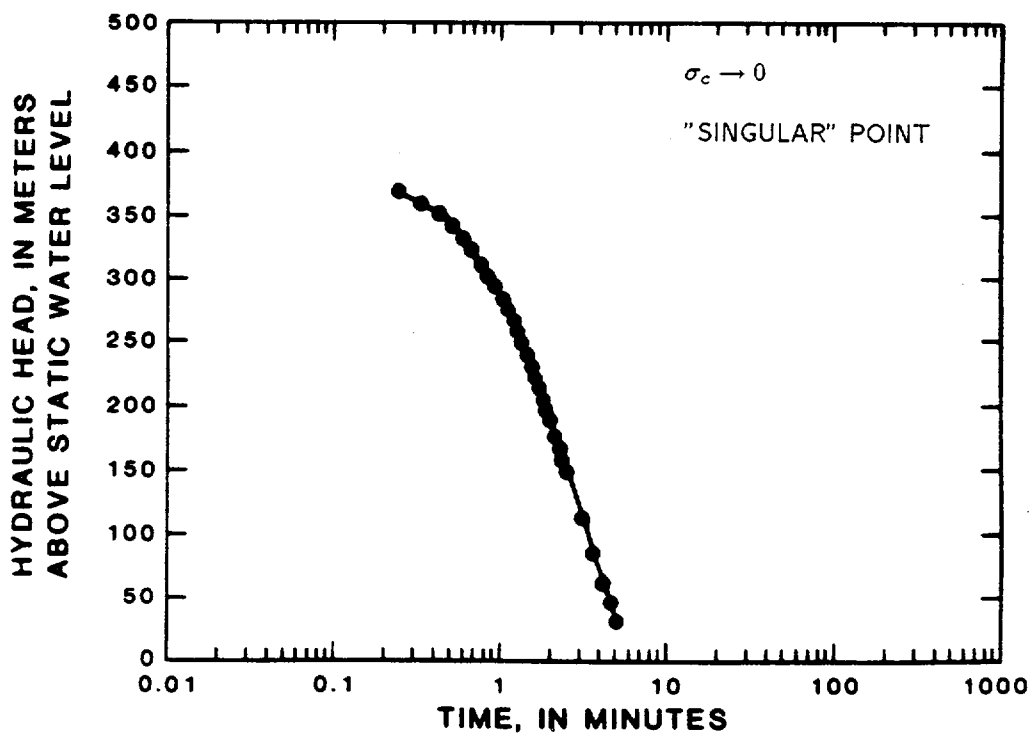


TEST INTERVAL 832m - 850m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.

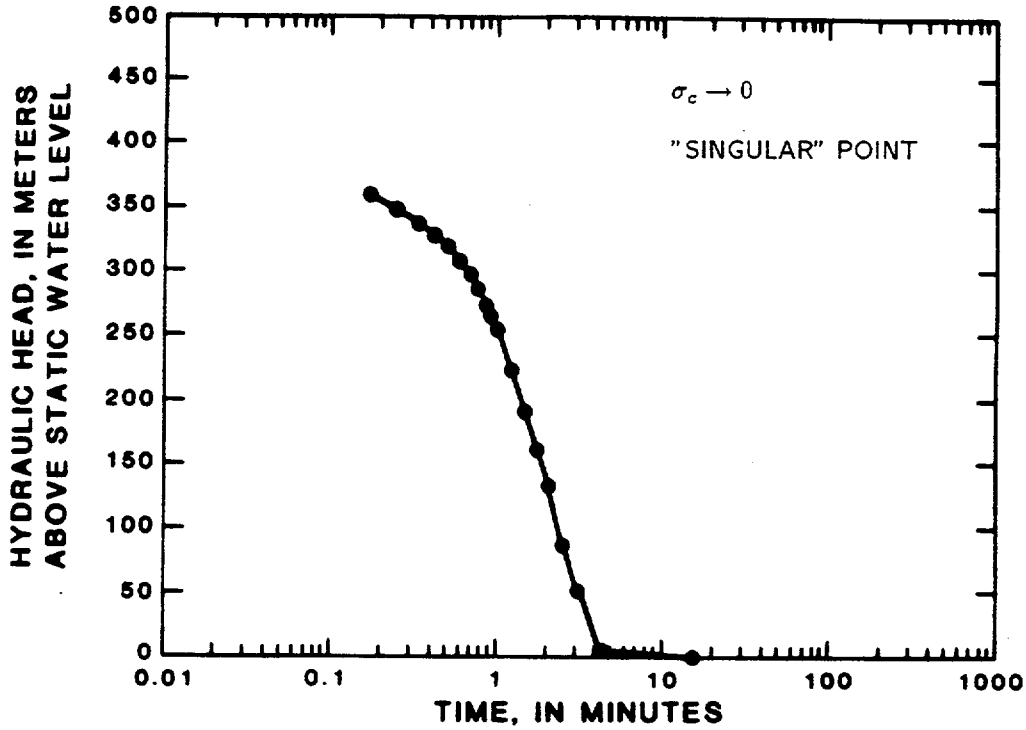


TEST INTERVAL 855m - 873m.

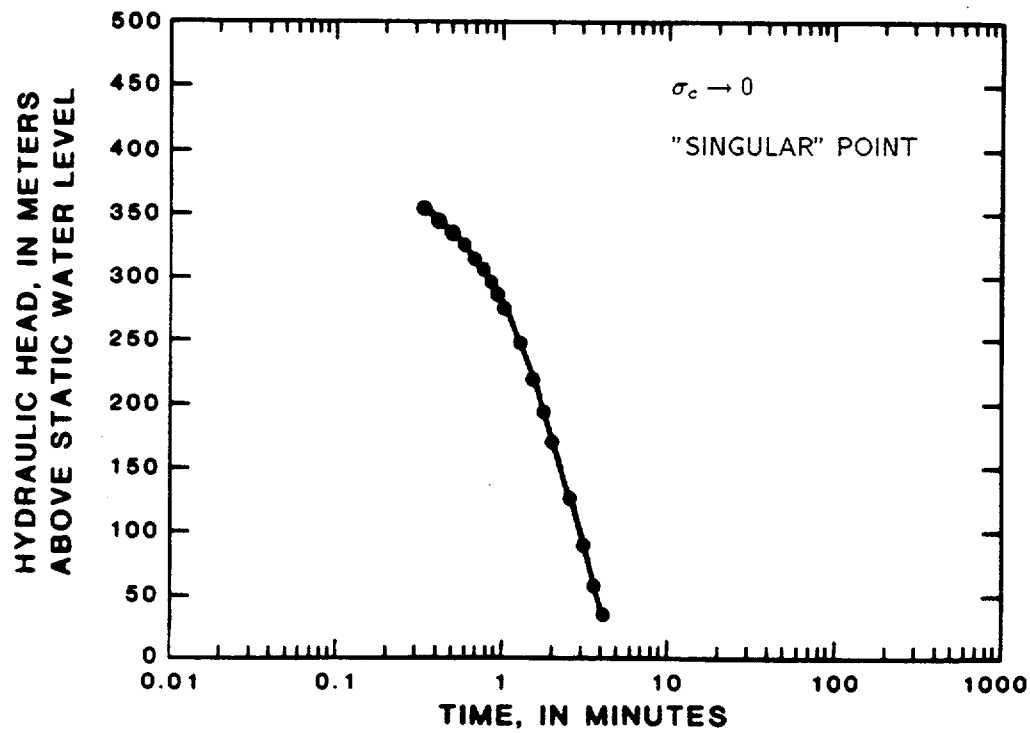


TEST INTERVAL 873m - 892m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.

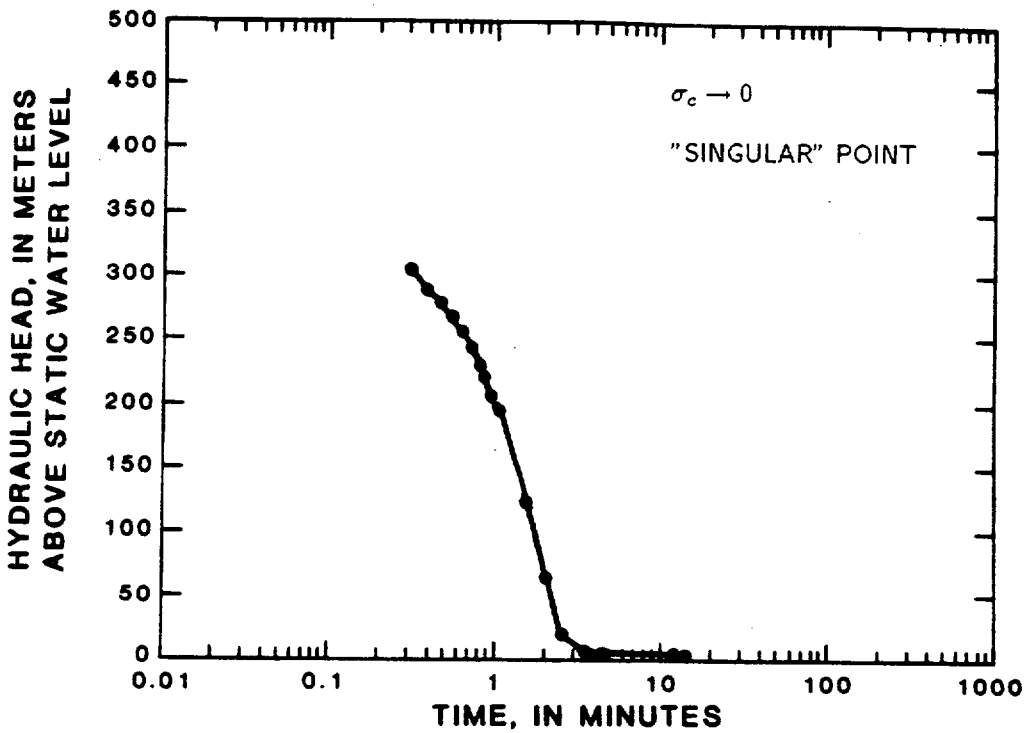


TEST INTERVAL 892m - 910m.

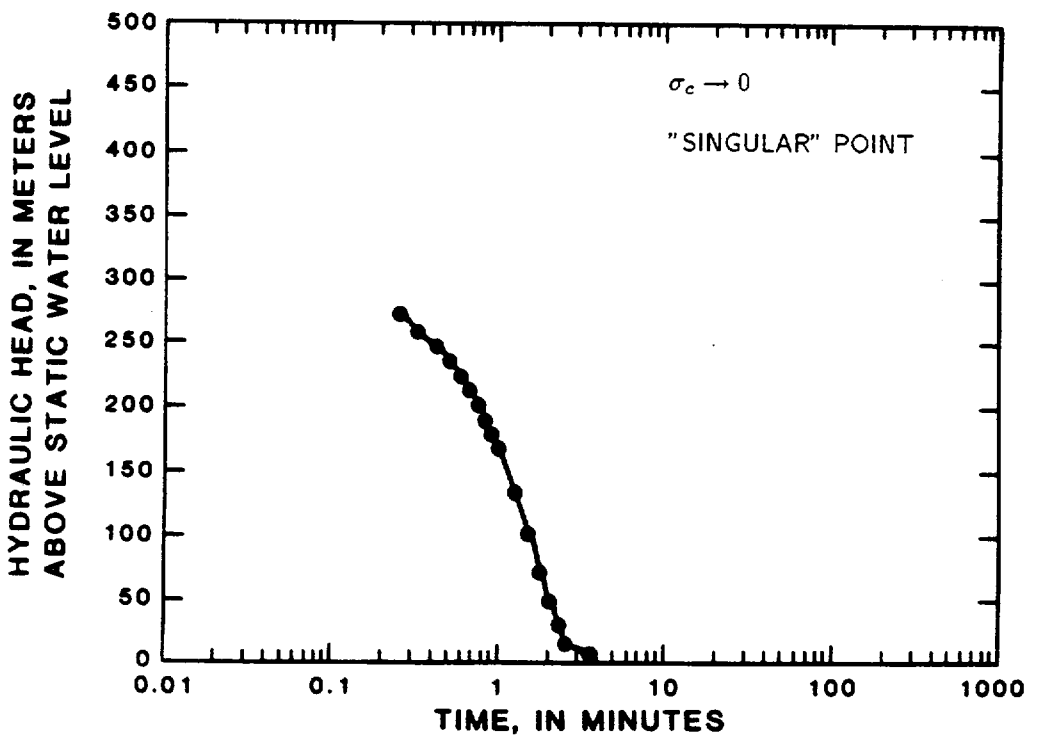


TEST INTERVAL 910m - 926m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.

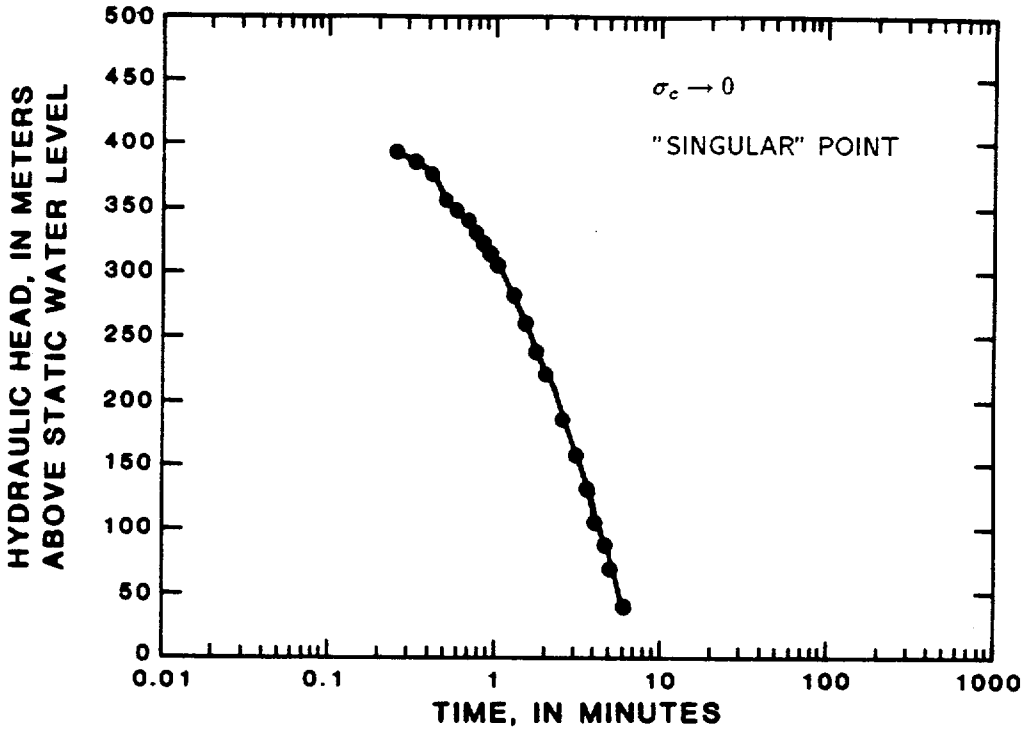


TEST INTERVAL 928m - 1219m.



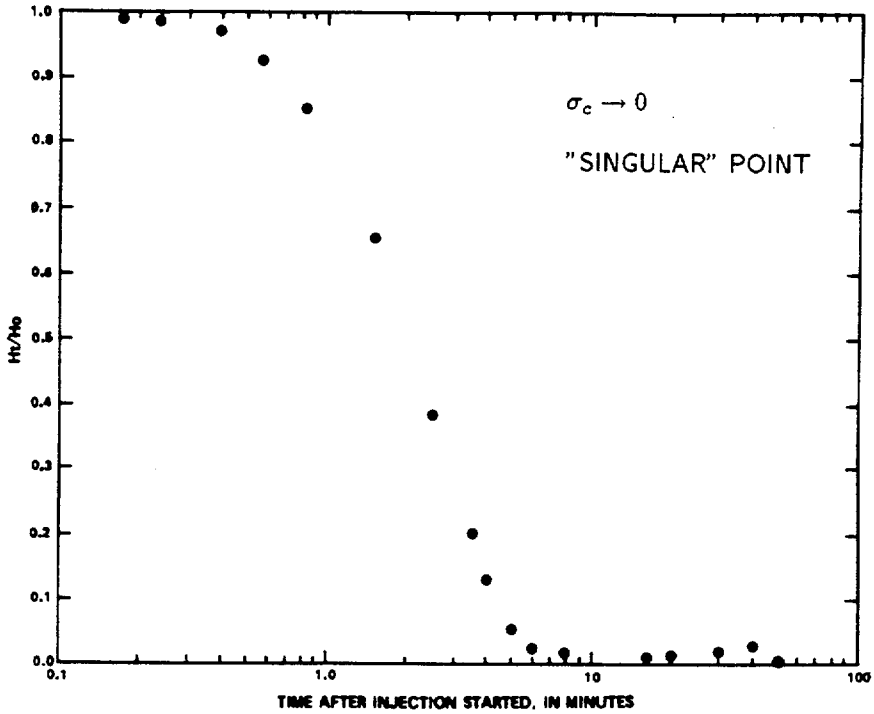
TEST INTERVAL 1173m - 1192m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.



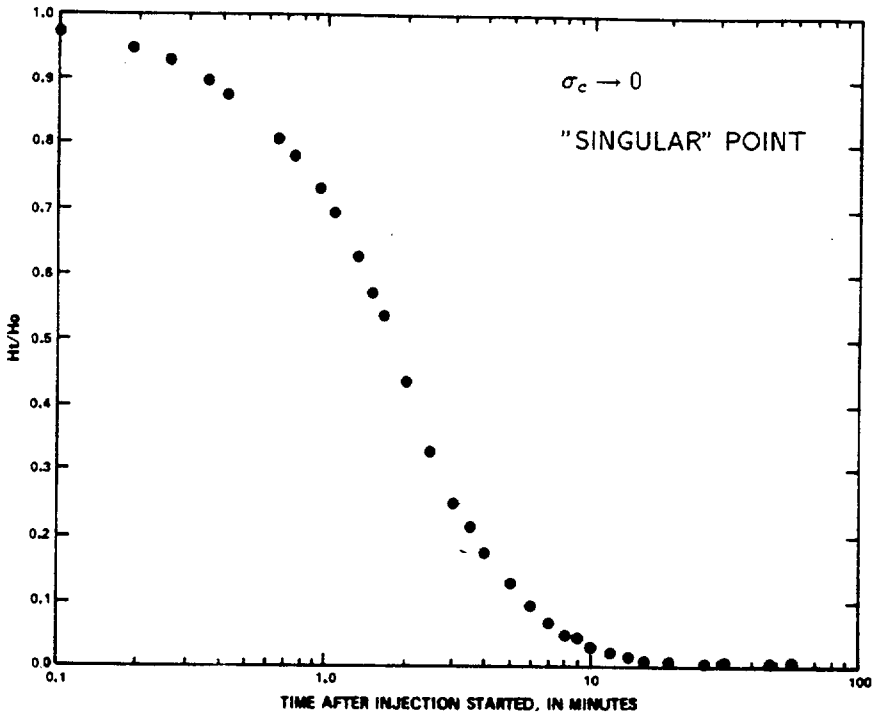
TEST INTERVAL 1195m - 1219m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.

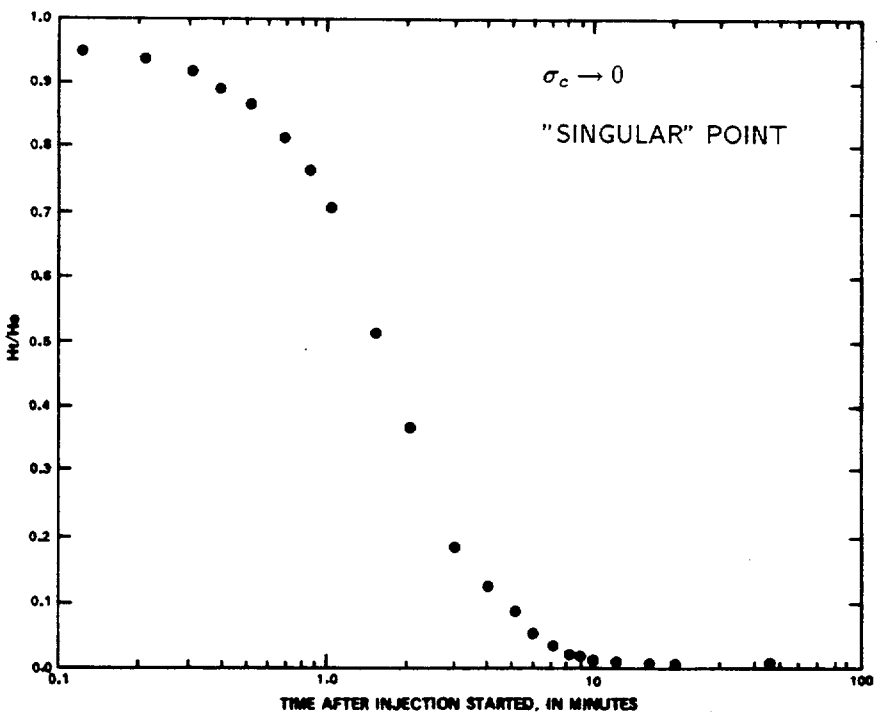


Packer-injection test for depth interval from 796 to 815 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.

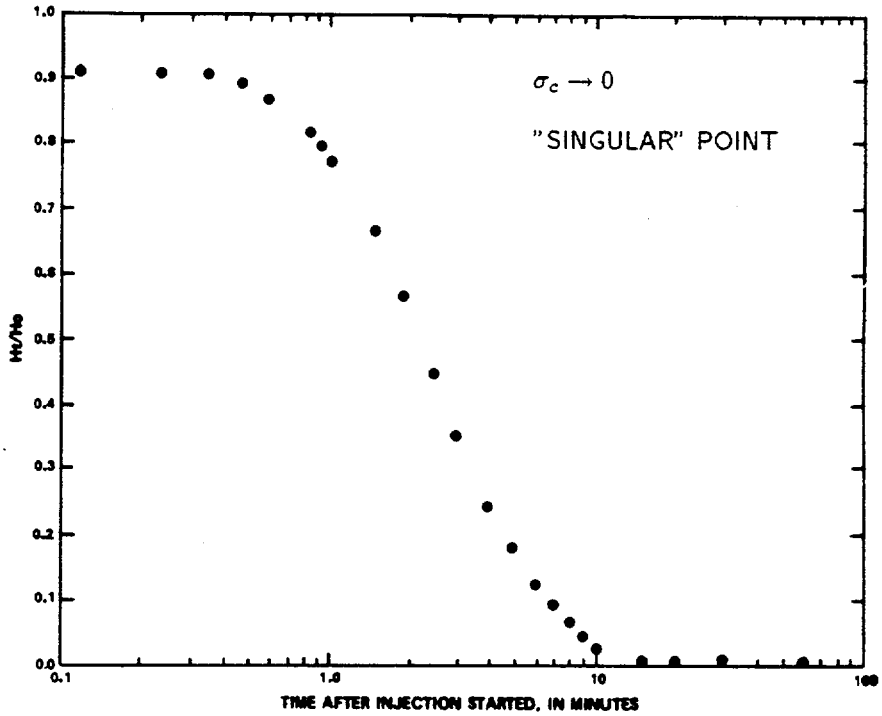


-Packer-injection test for depth interval from 887 to 947 meters.



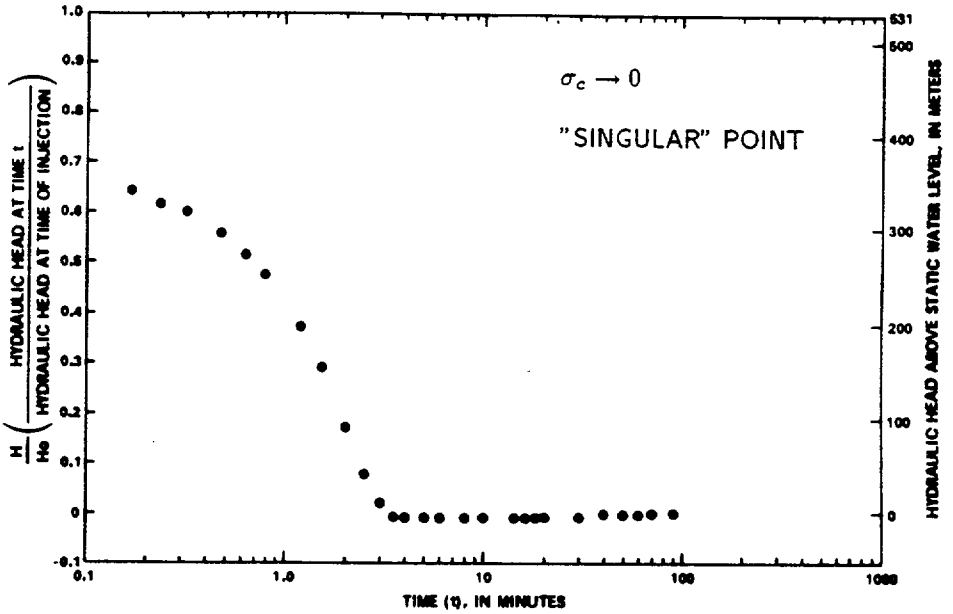
-Packer-injection test for depth interval from 888 to 949 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.



