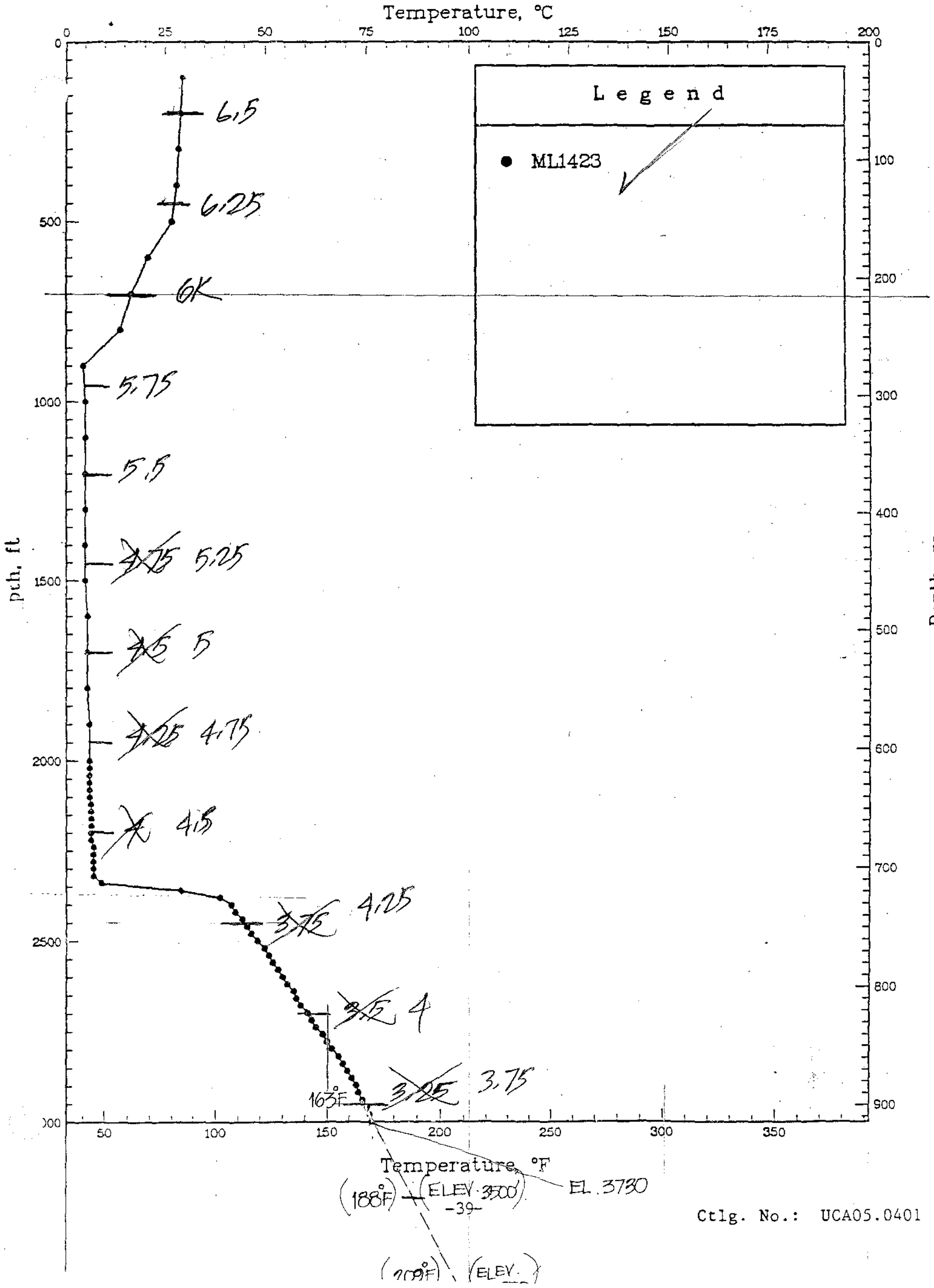
Well Name	ML14-23	Unocal memorandum
Latitude	4611367.49	Daniel L carrier
Longitude	616960.61	1989
TD ft	3000	

depthft	Temperature_F	depth_m	Temperature_C
503	77	153	25
2360	77	719	25
1000	41	305	5
2300	50	701	10
2500	122	762	50
2950	167	899	75

depth (ft)	Temperature (°F)	