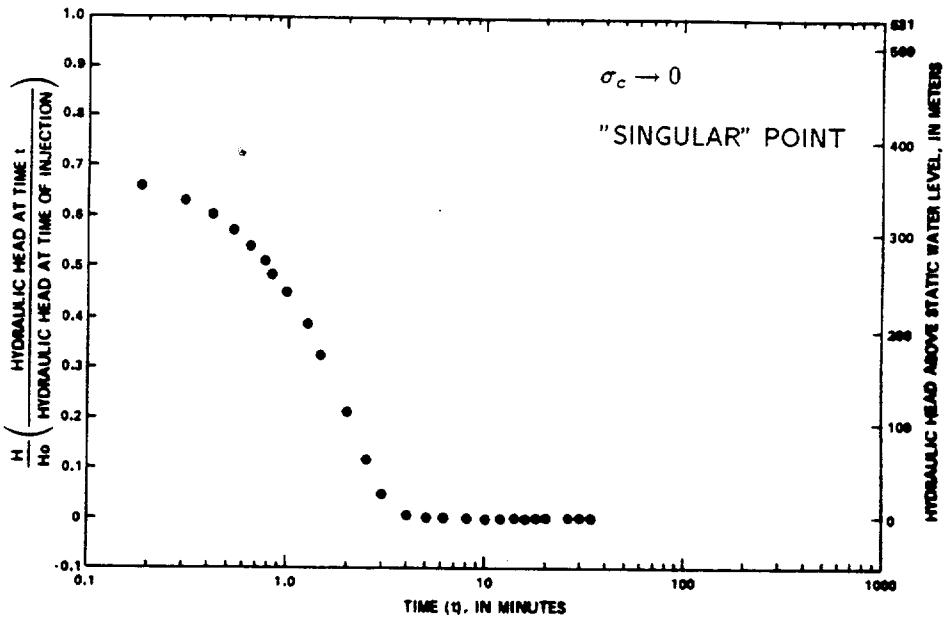
-Packer injection test for depth interval from 1,033 to 1,052 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.



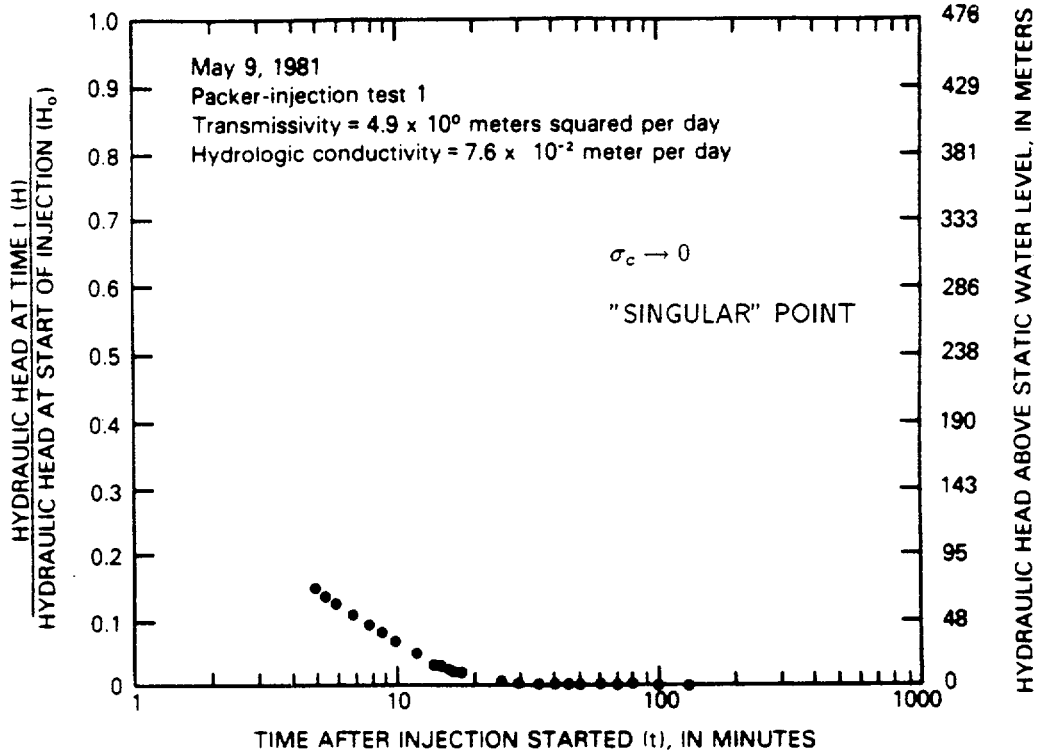
-Packer-injection test 2, depth interval from 606 to 640 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.

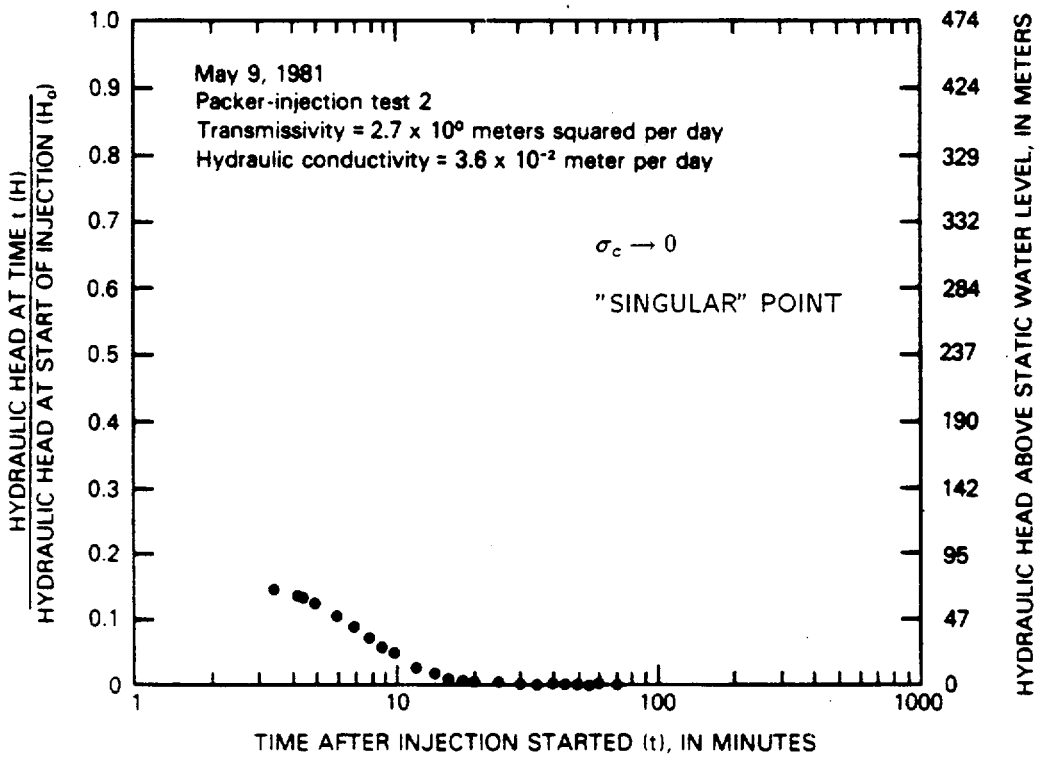


--Packer-injection test 5, depth interval from 753 to 787 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.

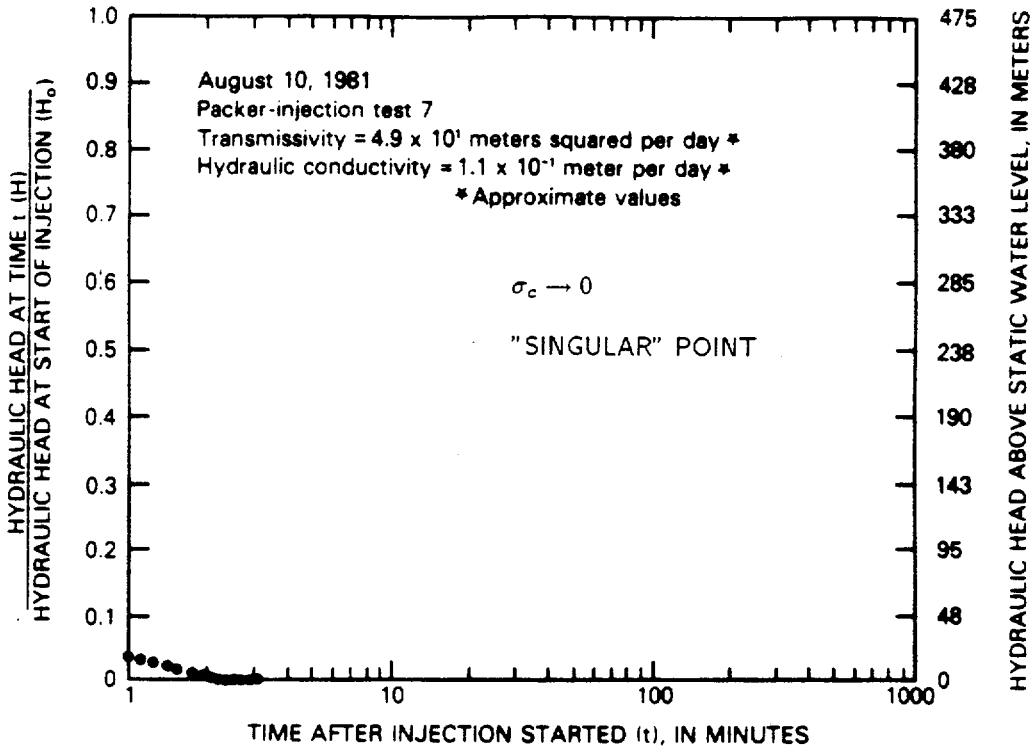


TEST INTERVAL 514m - 579m.

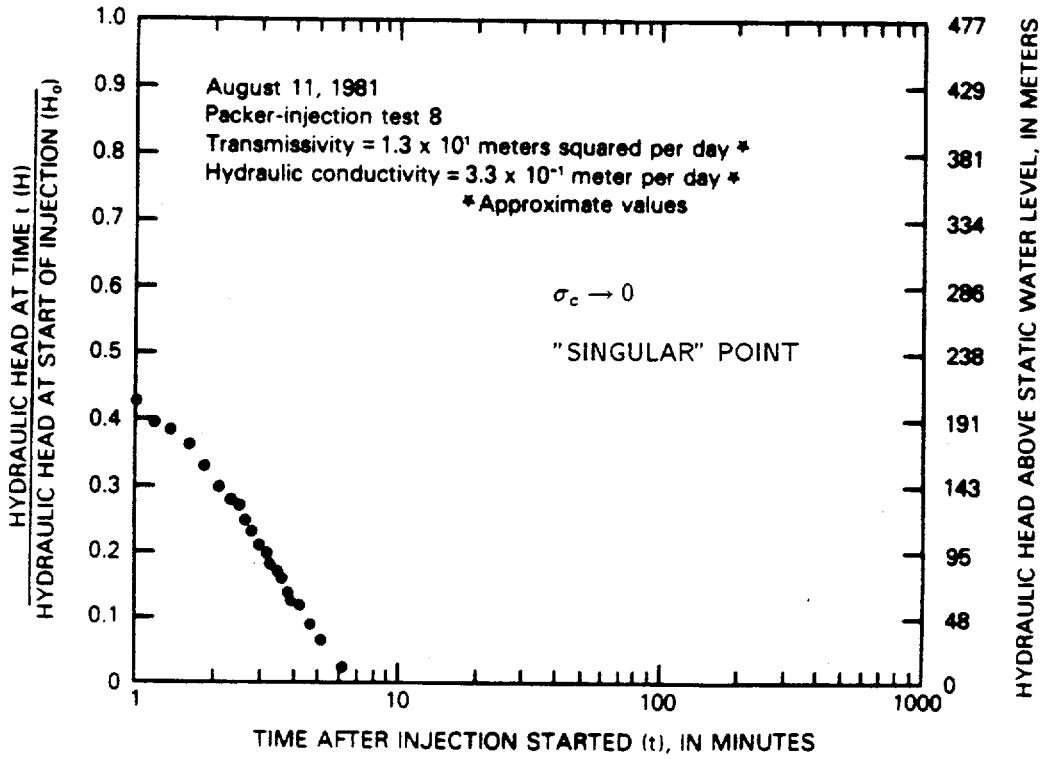


TEST INTERVAL 505m - 579m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.

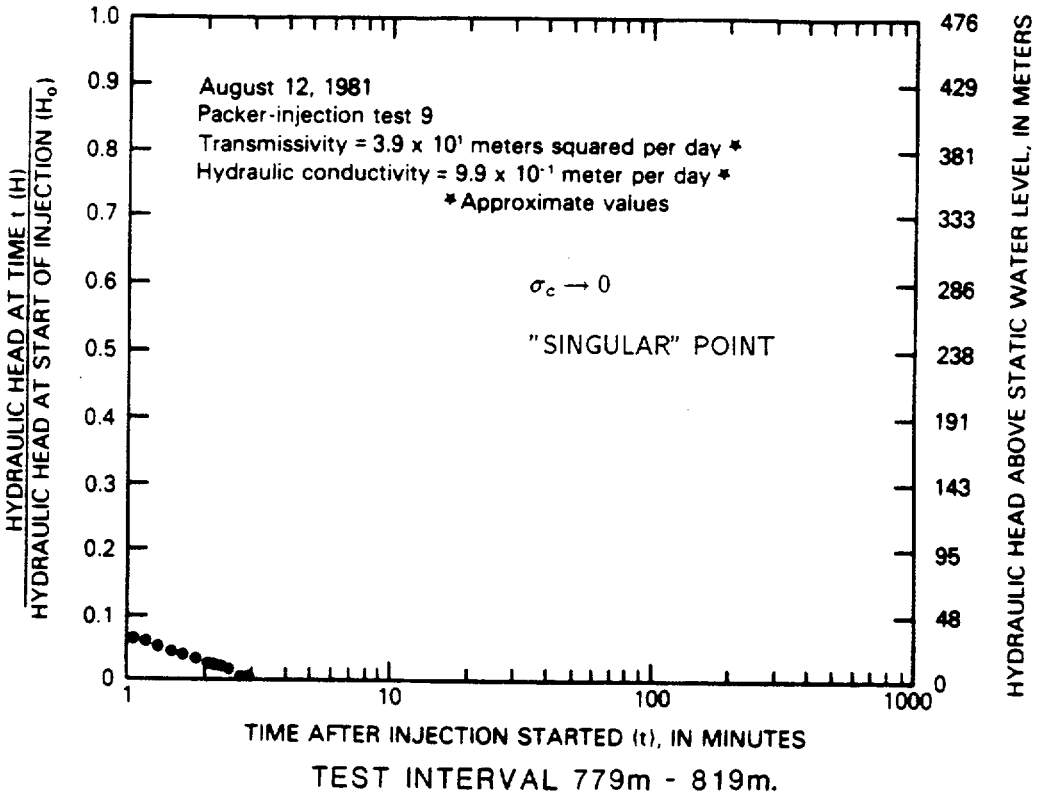


TEST INTERVAL 792m - 1220m.



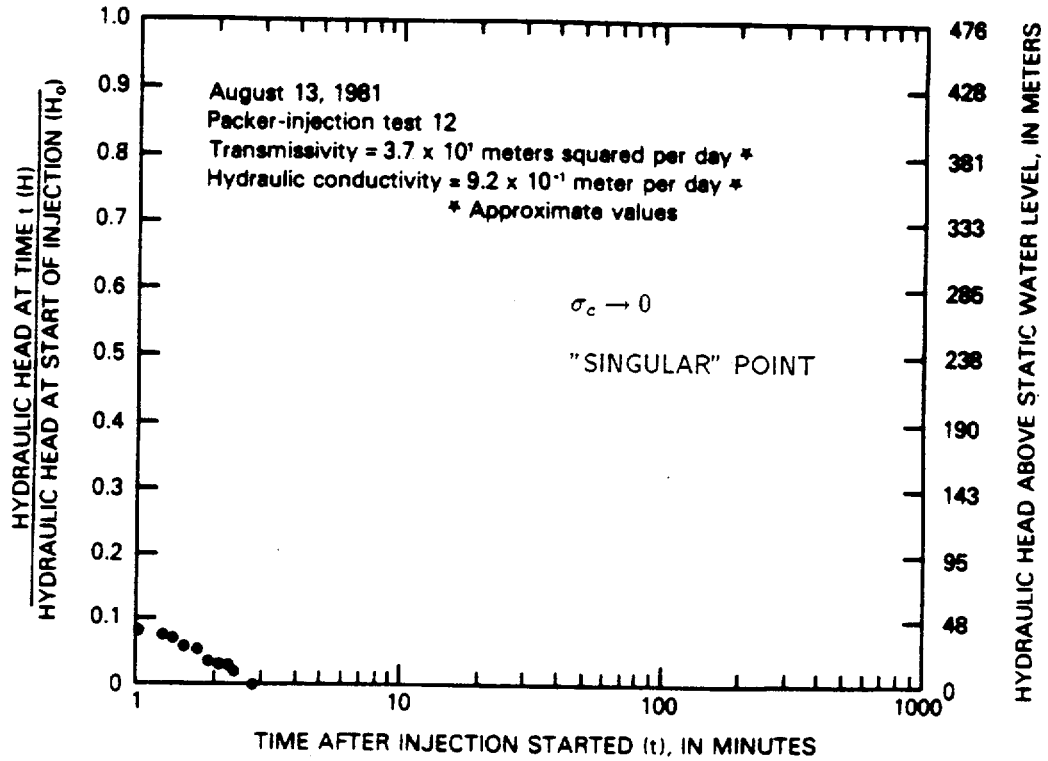
TEST INTERVAL 820m - 860m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.



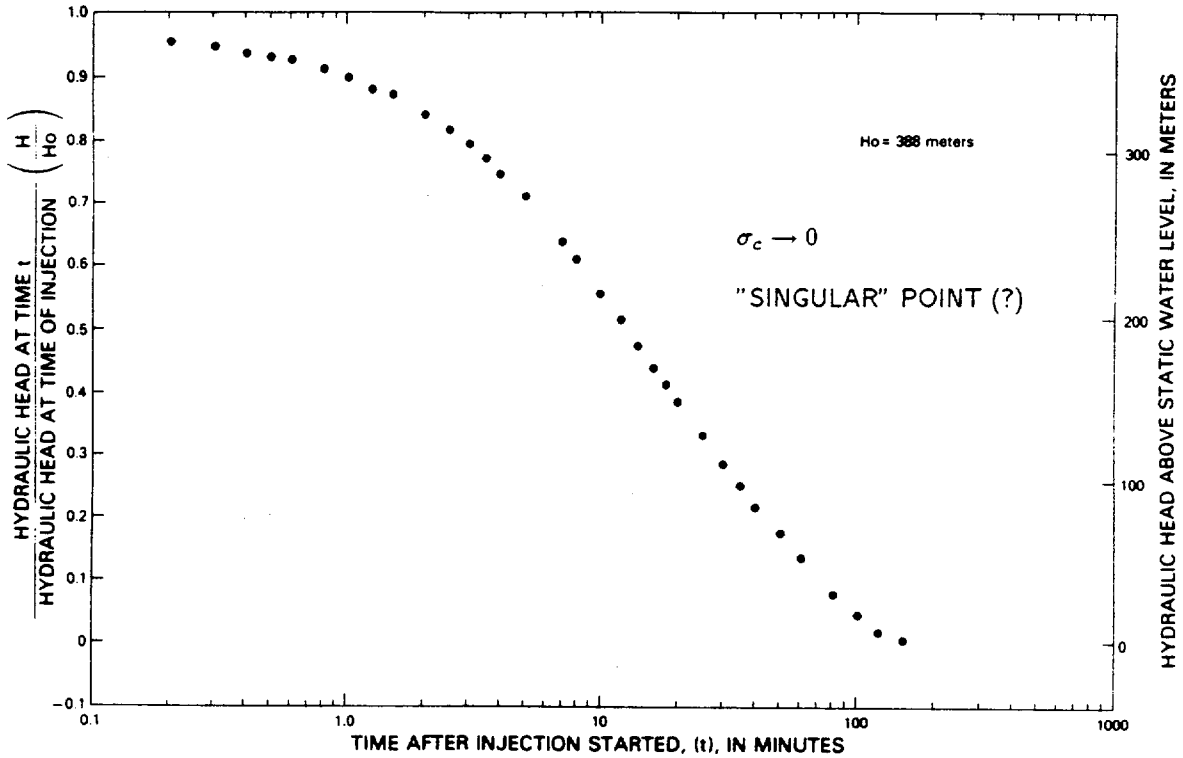
TEST INTERVAL 779m - 819m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.

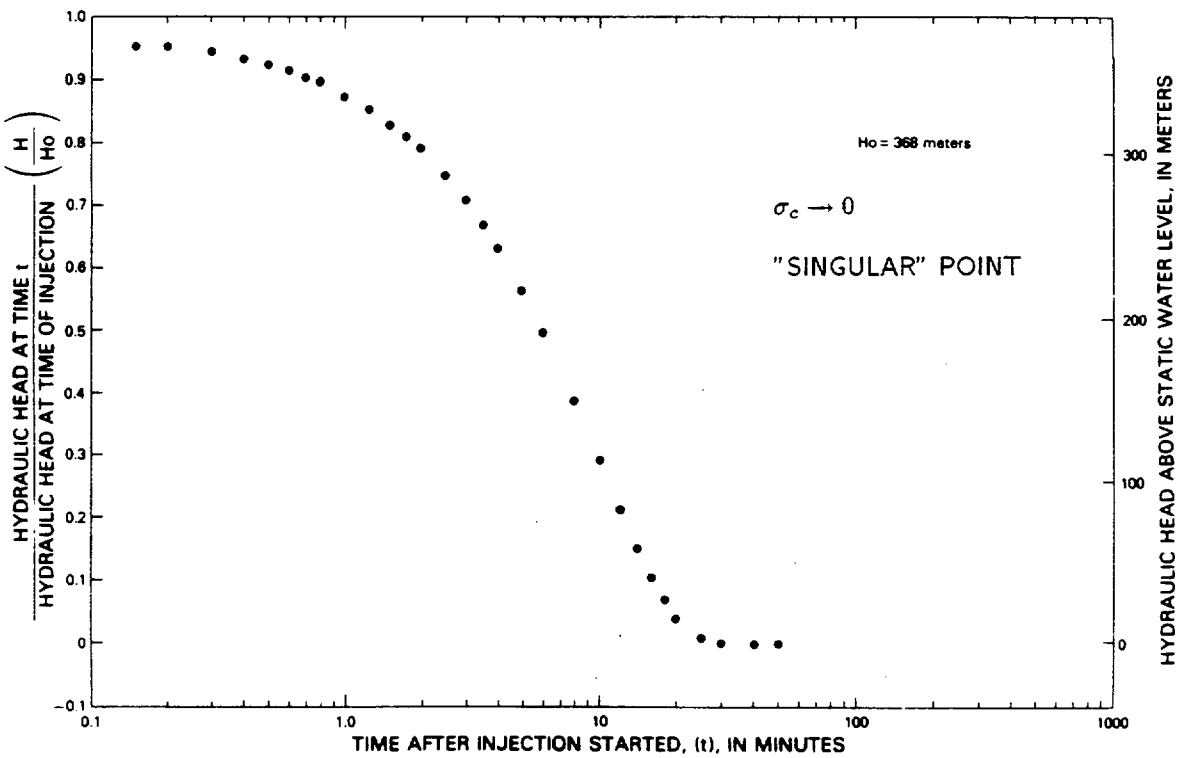


TEST INTERVAL 581m - 621m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.

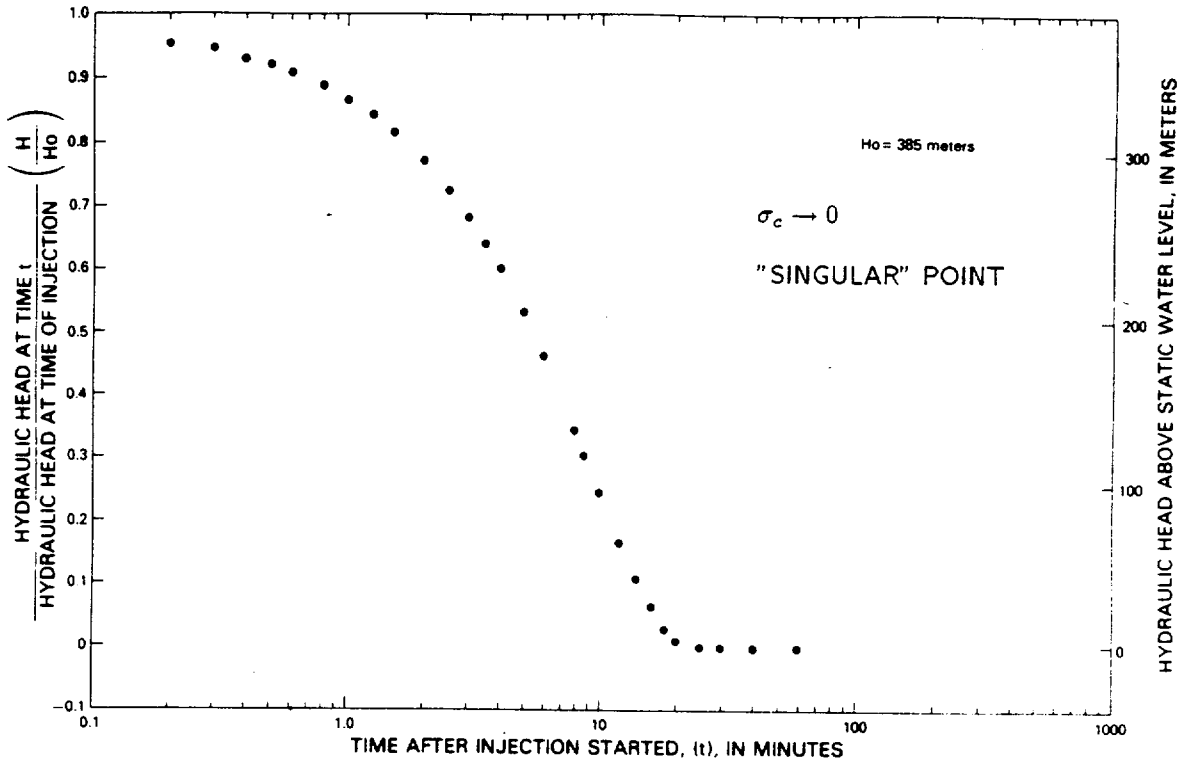


Packer-injection test 2, depth interval from 500 to 550 meters.

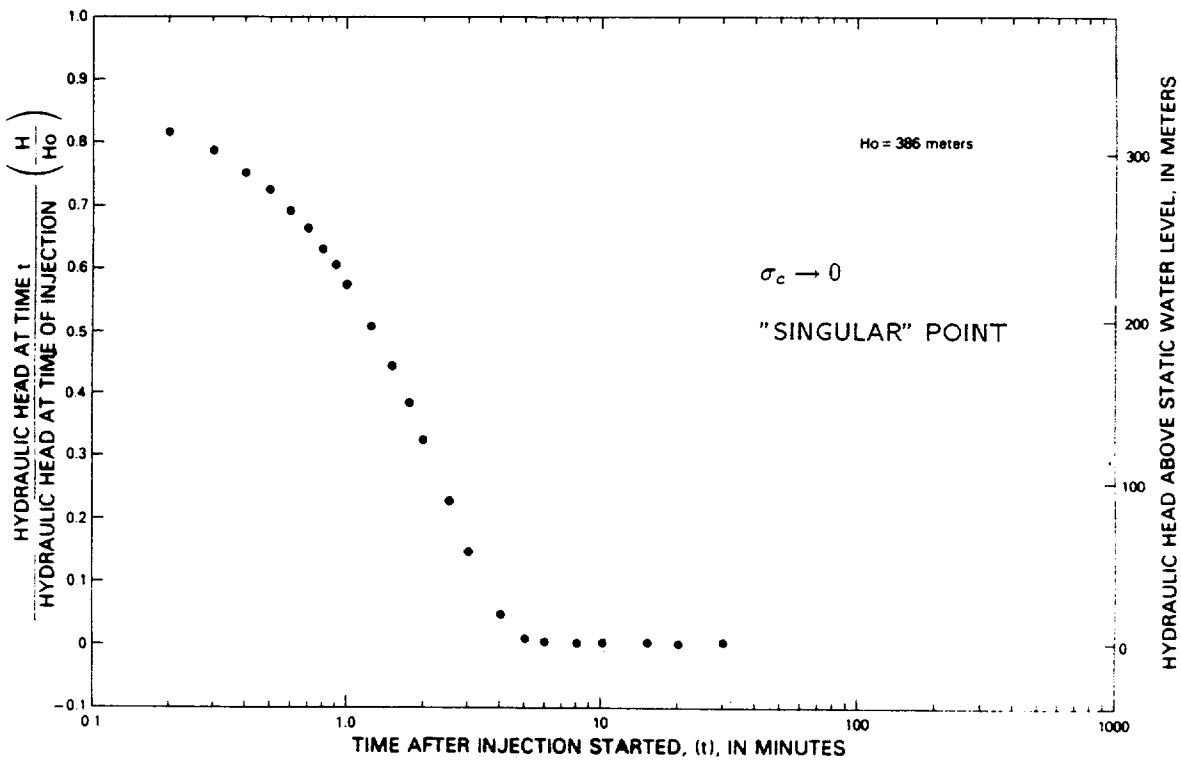


Packer-injection test 4, depth interval from 600 to 650 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

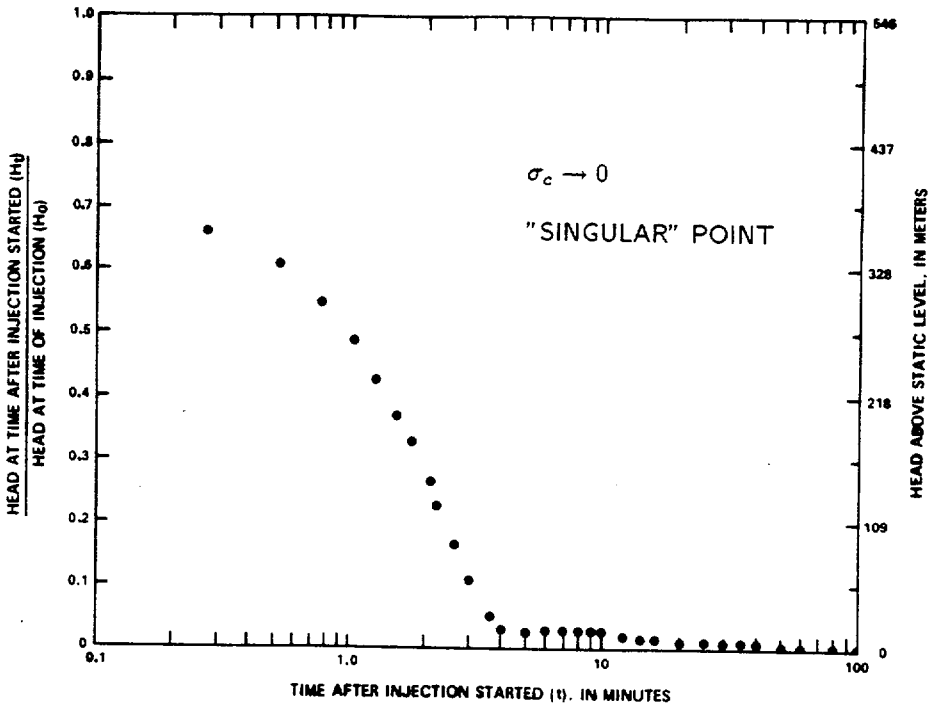


Packer-injection test 11, depth interval from 974 to 1,044 meters.



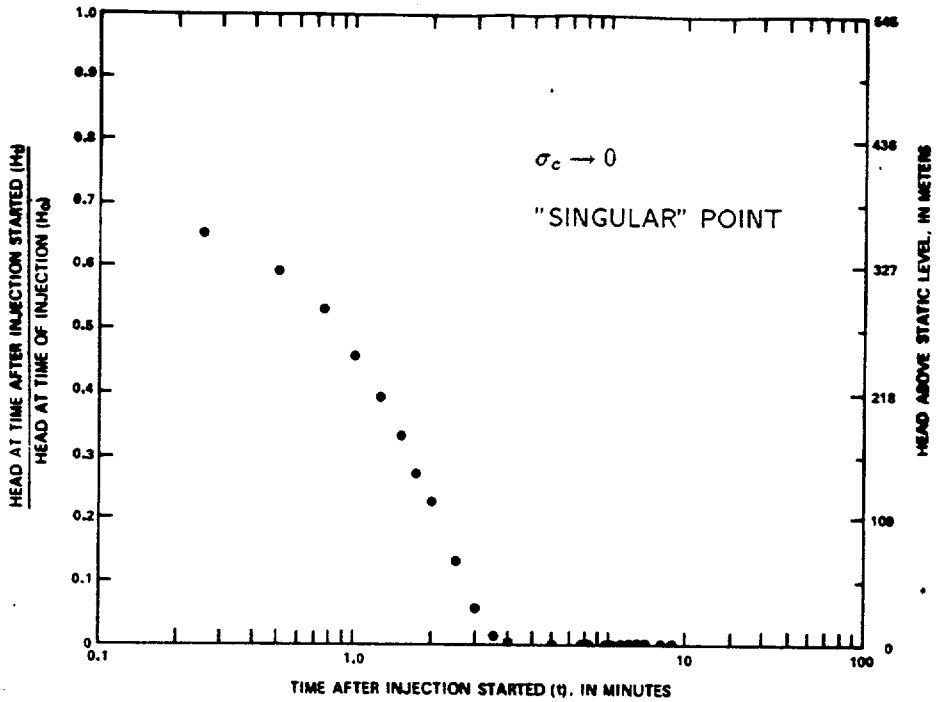
Packer-injection test 12, depth interval from 1,044 to 1,114 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

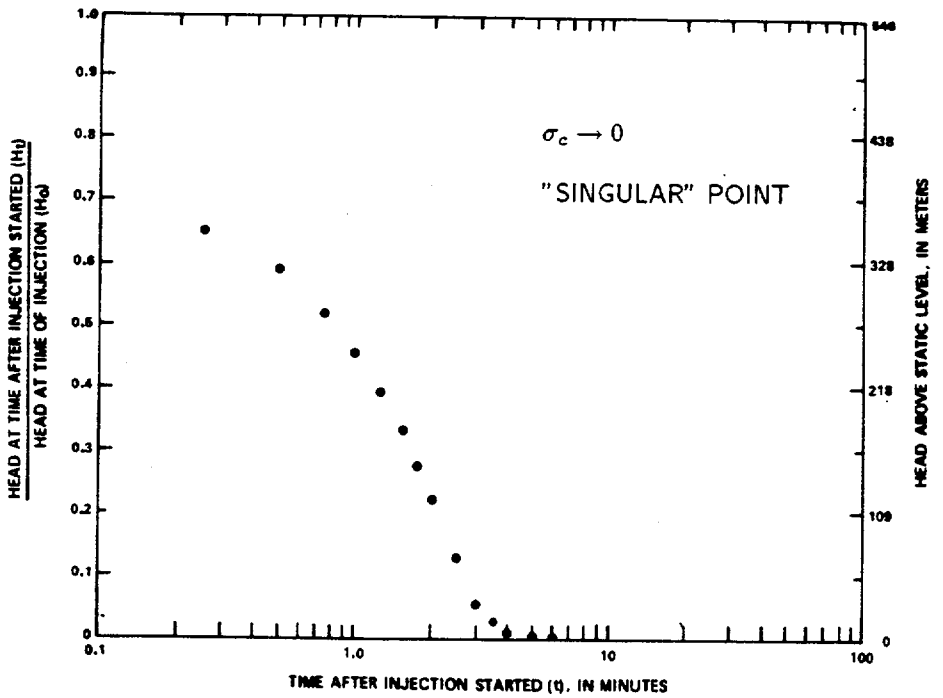


Packer-injection test for depth interval from 702 to 747 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.

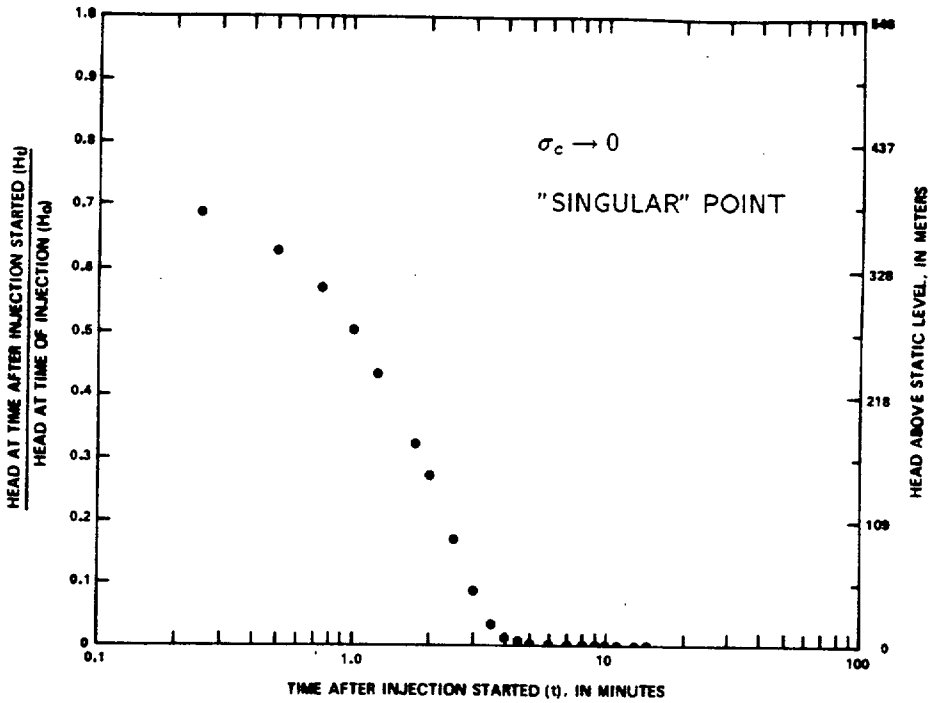


Packer-injection test for depth interval from 850 to 875 meters.



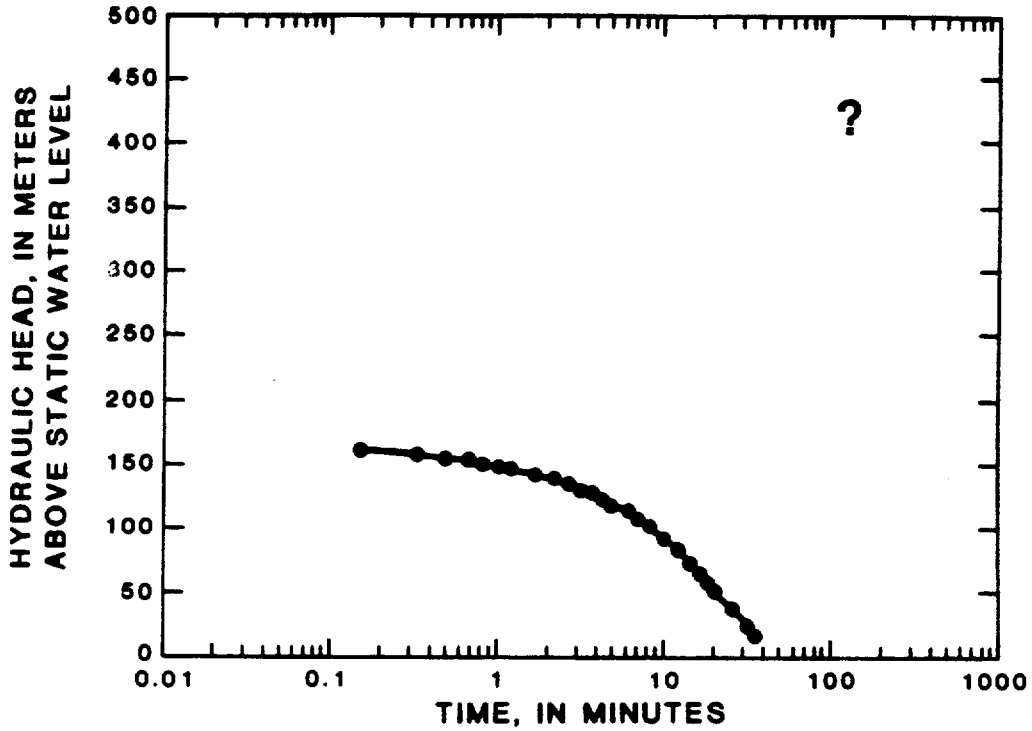
Packer-injection test for depth interval from 875 to 899 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.



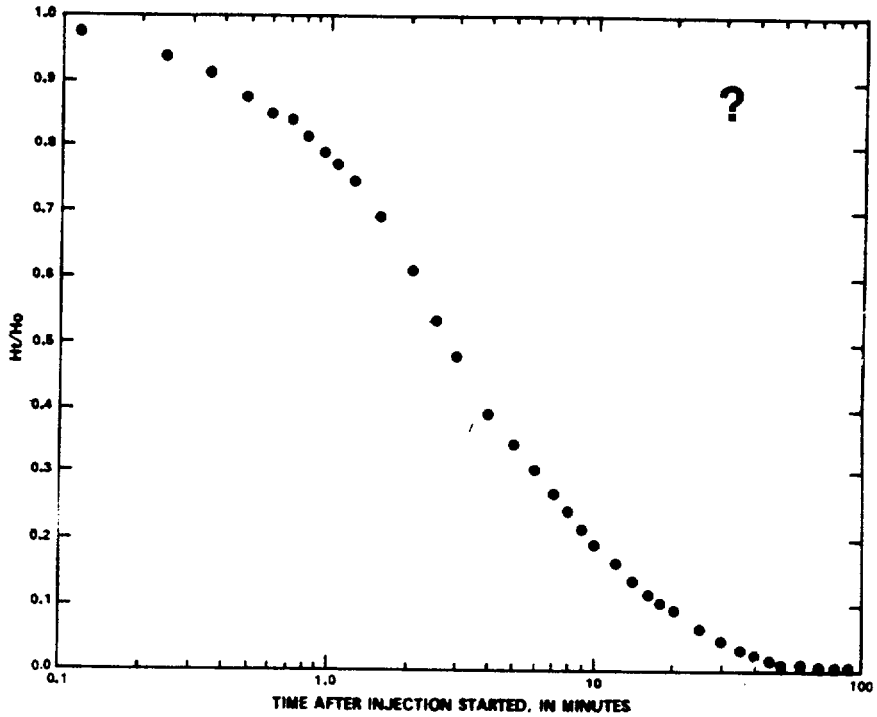
·Packer-injection test for depth interval from 899 to 915 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.



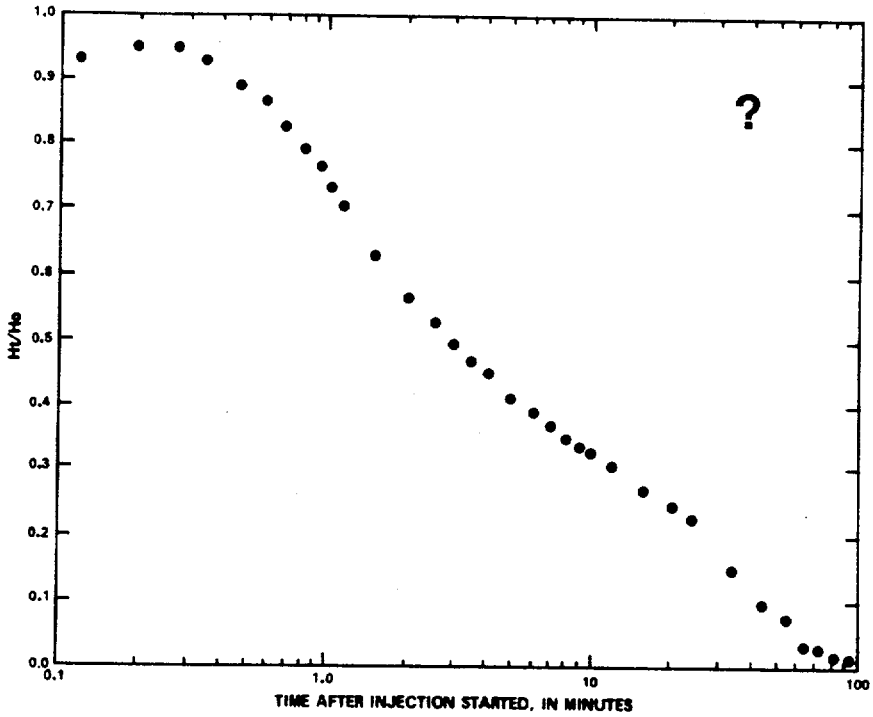
TEST INTERVAL 604m - 652m.

Results of the Cooper-Bredehoeft injection tests in Well USW H-4. From Whitfield et al., 1984.



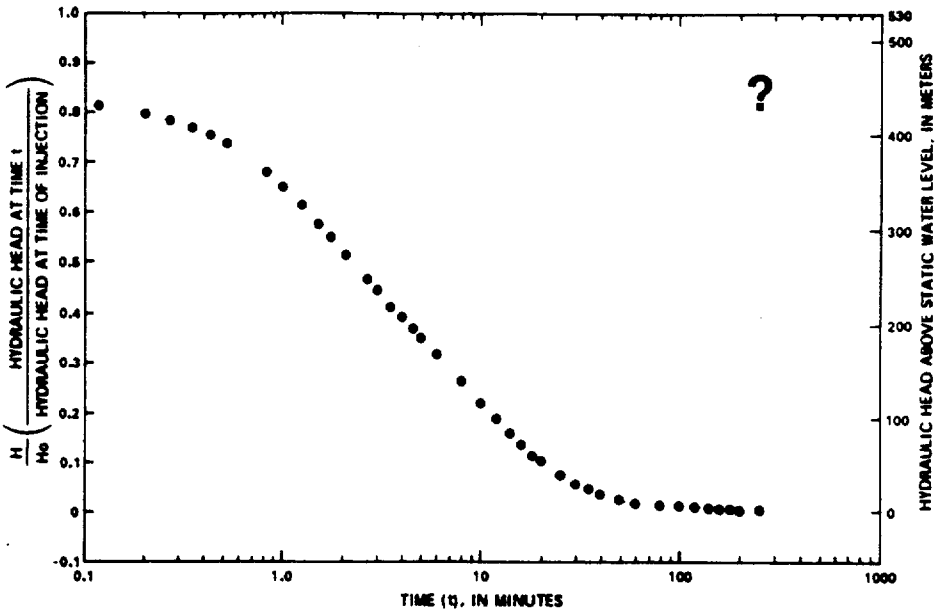
Packer-injection test for depth interval from 834 to 895 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.



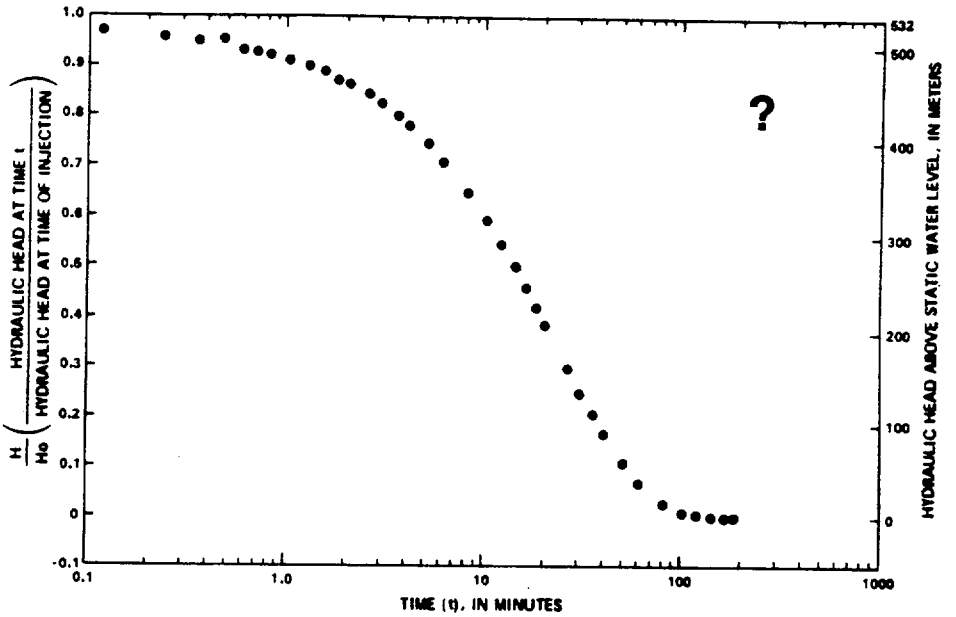
Packer-injection test for depth interval from 1,015 to 1,033 meters (second test).

Results of the Cooper-Bredehoeft injection tests in Well USW H-5. From Bentley et al., 1983.



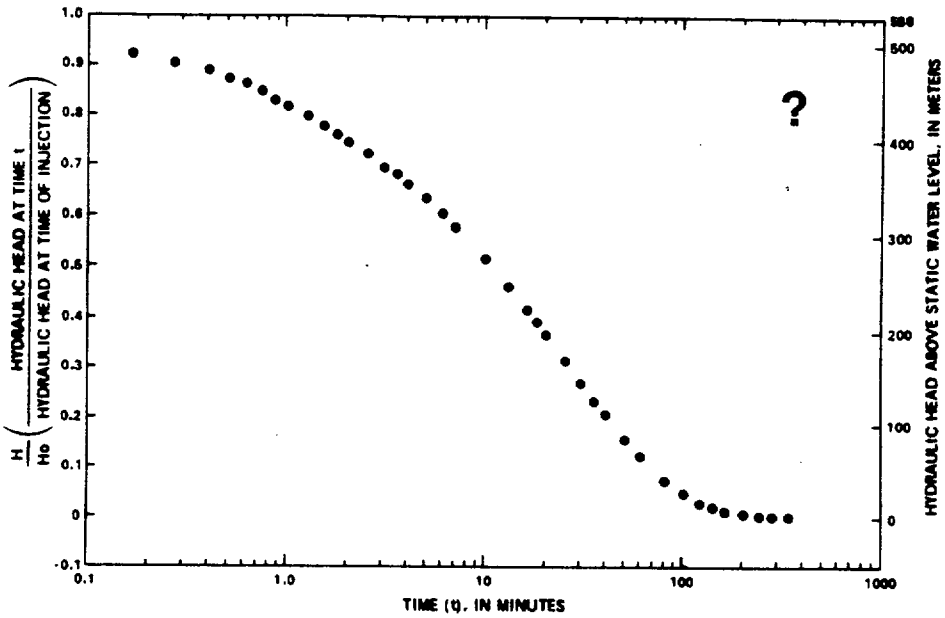
-Packer-injection test 1, depth interval from 581 to 607 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.



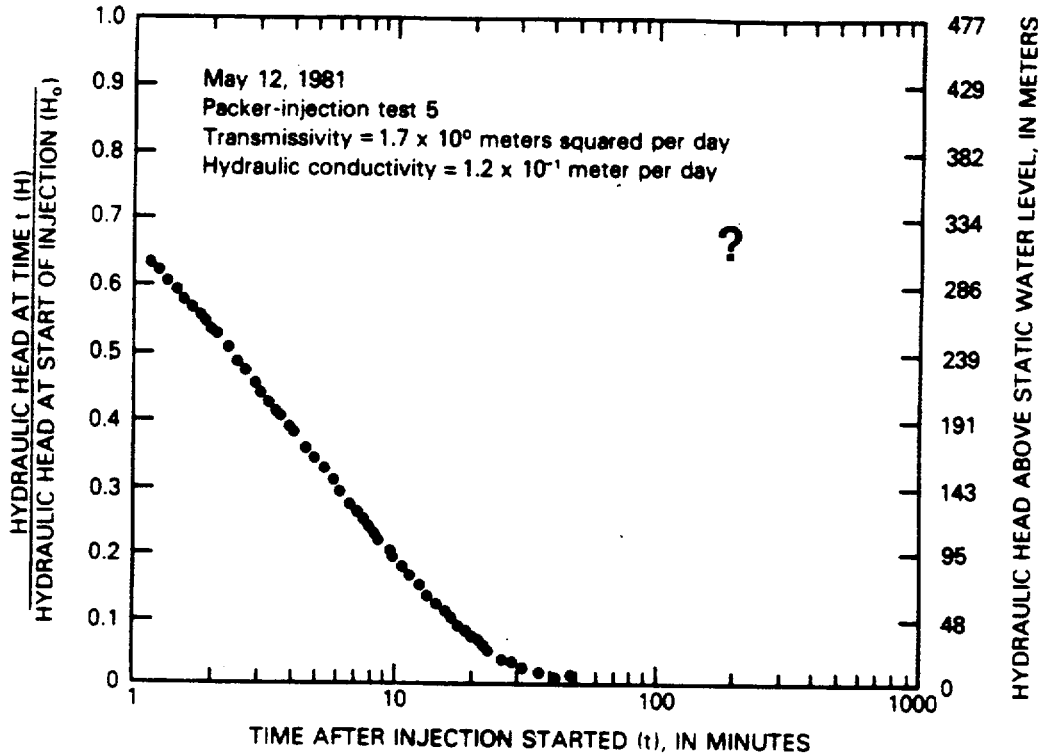
-Packer-injection test 4, depth interval from 686 to 753 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.

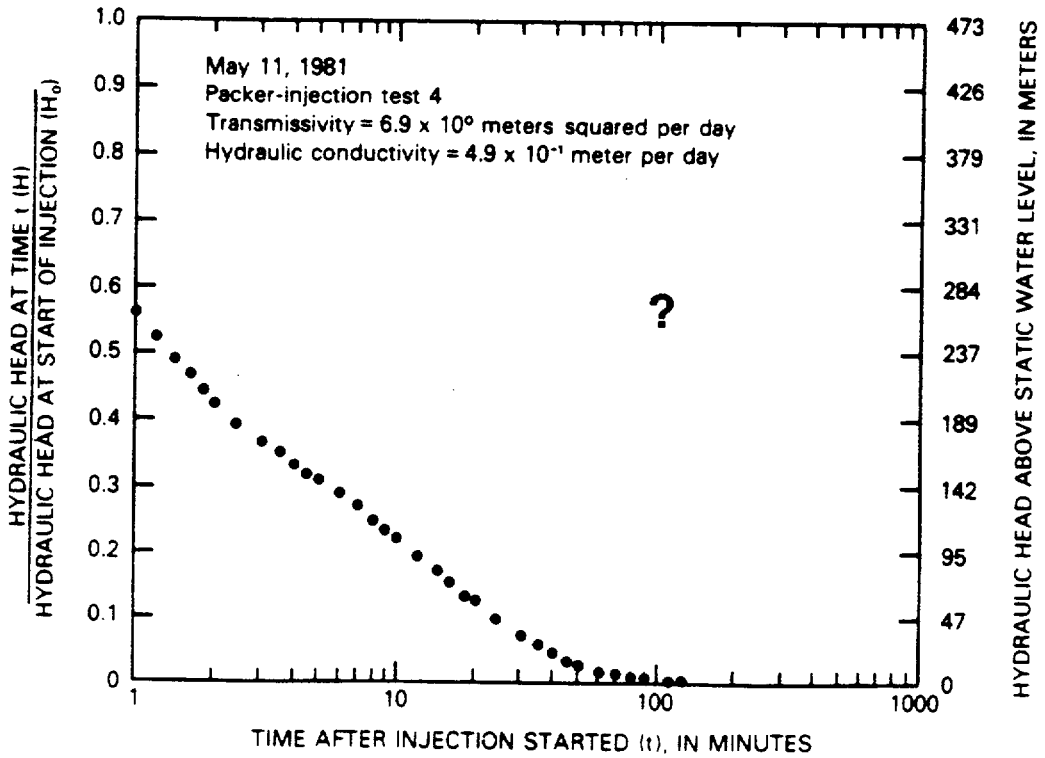


-Packer-injection test 6, depth interval from 804 to 838 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW H-6. From Craig et al., 1983.

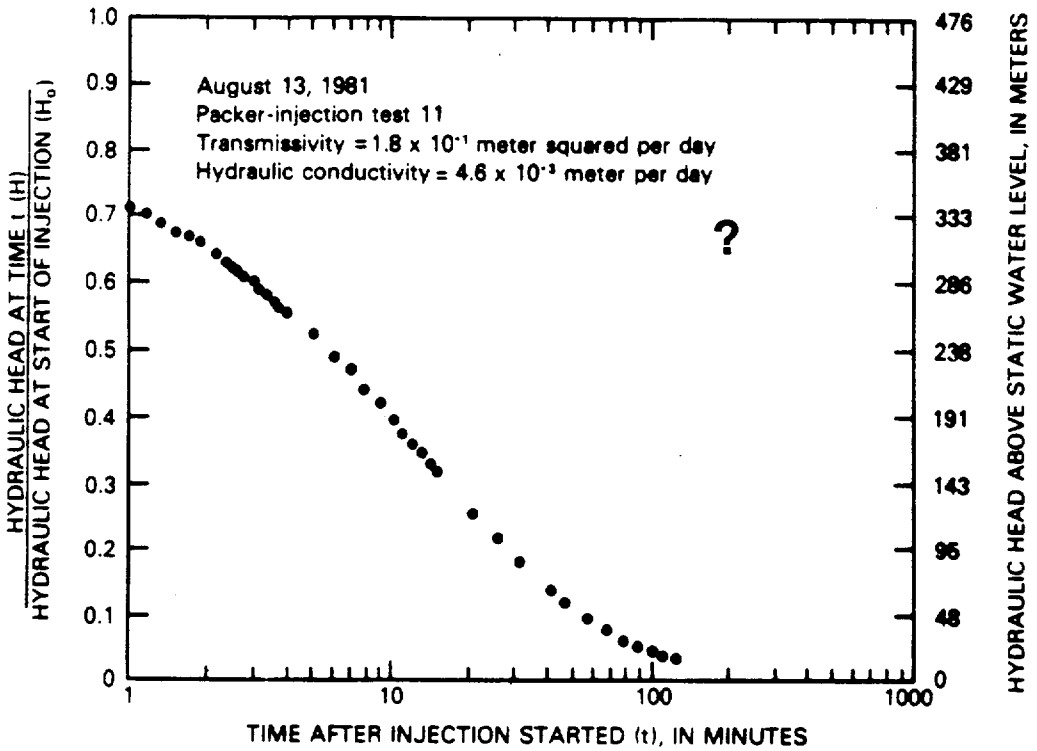


TEST INTERVAL 477m - 491m.



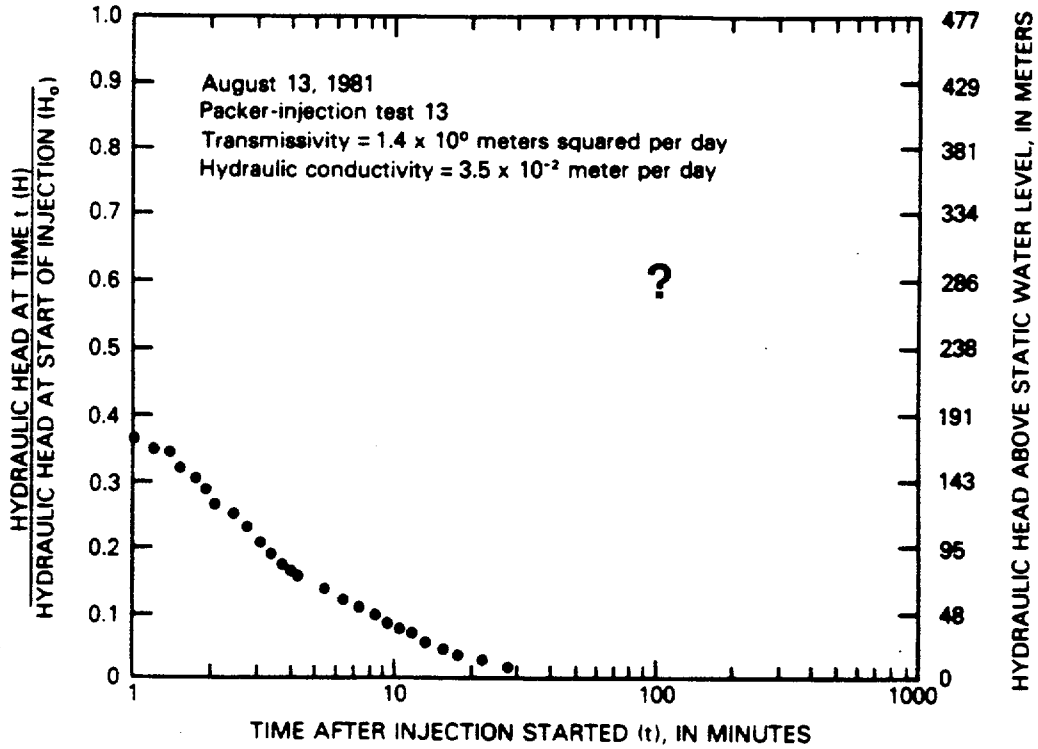
TEST INTERVAL 491m - 505m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.

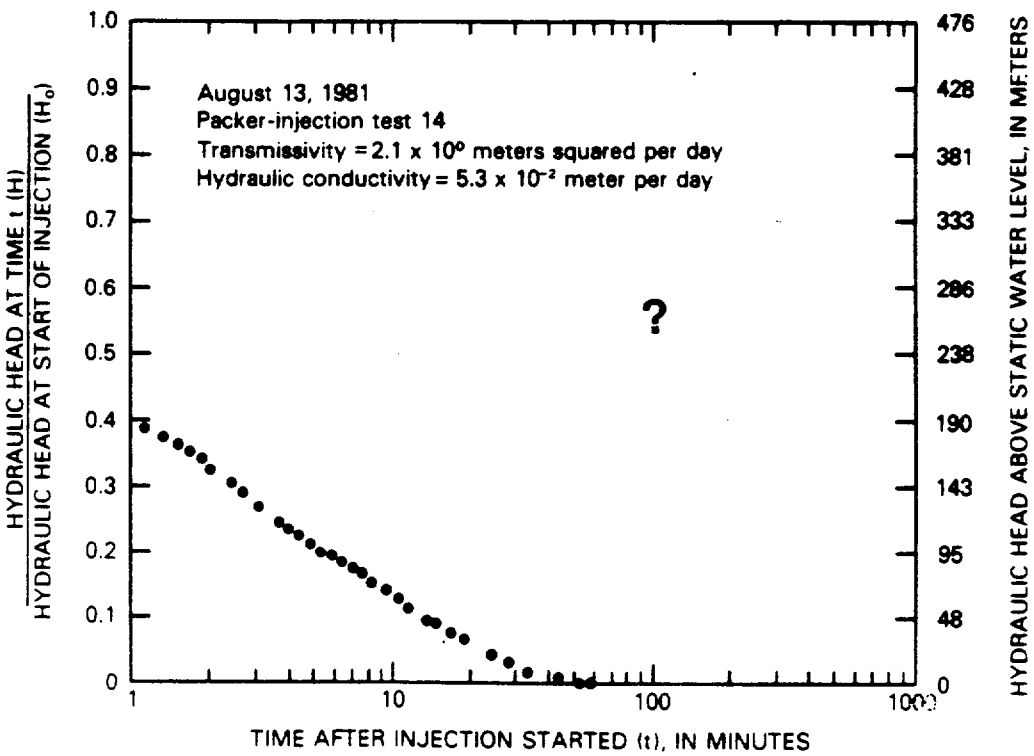


TEST INTERVAL 703m - 743m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.

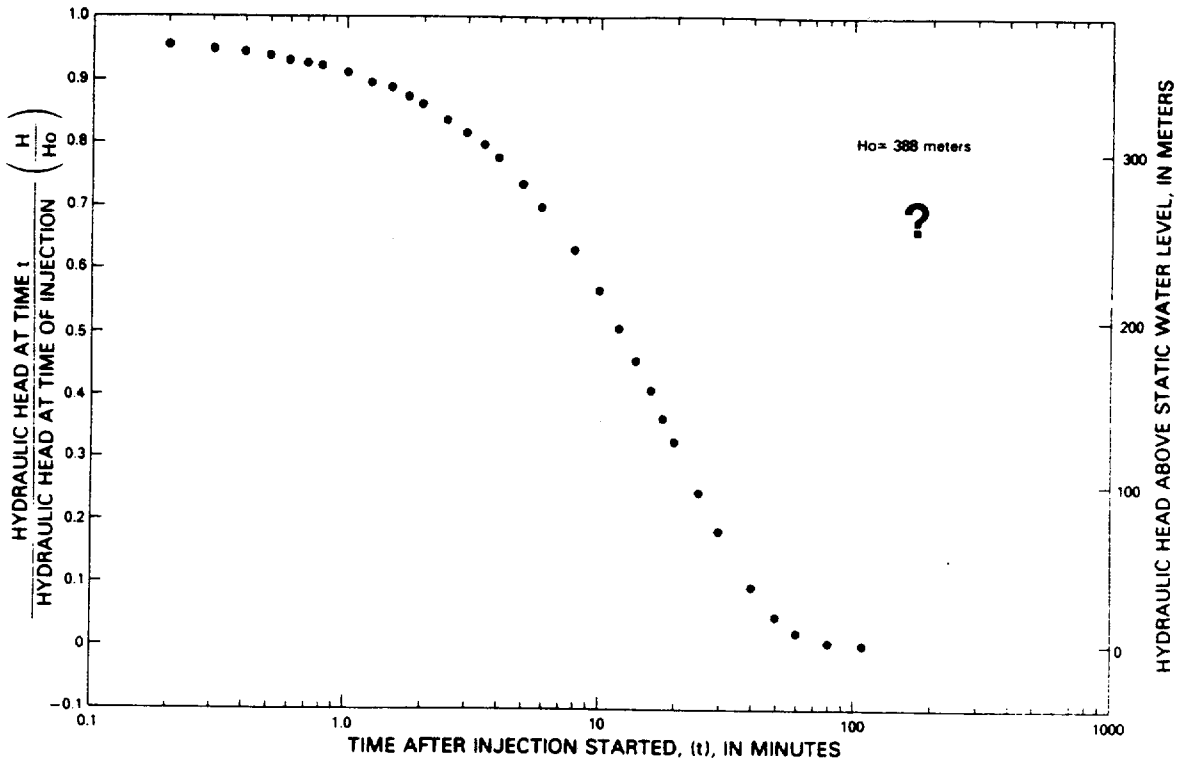


TEST INTERVAL 504m - 544m.

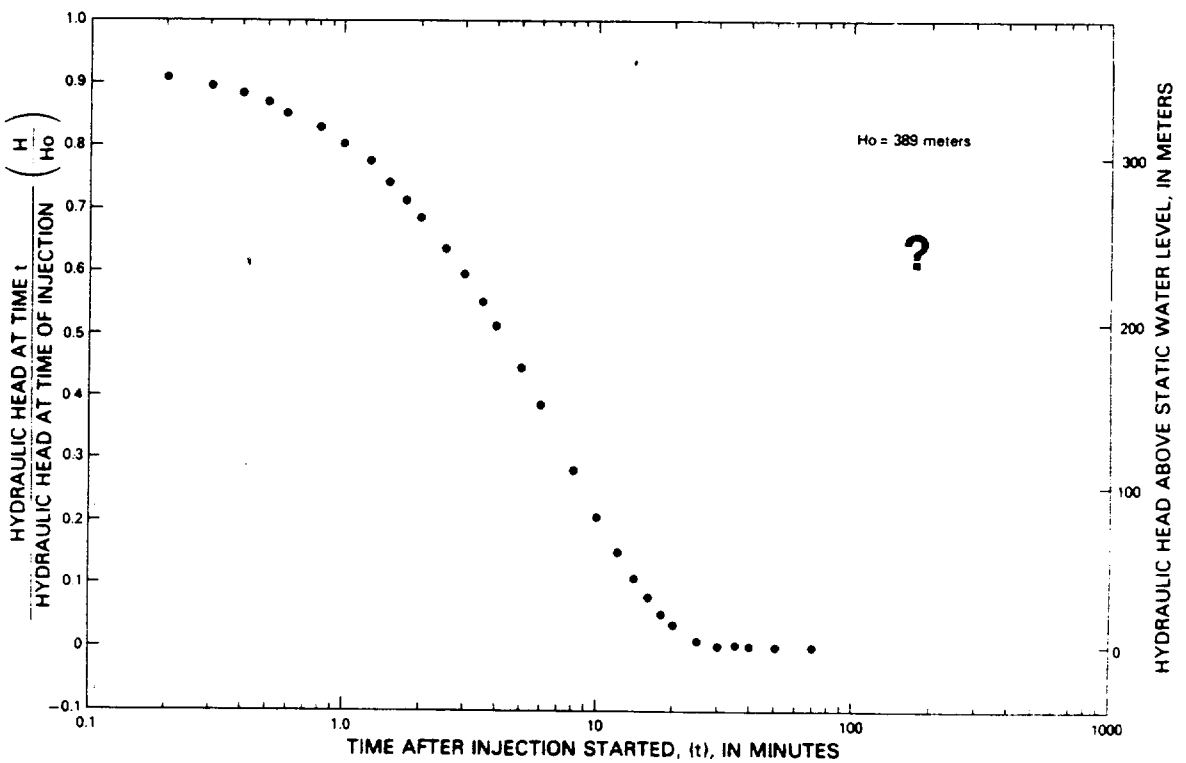


TEST INTERVAL 621m - 661m.

Results of the Cooper-Bredehoeft injection tests in Well UE-25b#1. From Lahoud et al., 1984.

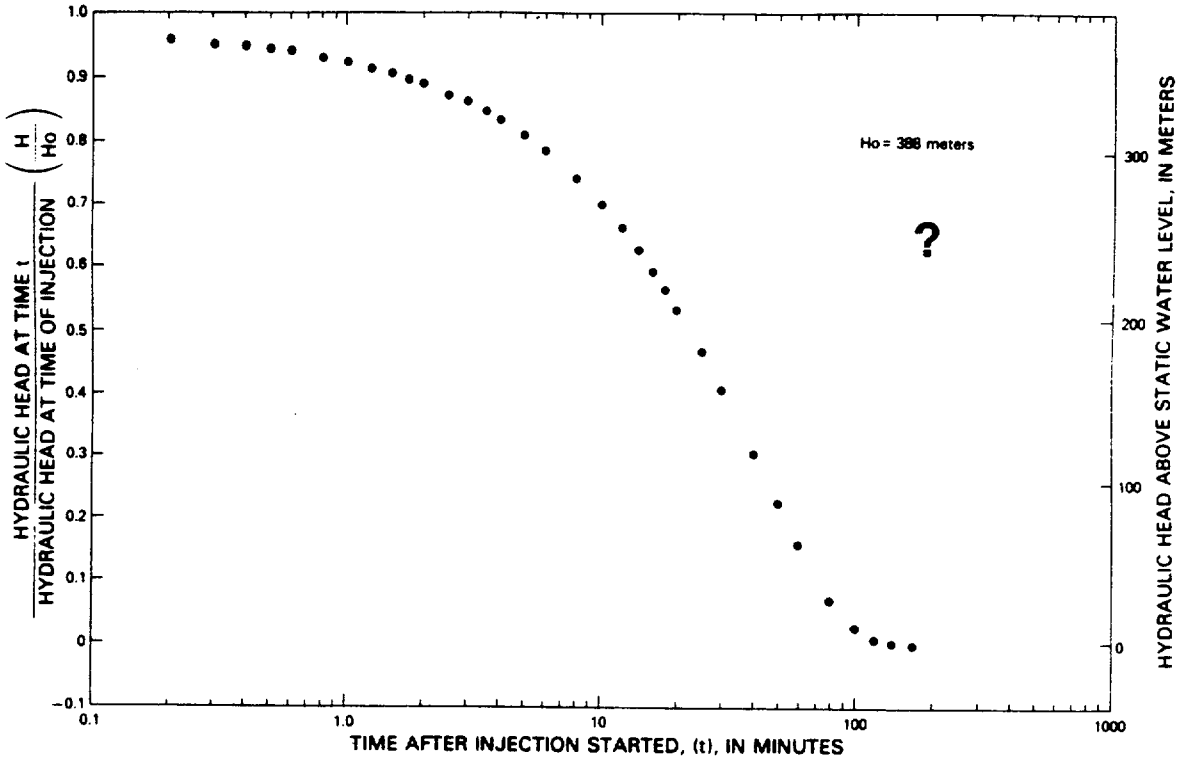


Packer-injection test 5, depth interval from 640 to 690 meters.

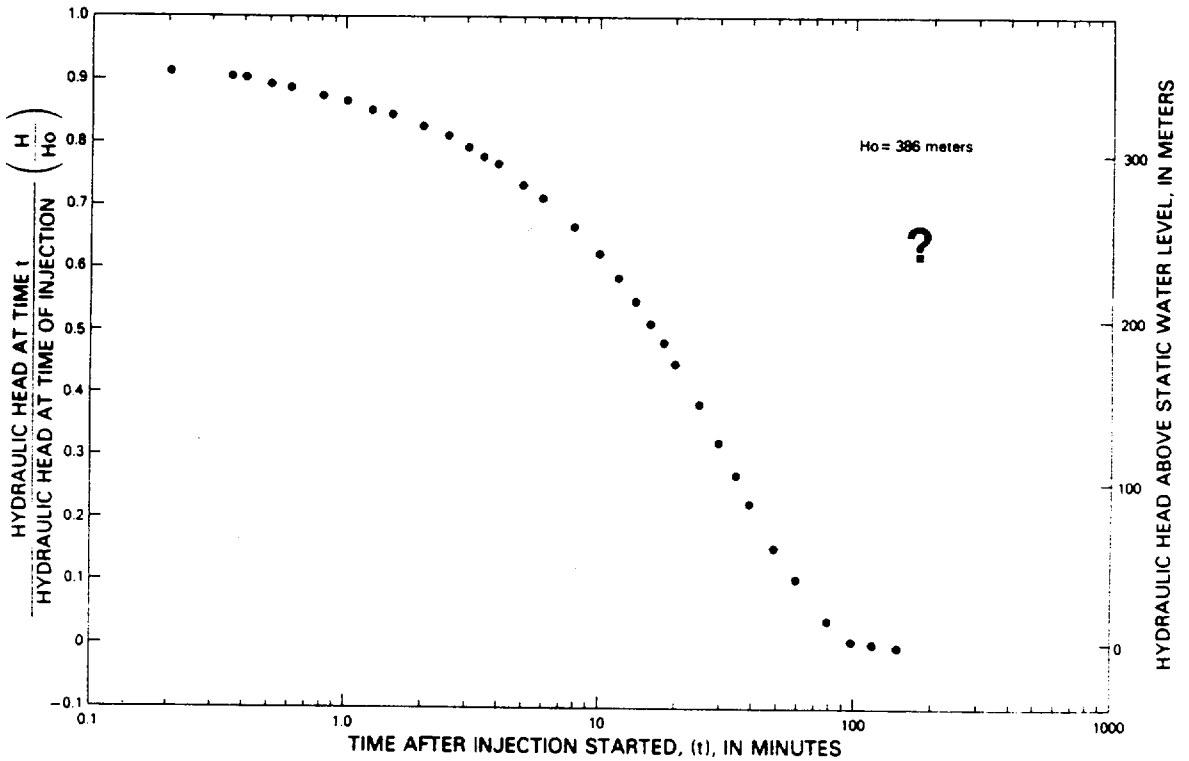


Packer-injection test 3, depth interval from 550 to 600 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

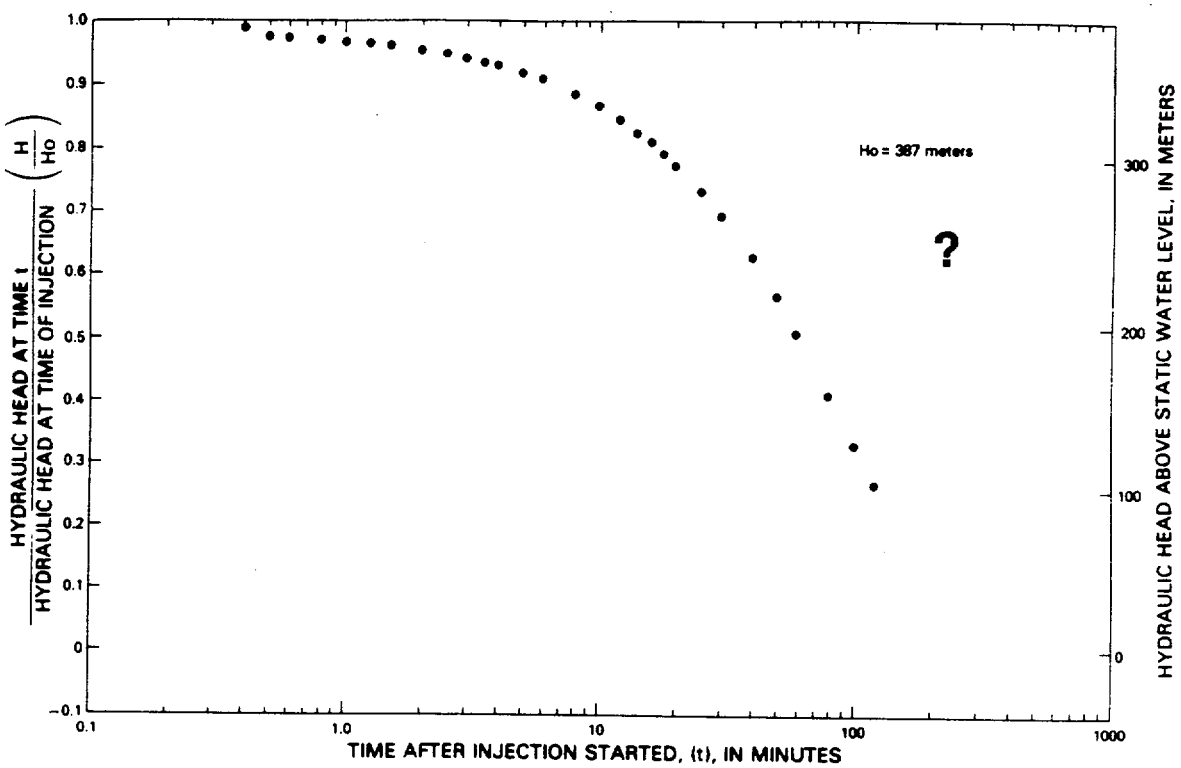


Packer-injection test 8, depth interval from 764 to 834 meters.



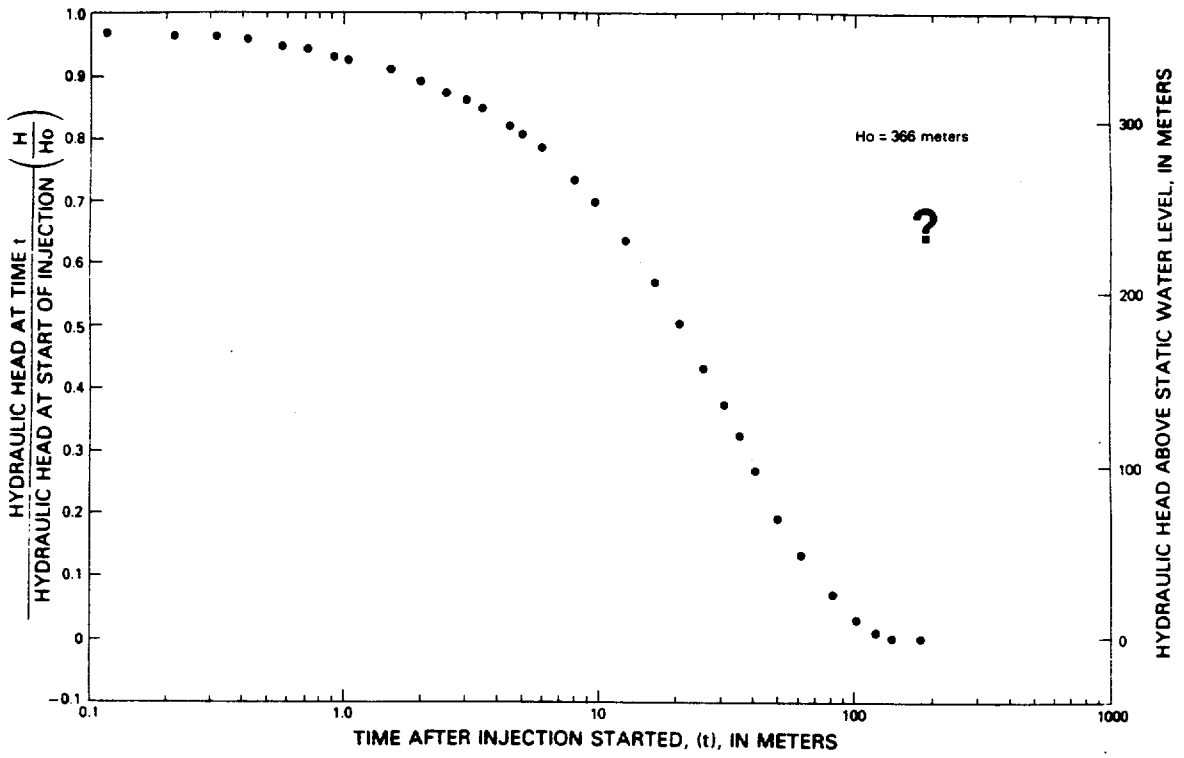
Packer-injection test 9, depth interval from 834 to 904 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

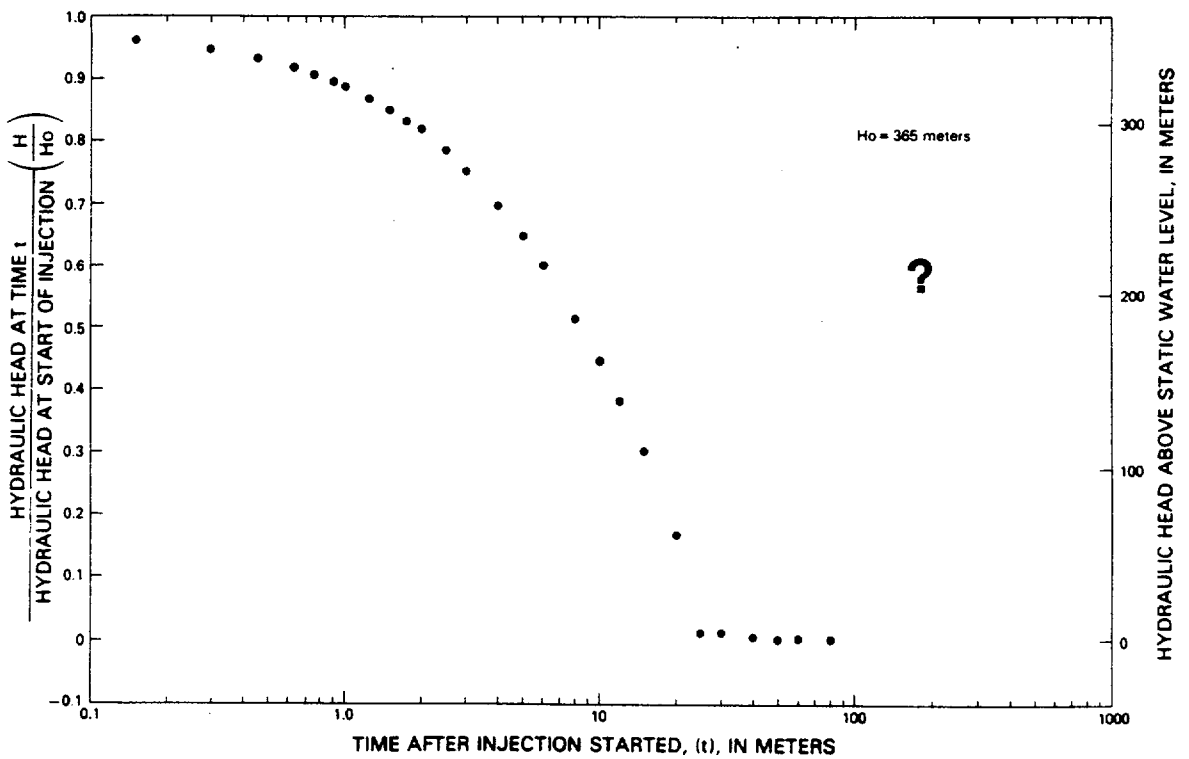


Packer-injection test 6, depth interval from 690 to 740 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

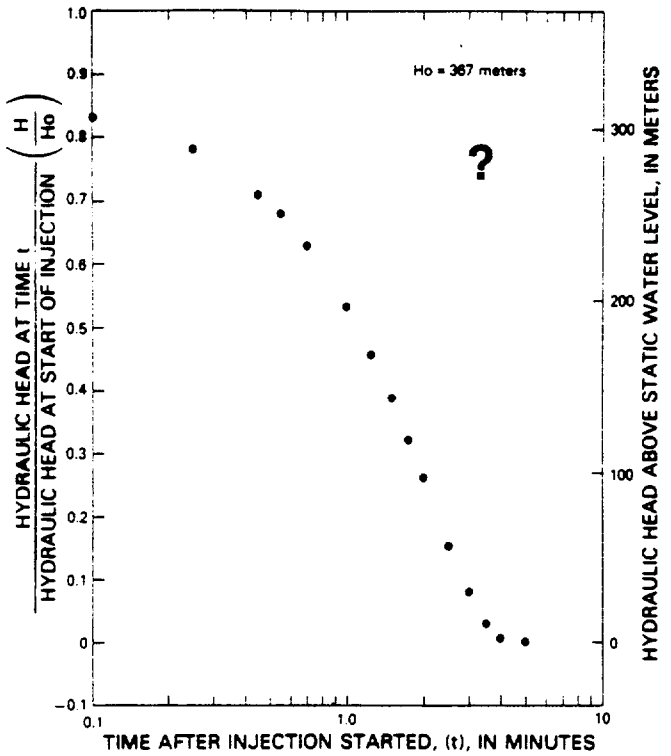


Packer-injection test 15, depth interval from 1,297 to 1,308 meters.

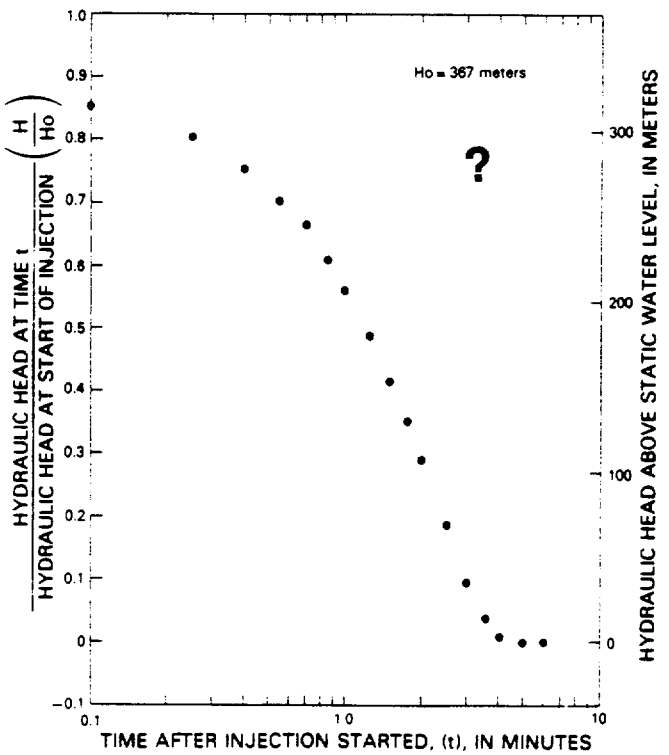


Packer-injection test 16, depth interval from 1,297 to 1,337 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

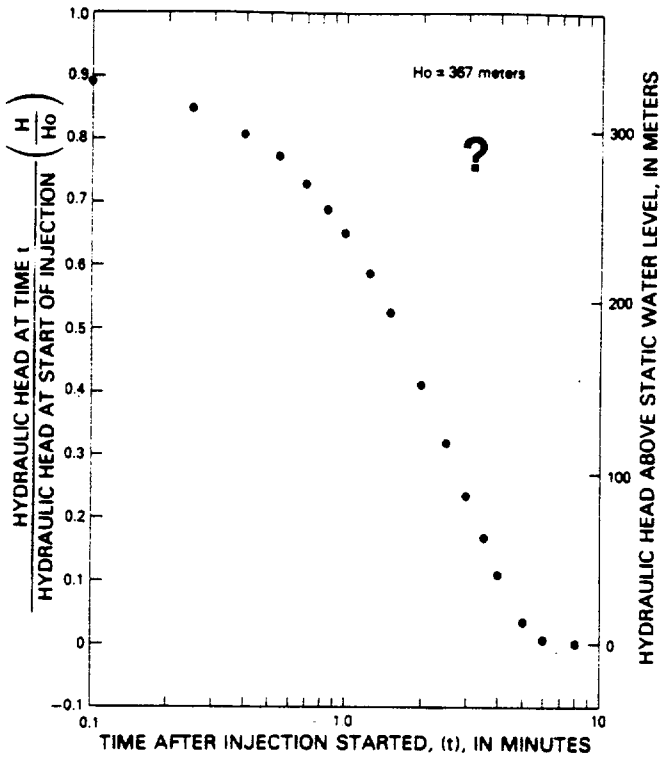


Packer-injection test 17, depth interval from 1,341 to 1,381 meters.

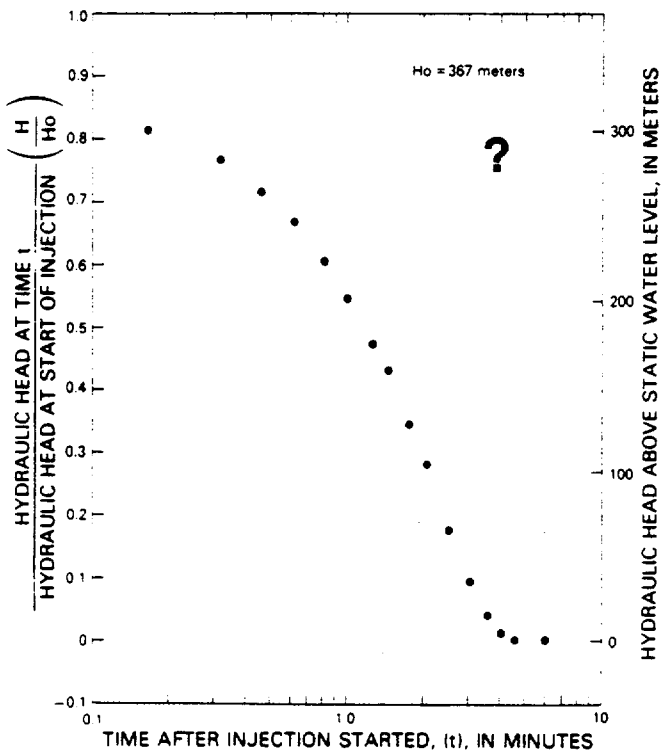


Packer-injection test 18, depth interval from 1,381 to 1,421 meters

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

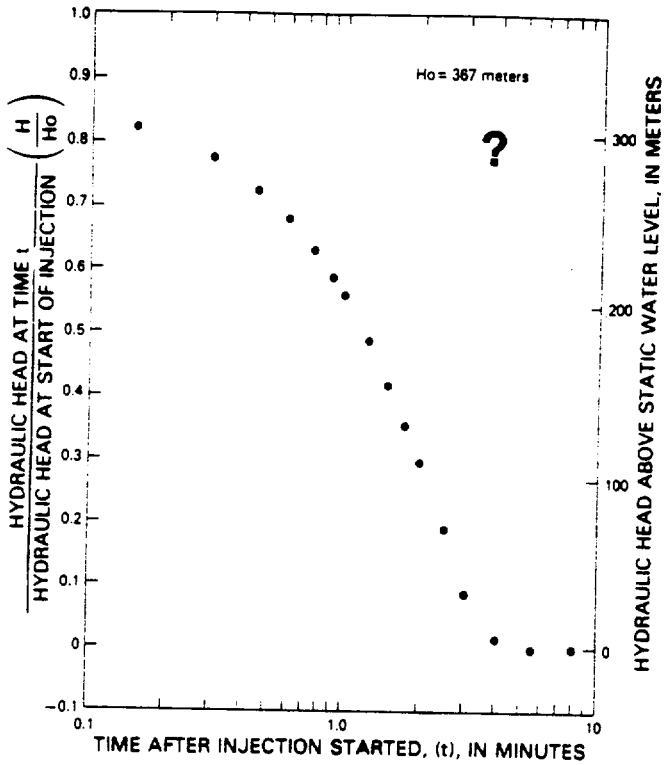


Packer-injection test 19, depth interval from 1,423 to 1,463 meters.

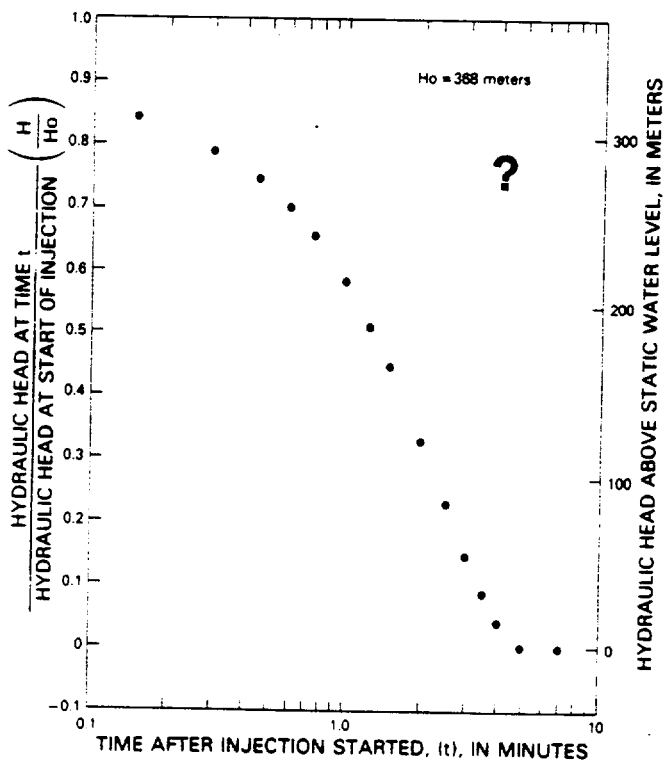


Packer-injection test 20, depth interval from 1,463 to 1,509 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

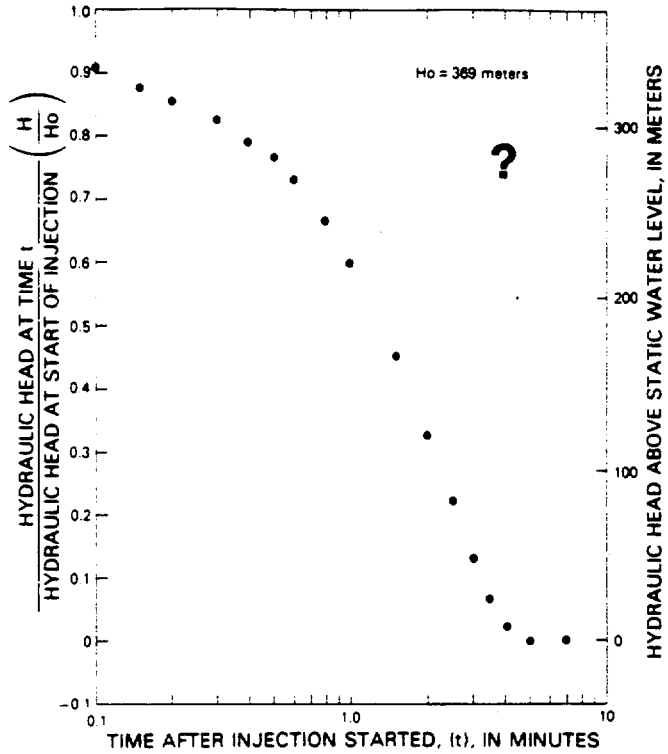


Packer-injection test 21, depth interval from 1,509 to 1,555 meters.

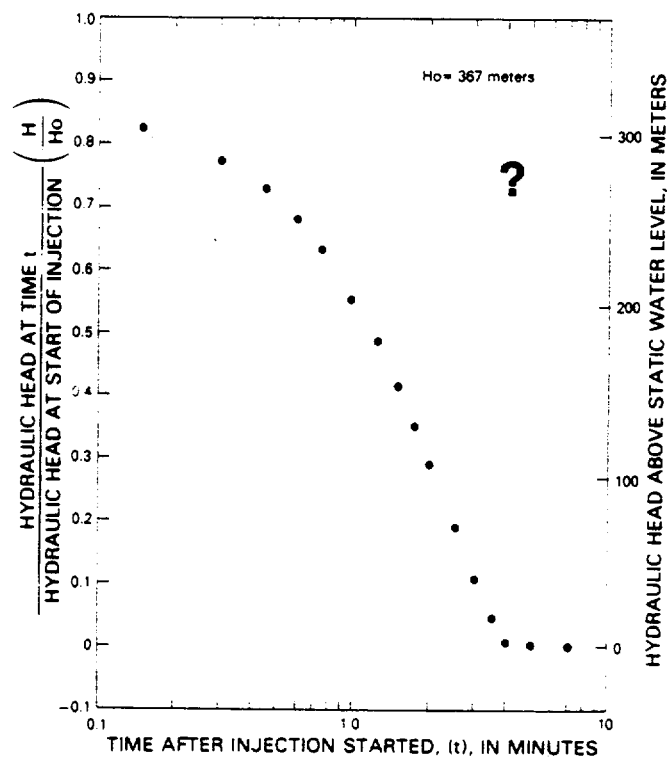


Packer-injection test 22, depth interval from 1,558 to 1,805 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

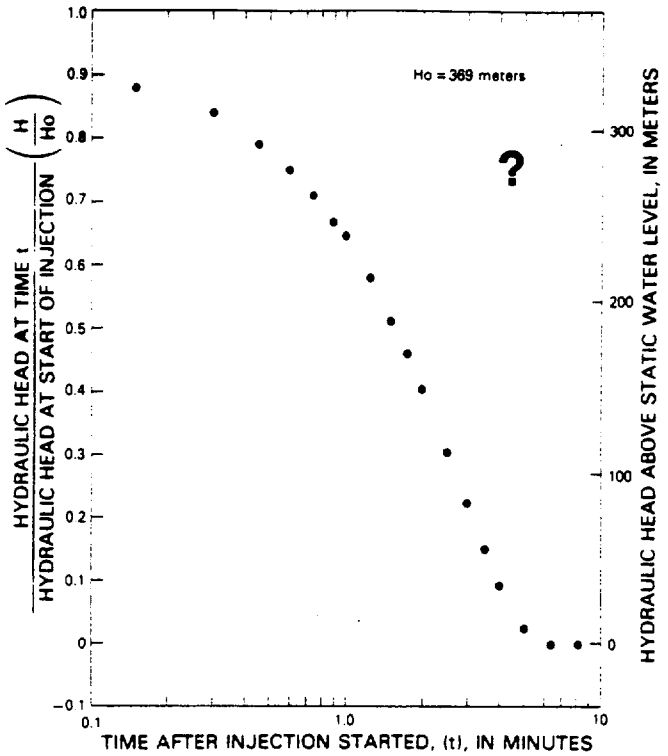


Packer-injection test 24, depth interval from 1,597 to 1,643 meters.

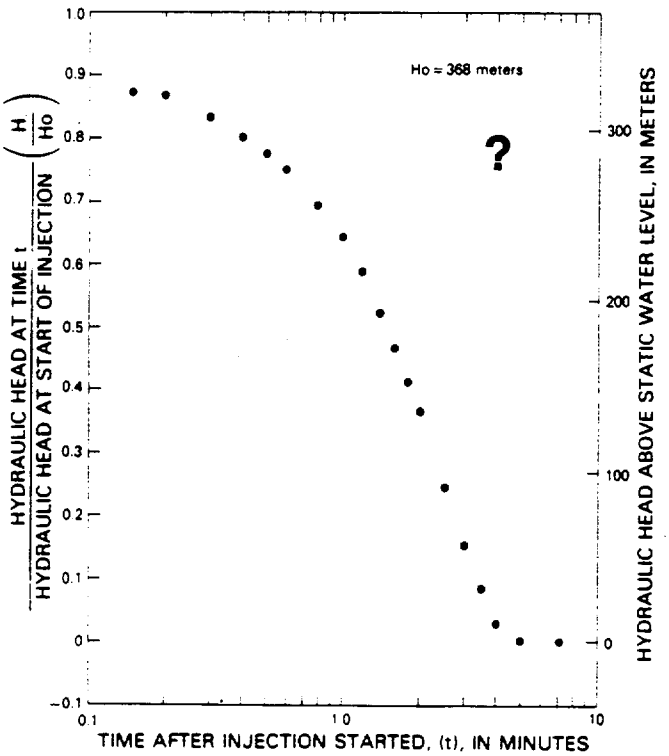


Packer-injection test 23, depth interval from 1,554 to 1,600 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

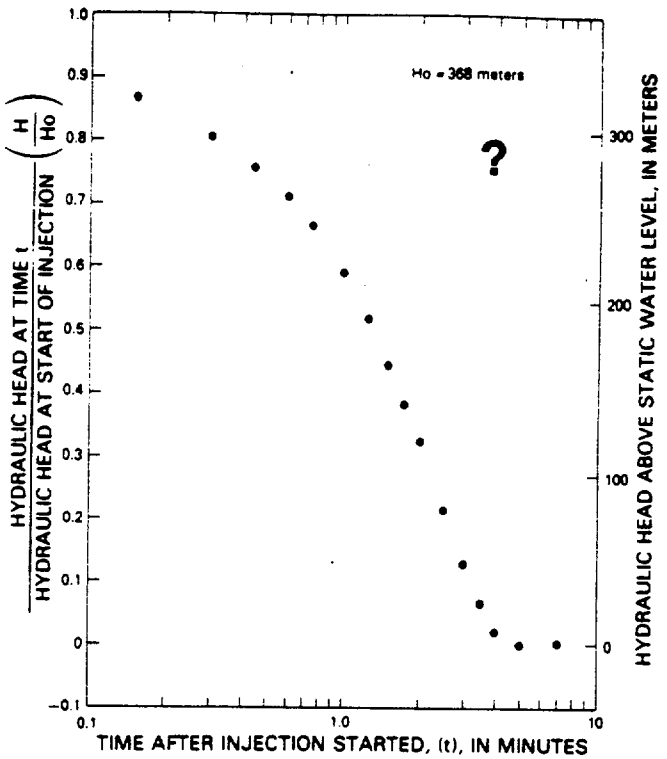


Packer-injection test 25, depth interval from 1,646 to 1,805 meters.

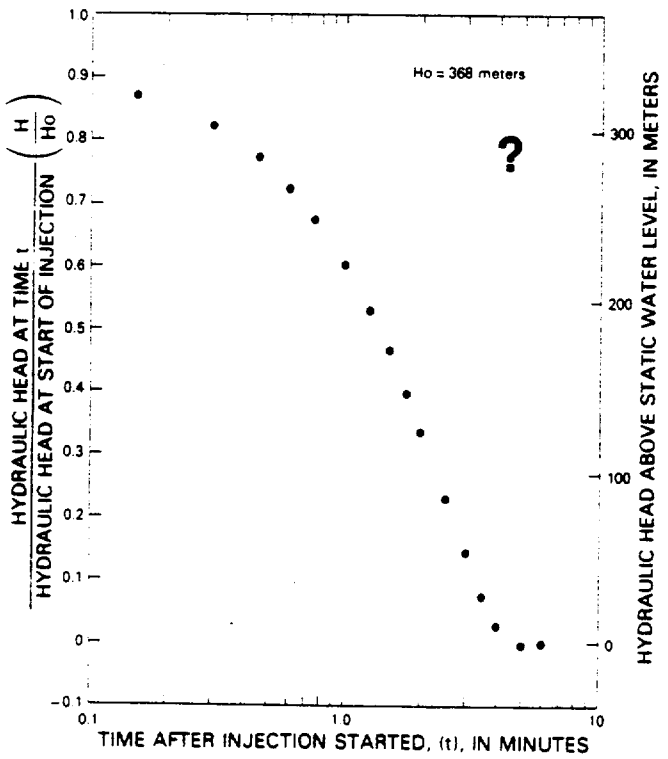


Packer-injection test 26, depth interval from 1,643 to 1,689 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

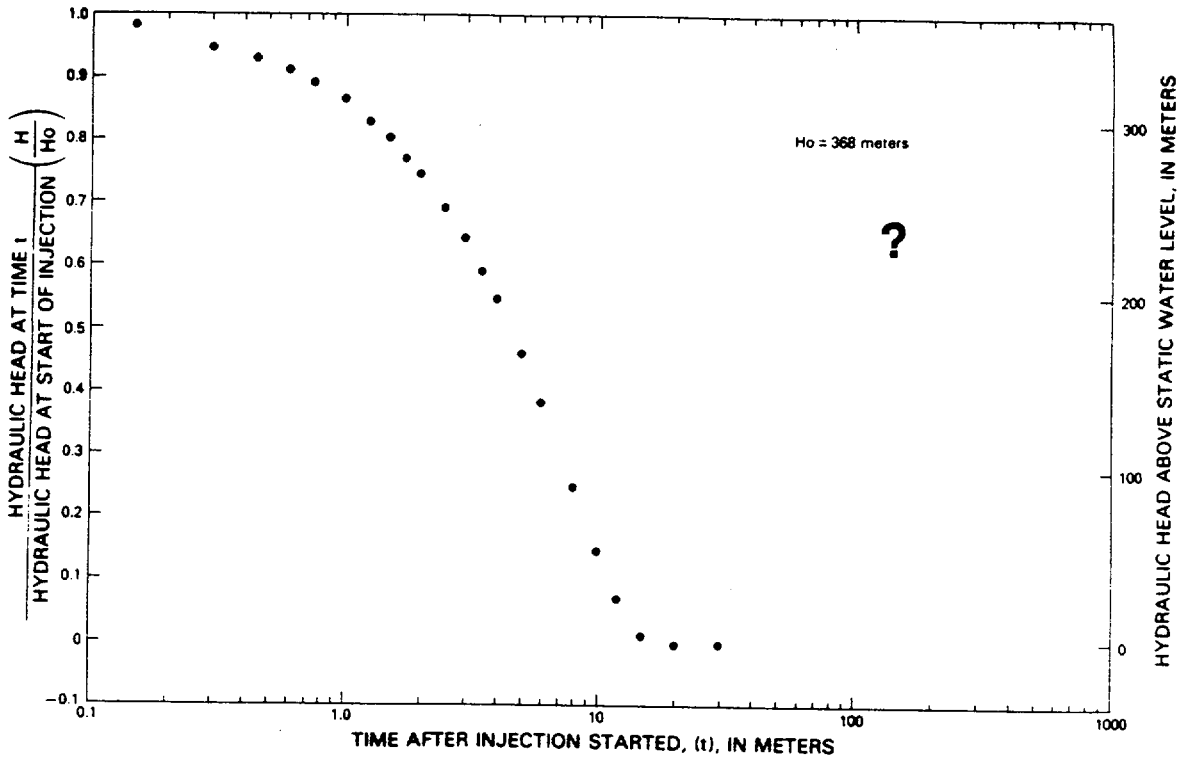


Packer-injection test 27, depth interval from 1,689 to 1,735 meters



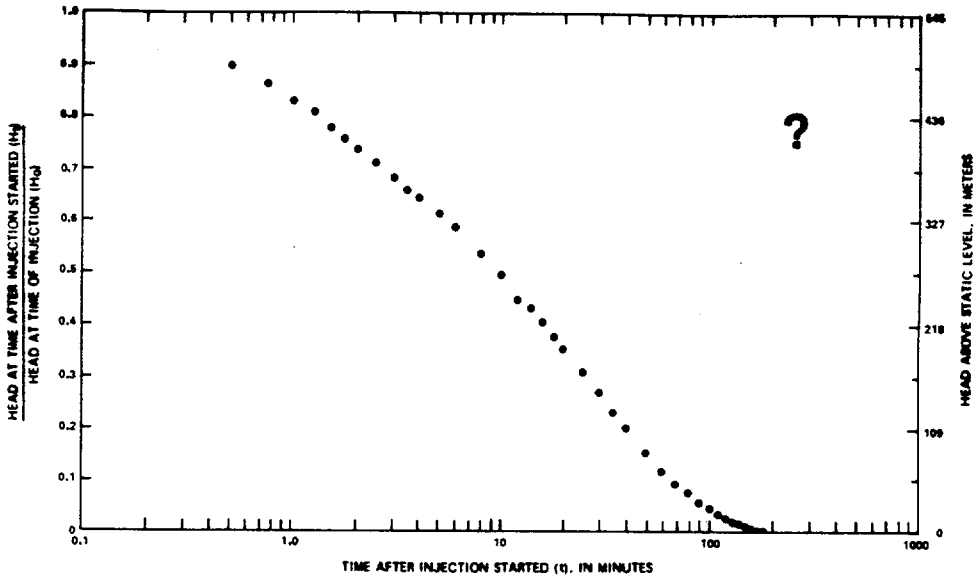
Packer-injection test 28, depth interval from 1,735 to 1,781 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.



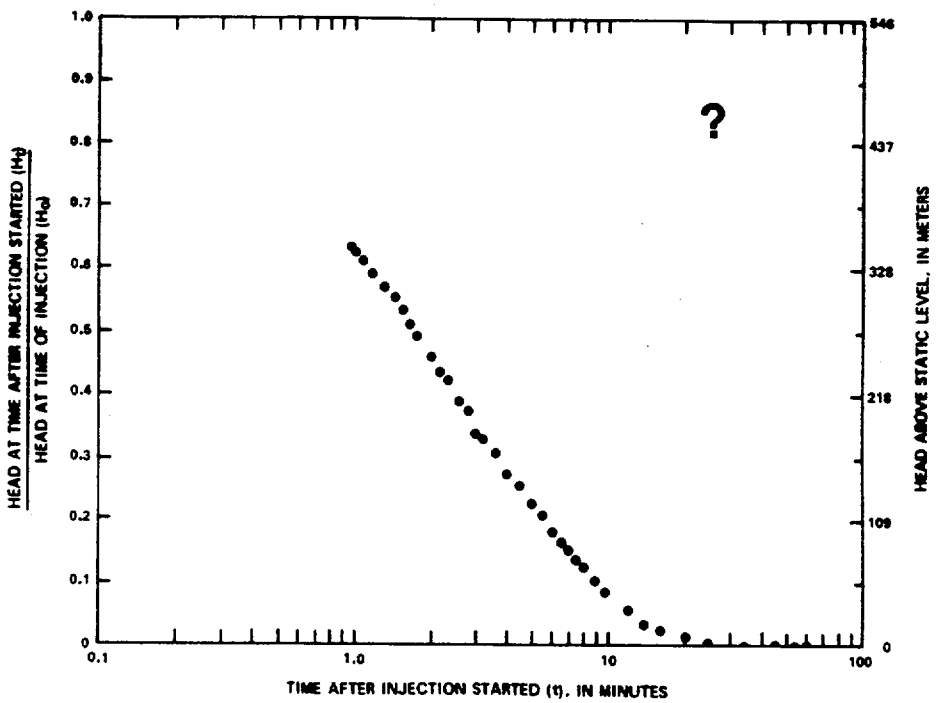
Packer-injection test 29, depth interval from 1,783 to 1,805 meters.

Results of the Cooper-Bredehoeft injection tests in Well UE-25p#1. From Craig and Johnson, 1984.

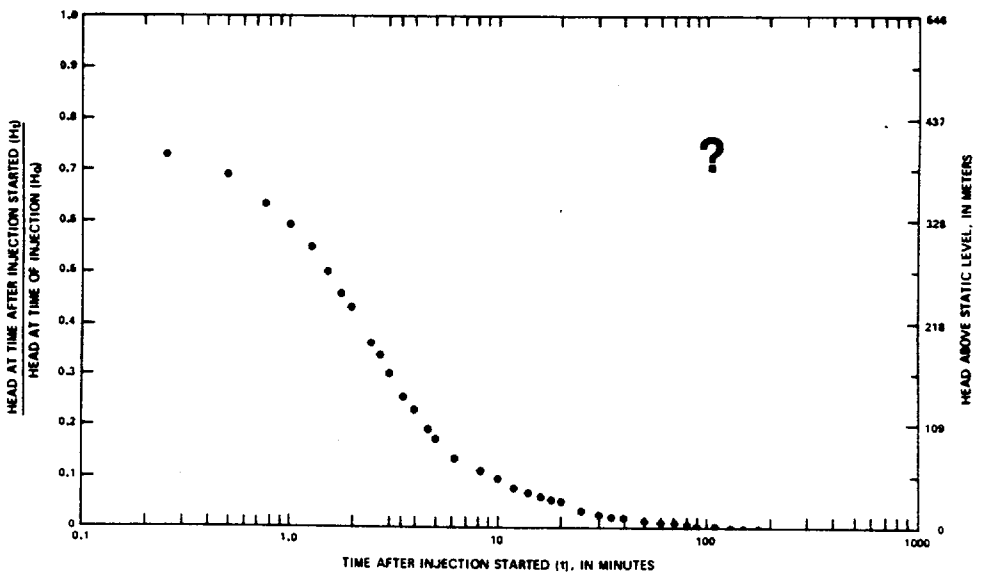


Packer-injection test for depth interval from 698 to 722 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.

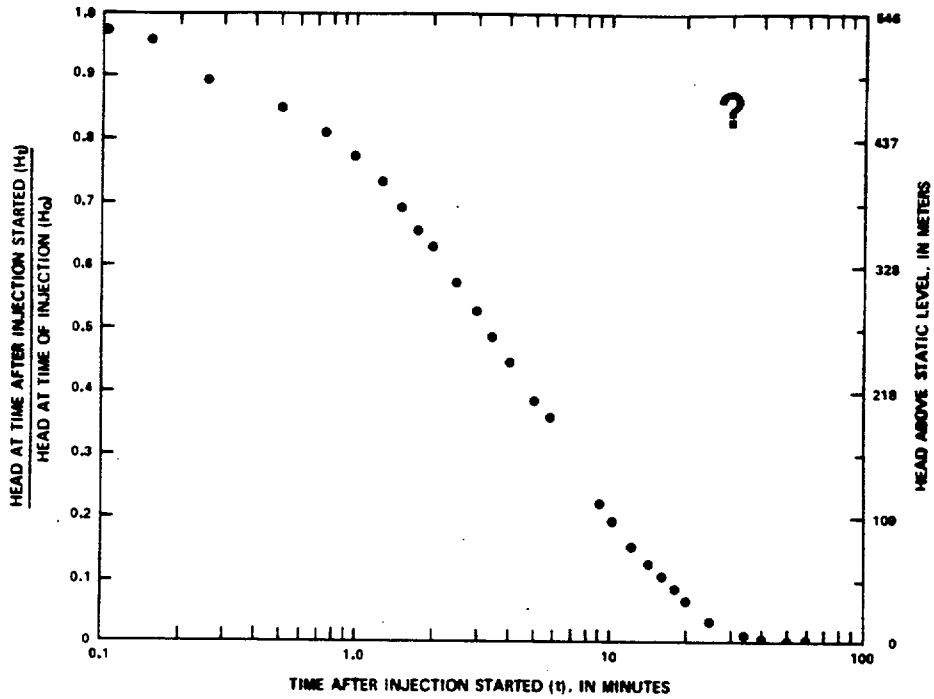


Packer-injection test for depth interval from 615 to 655 meters.

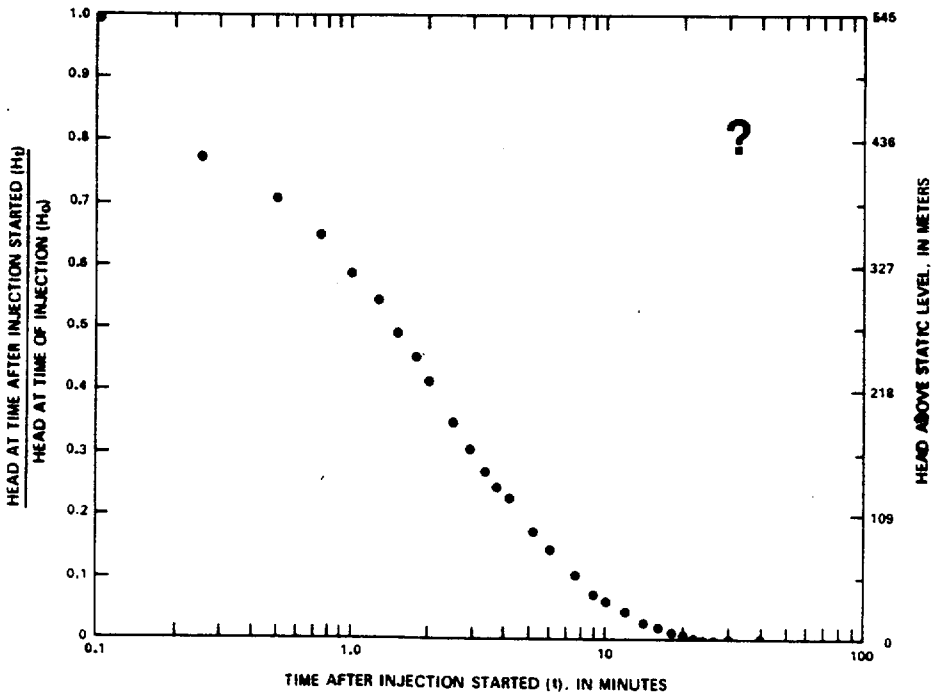


Packer-injection test for depth interval from 655 to 701 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.

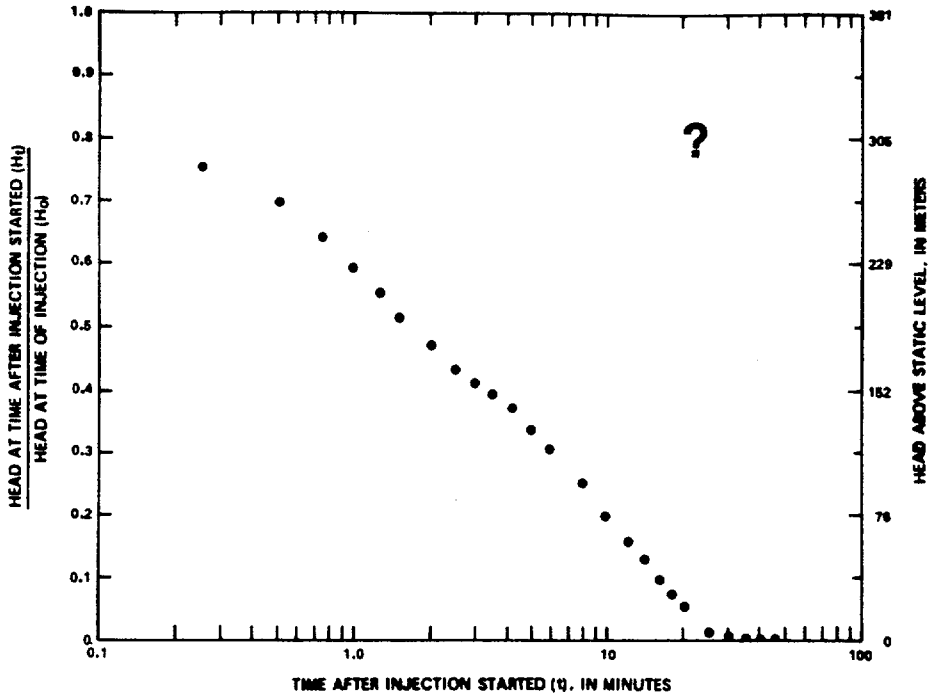


Packer-injection test for depth interval from 722 to 747 meters.

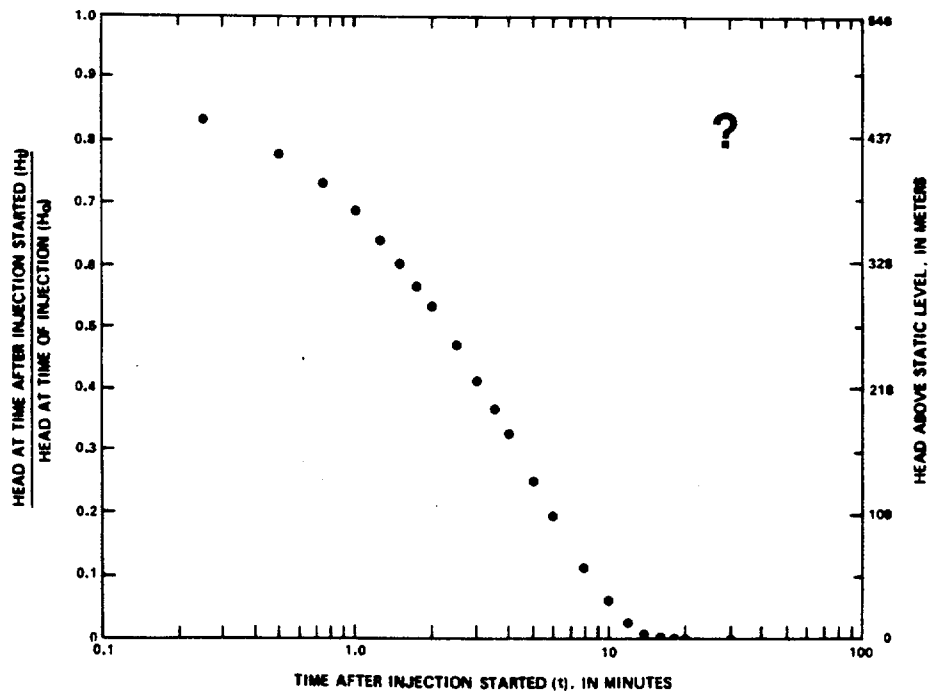


Packer-injection test for depth interval from 747 to 792 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.



-Packer-injection test for depth interval from 802 to 826 meters (second test).



-Packer-injection test for depth interval from 826 to 850 meters.

Results of the Cooper-Bredehoeft injection tests in Well USW G-4. From Bentley, 1984.

HYDRAULIC FRACTURING

Borehole	Depth	σ c	Stress Conditions
G-1	646	35	LE
G-1	792	50	nLE
G-1	945	54	LE
G-1	1038	61	nLE
G-1	1218	58	LE
G-1	1288	78	nLE
G-2	295	51	nLE
G-2	418	54	nLE
G-2	432	55	nLE
G-2	1026	62	nLE
G-2	1209	53	LE
G-3	1074	37	LE
G-3	1338	59	LE
G-3	1356	57	LE
UE-25p#1	731	39	LE
UE-25p#1	1001	50	LE
UE-25p#1	1131	56	LE
UE-25p#1	1564	222	nLE
UE-25p#1	1573	91	nLE
UE-25p#1	1693	237	nLE

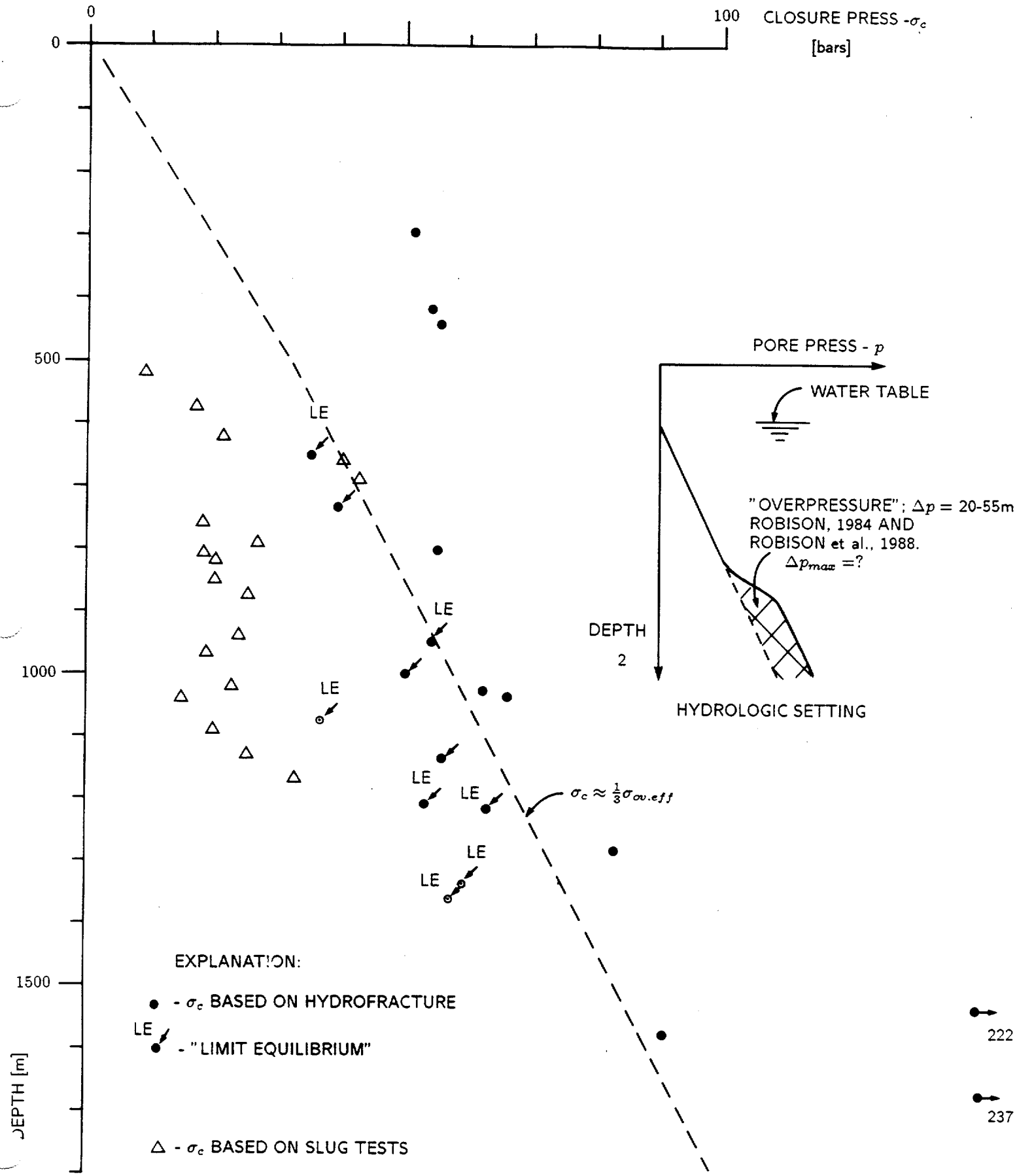
SLUG TESTS

Borehole	Depth	σ c
USW H-1	692	42.5
USW H-3	884	25
USW H-3	941	24
USW H-3	1093	20
USW H-3	1172	33
USW H-4	579	17.5
USW H-4	628	21
USW H-5	793	27.5
USW H-5	823	20
USW H-5	979	19
USW H-5	1024	23
USW H-5	1135	25
USW H-6	666	40
USW H-6	852	20
USW H-6	1045	15
UE-25b#1	528	9.6
UE-25b#1	763	18
USW G-4	815	19
USW G-4	814	18

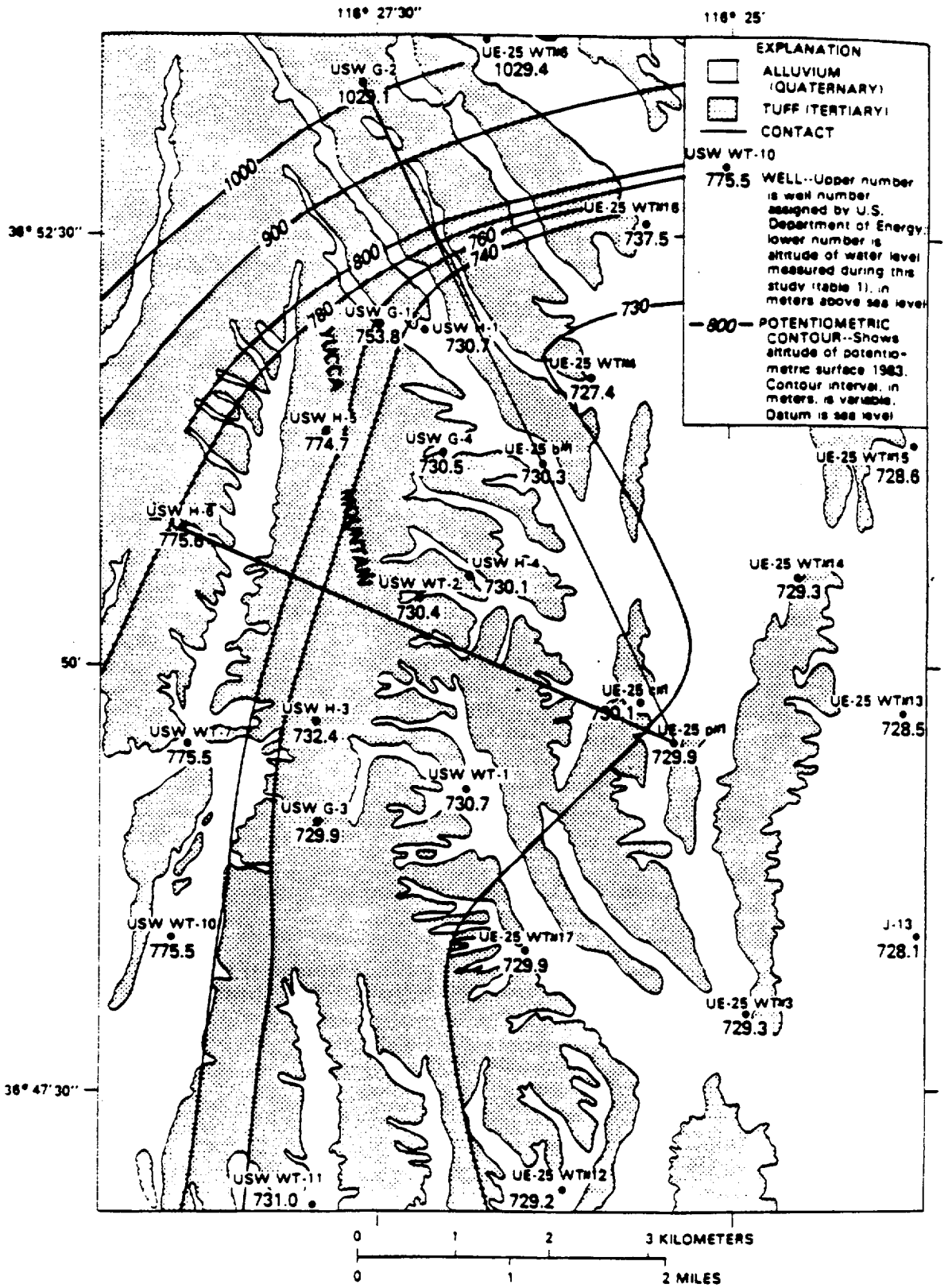
"SINGULAR" POINTS

Borehole	Depth	σ c
USW H-3	792	0
USW H-4	652	
USW H-4	703	
USW H-4	735	
USW H-4	783	
USW H-4	832	
USW H-4	855	
USW H-4	873	
USW H-4	892	
USW H-4	910	
USW H-4	928	
USW H-4	1173	
USW H-4	1195	
USW H-5	796	
USW H-5	887	
USW H-5	888	
USW H-5	1033	
USW H-6	606	
USW H-6	753	
UE-25b#1	514	
UE-25b#1	505	
UE-25b#1	792	
UE-25b#1	820	
UE-25b#1	779	
UE-25b#1	581	
UE-25p#1	550	
UE-25p#1	600	
UE-25p#1	974	
UE-25p#1	1044	
USW G-4	702	
USW G-4	850	
USW G-4	875	

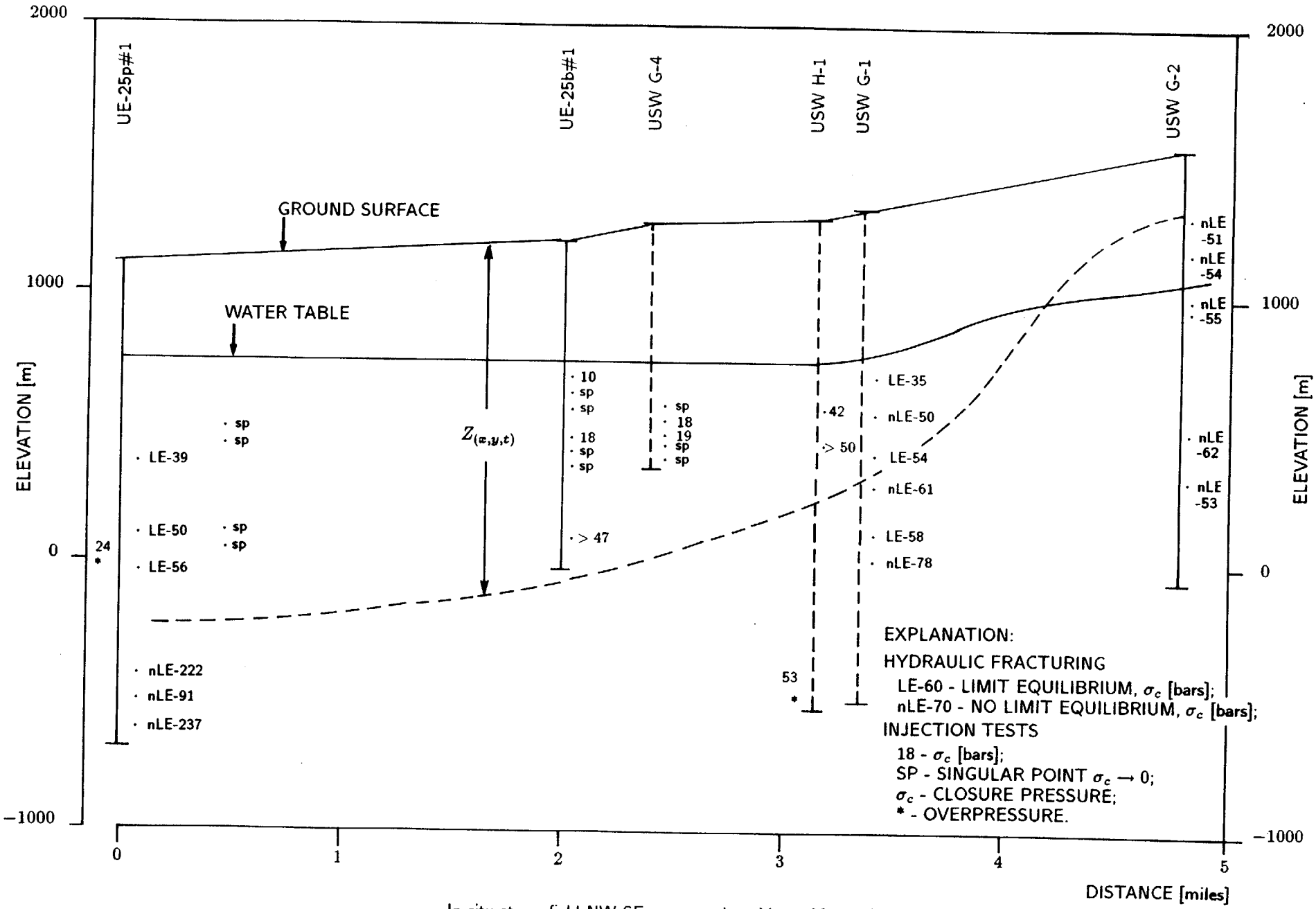
State of in situ stress. Summary. Yucca Mountain.



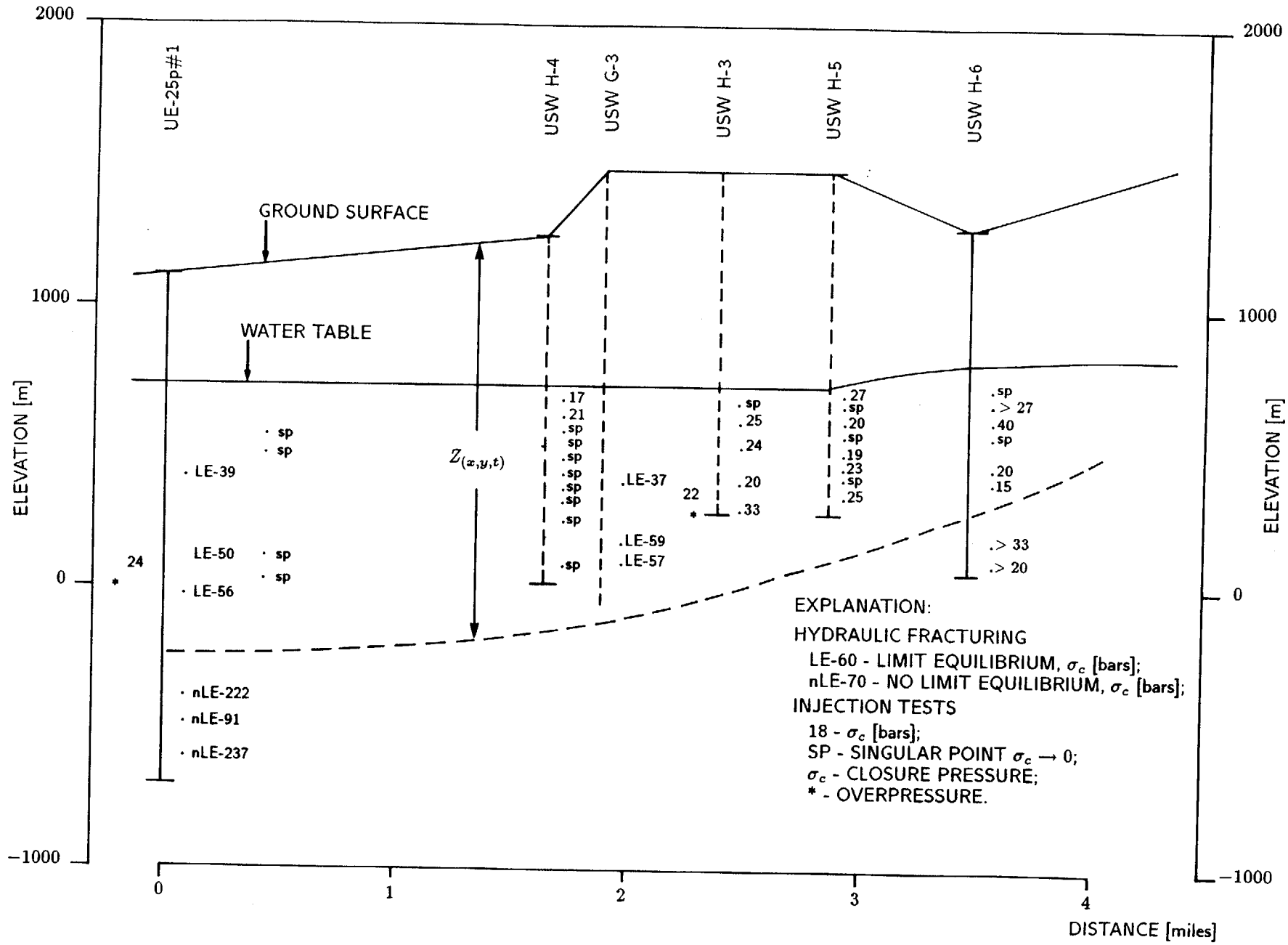
State of in situ stress. Summary. Yucca Mountain.



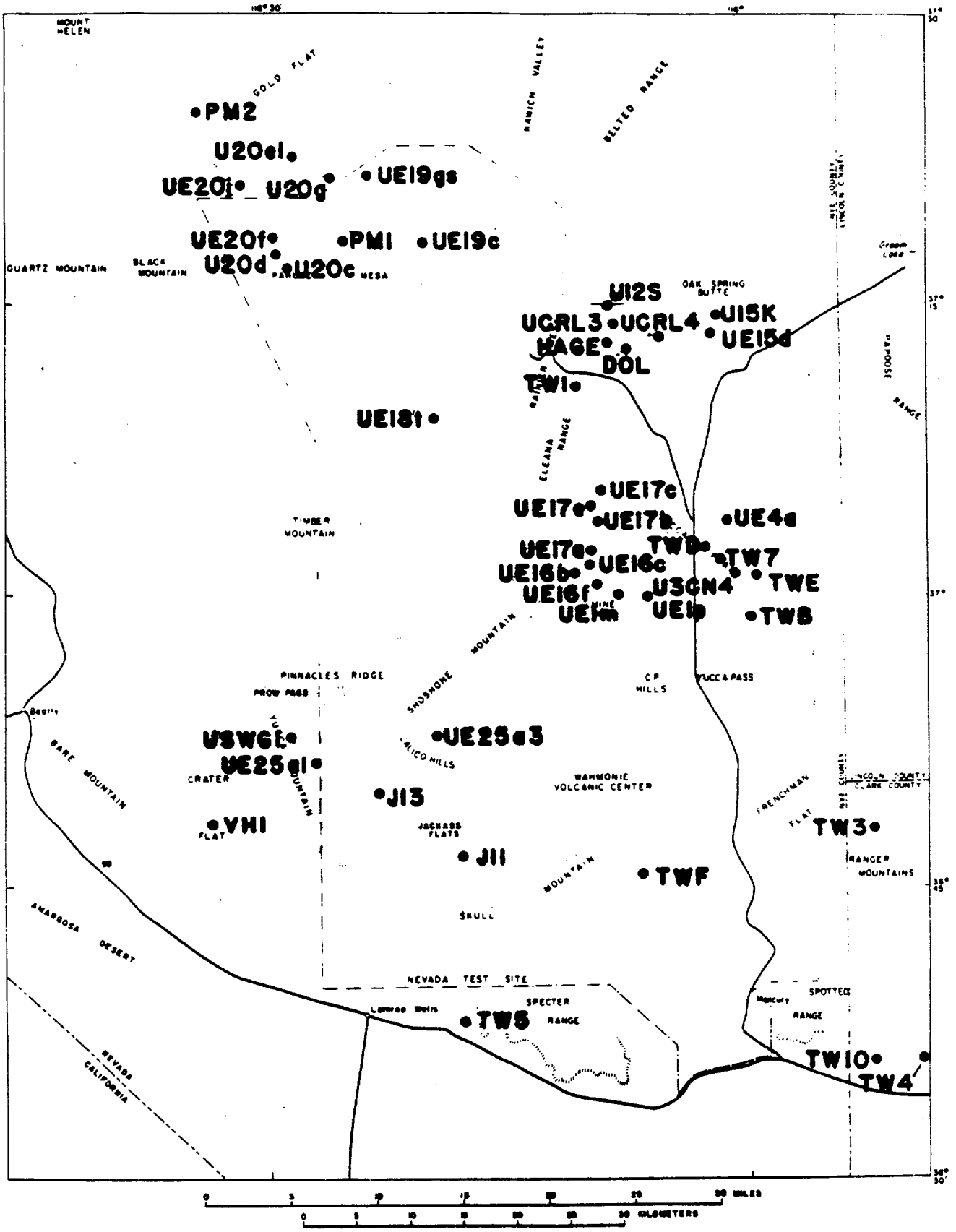
Location map for in situ stress cross-sections. Yucca Mountain. Modified from Robison, 1984.



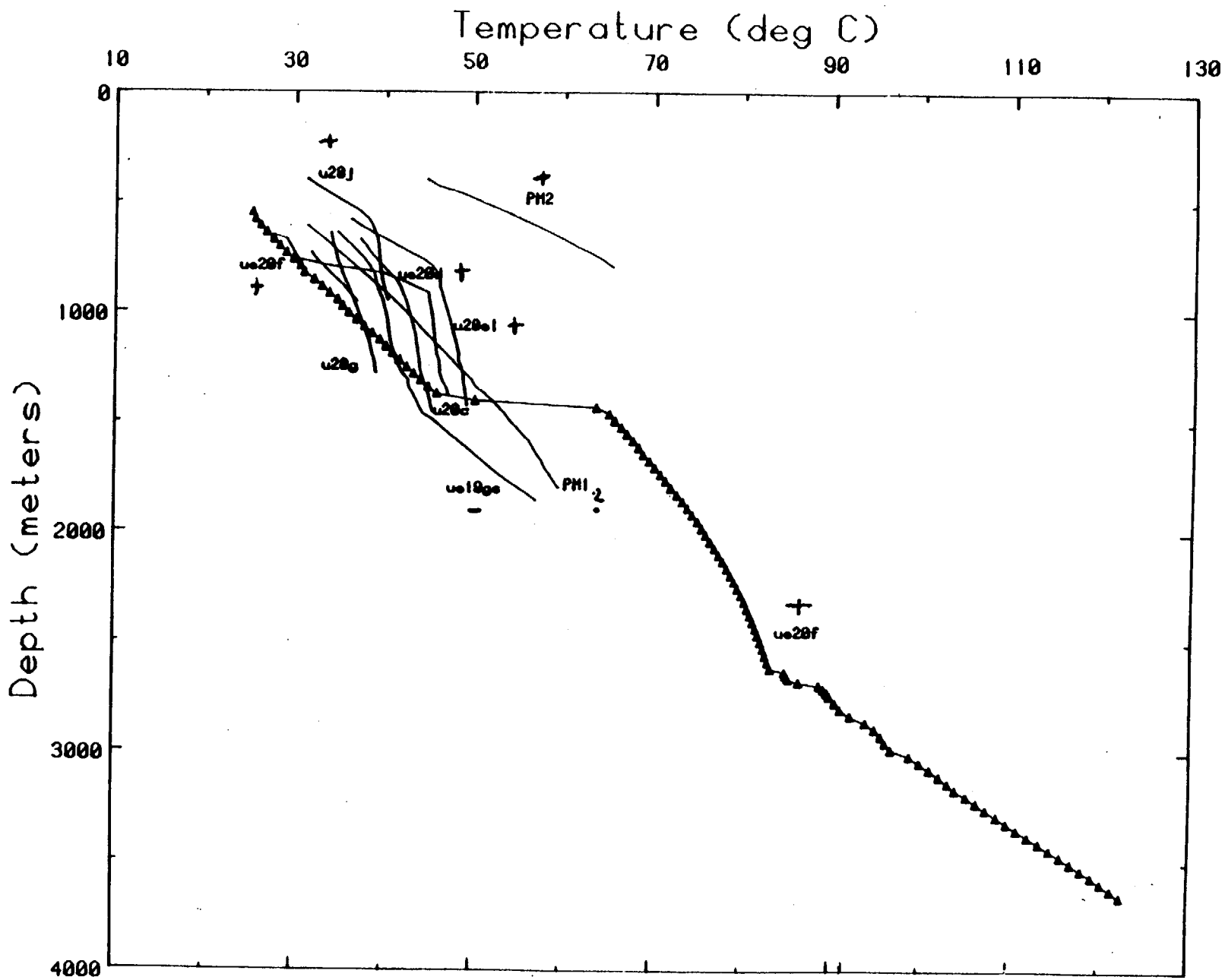
In situ stress field NW-SE cross-section. Yucca Mountain.



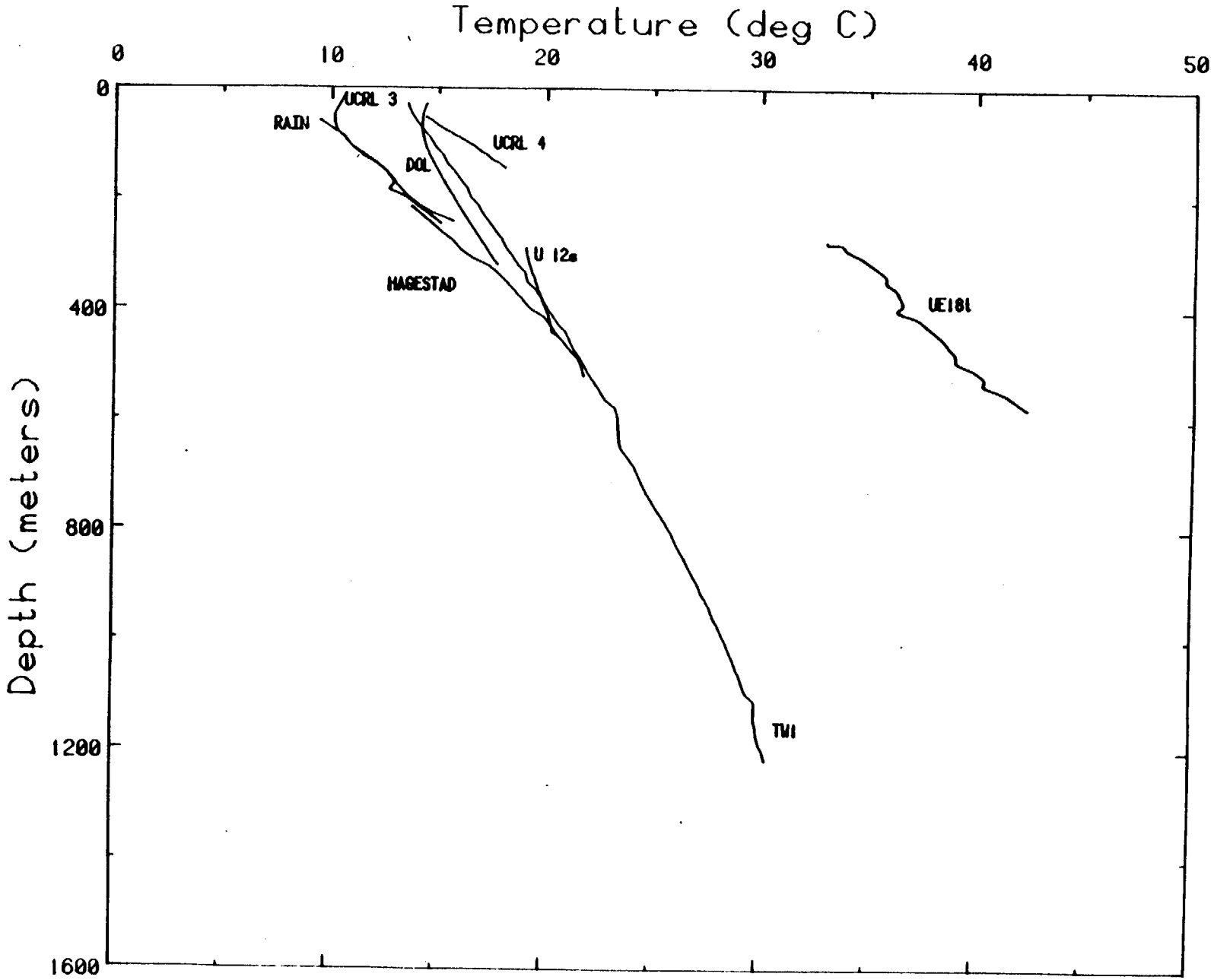
In situ stress field. W-E cross-section. Yucca Mountain.



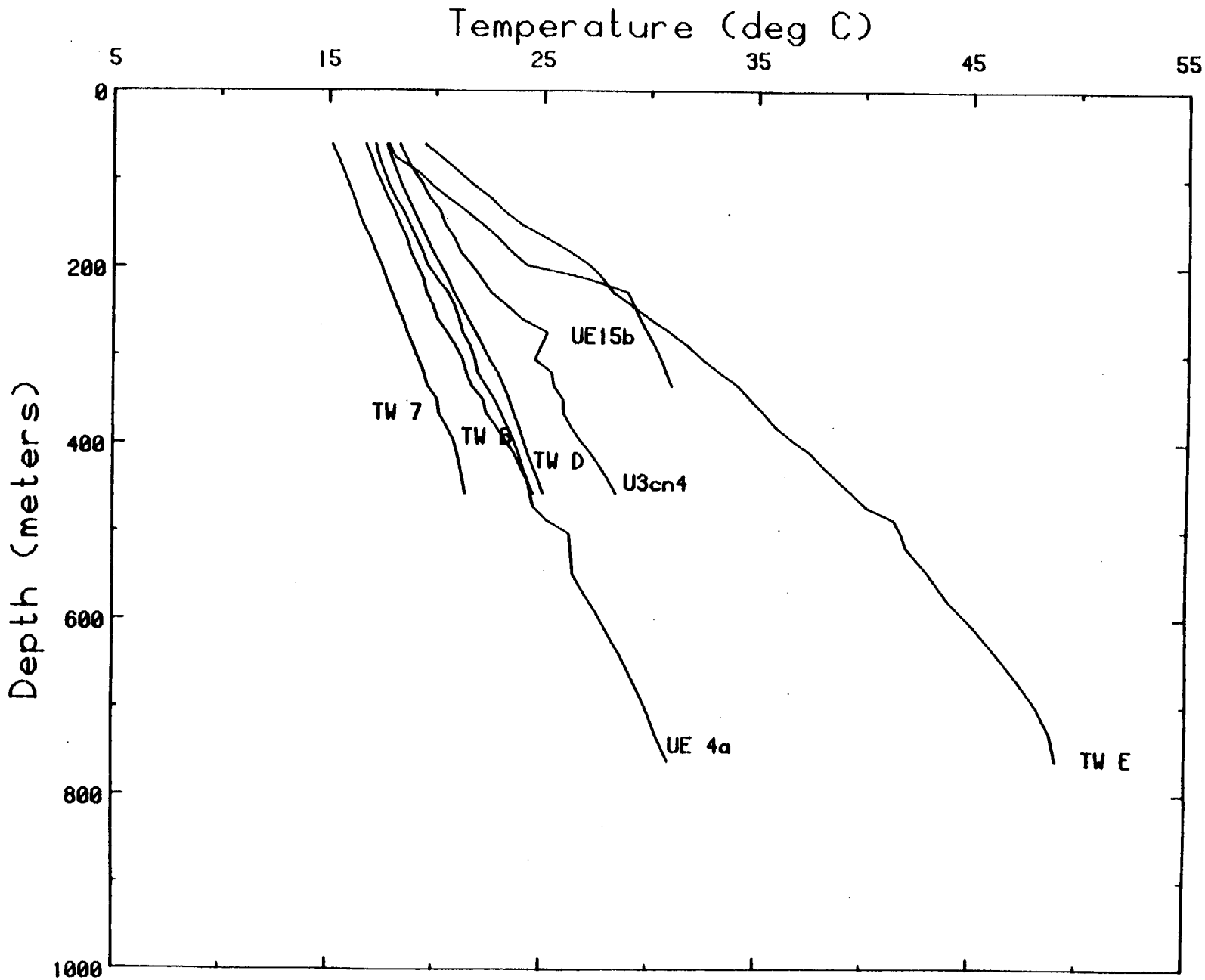
Location of wells in which temperature measurements were made. From Sass and Lachenbruch, 1982.



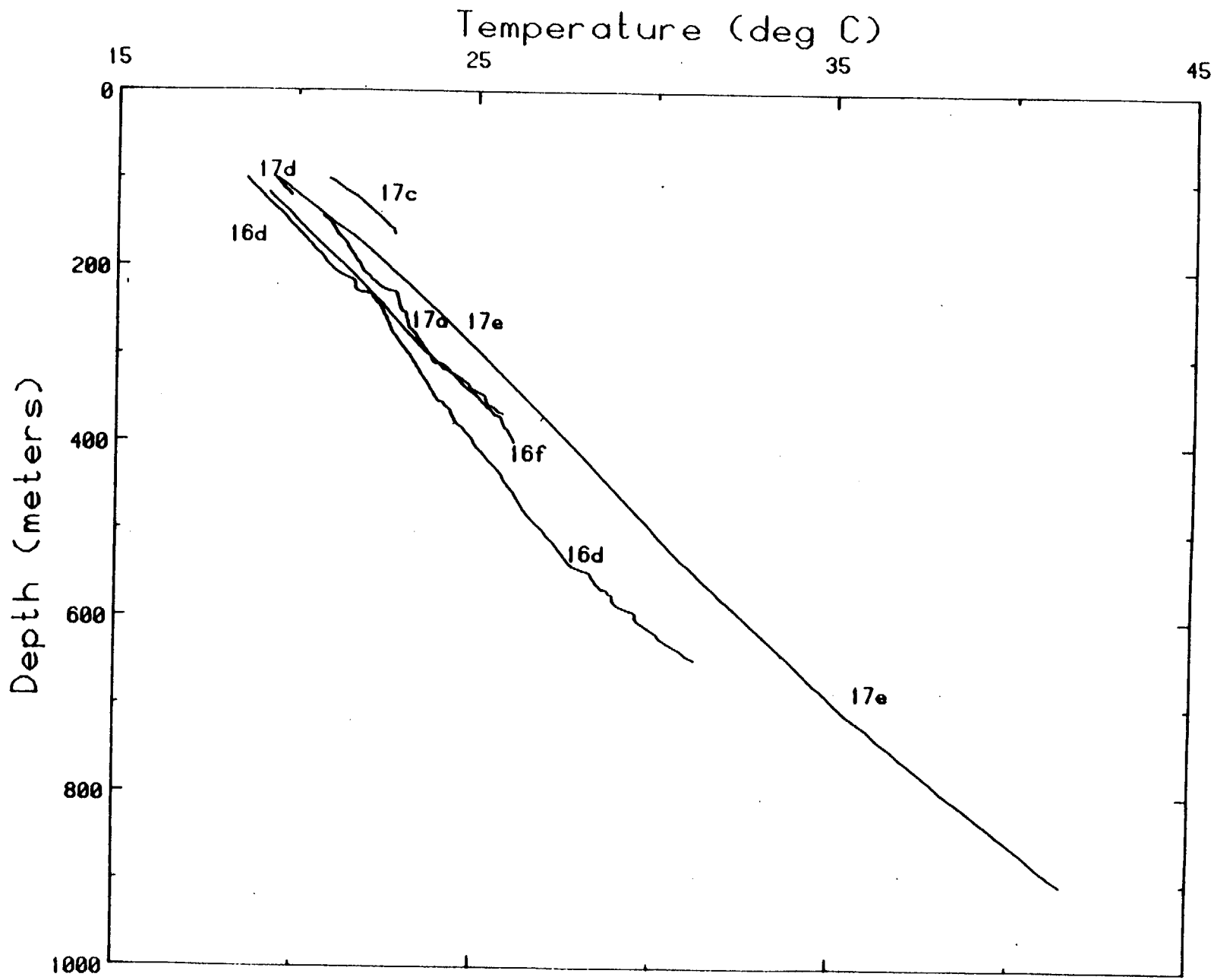
Composite temperature profile, Pahute Mesa. From Sass and Lachenbruch, 1982.



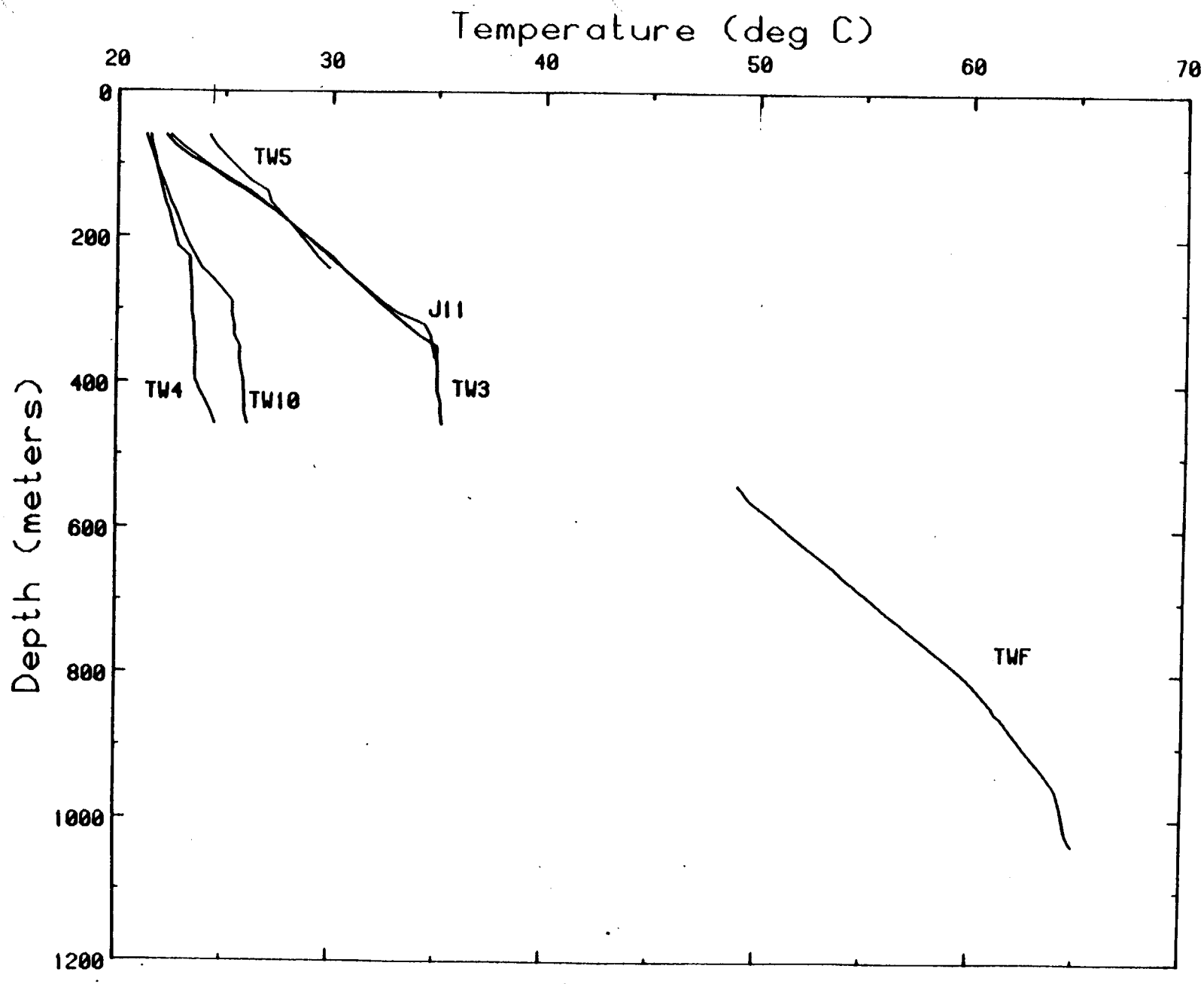
Composite temperature profile for Rainier Mesa and environments. From Sass and Lachenbruch, 1982.



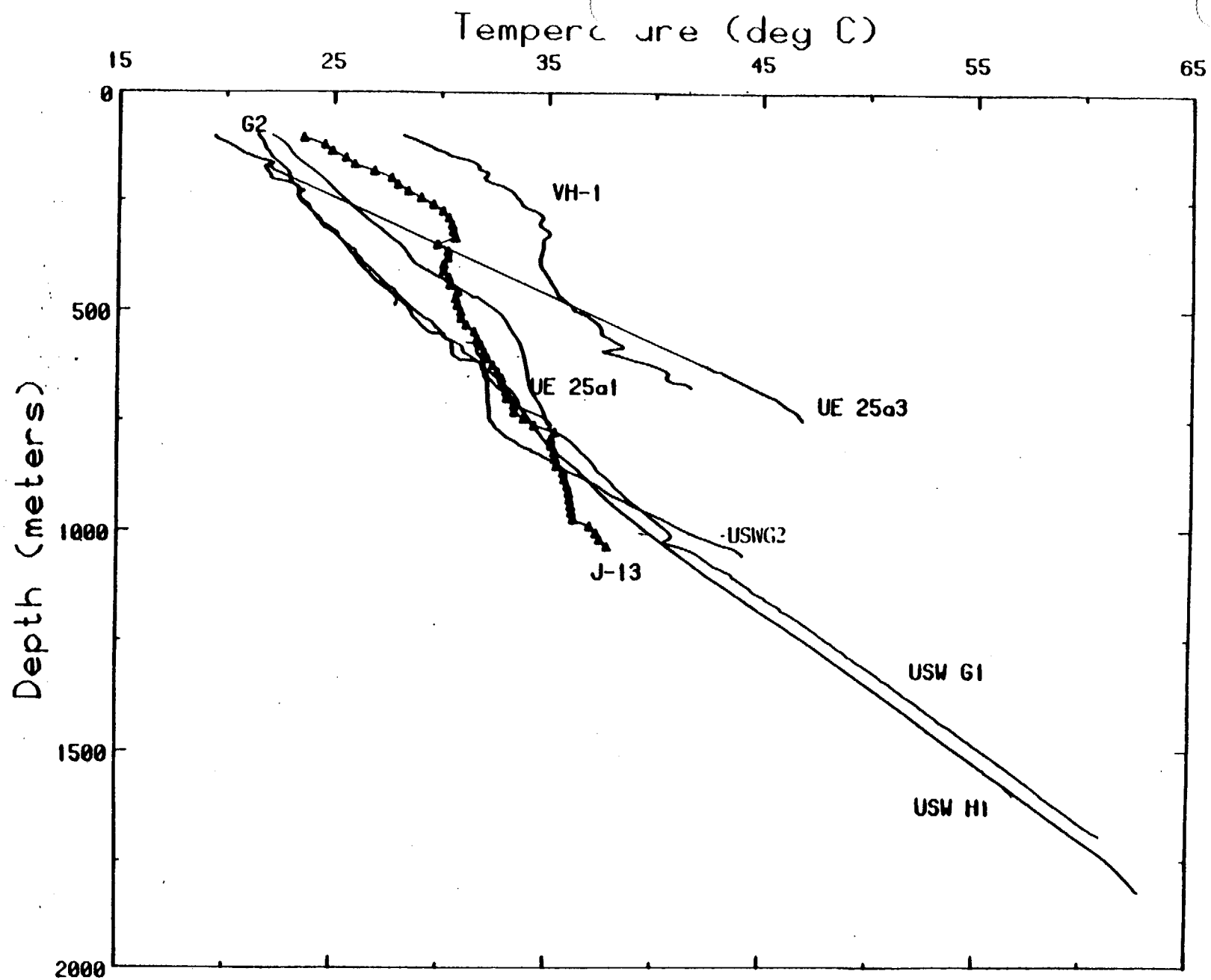
Composite temperature profile for Yucca Flat area. From Sass and Lachenbruch, 1982.



Composite plot of temperatures below 100 m, Syncline Ridge area. From Sass and Lachenbruch, 1982.



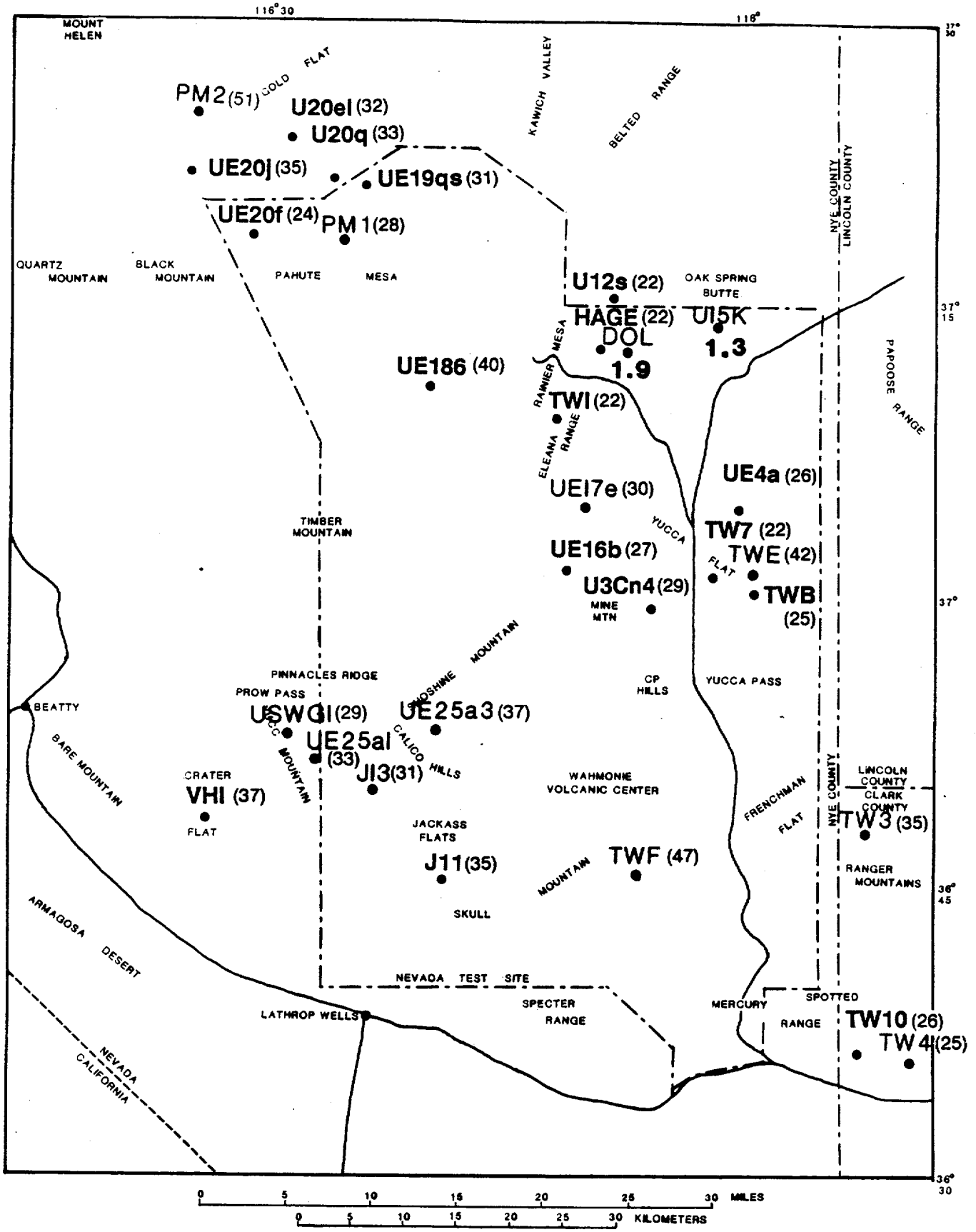
Composite temperature profile for the southern NTS. From Sass and Lachenbruch, 1982.



Temperatures in wells deeper than 600 m, Yucca Mountain. From Sass and Lachenbruch, 1982.

General Location	Well No.	Temp. °C at depth of 500m	Average Yearly Temp. °C	Approximate Value of Geothermal Grad. °C/km
Pahute Mesa.	PM-1	28	≈ 15	26
	PM-2	51	≈ 15	72
	UE-20f	24	≈ 15	18
	UE-20j	35	≈ 15	40
	U-20g	33	≈ 15	36
	UE-19gs	31	≈ 15	32
	U20-el	32	≈ 15	34
Rainier Mesa-Yucca Flat-Syncline Ridge.	TWE	42	≈ 16	52
	UE-18t	40	≈ 16	48
	HAGE	22	≈ 16	12
	U12s	22	≈ 16	12
	TW-7	22	≈ 16	12
	UE-4a	26	≈ 16	20
	TWB	25	≈ 16	18
	U3cn4	29	≈ 16	26
	UE-17e	30	≈ 16	28
	UE-16b	27	≈ 16	22
	TWI	22	≈ 16	12
Southern NTS	TWF	47	≈ 20	54
	TW3	35	≈ 20	30
	J11	35	≈ 20	30
	TW4	25	≈ 20	10
	TW10	26	≈ 20	12
Yucca Mountain.	UE-25a3	37	≈ 17	40
	VH-1	37	≈ 17	40
	J-13	31	≈ 17	28
	UE-25al	33	≈ 17	32
	USW G-1	29	≈ 17	24

Downhole in situ temperatures at a depth of 500 m. Nevada Test Site.



Distribution of in situ temperature at the Nevada Test Site at a depth of 500 m.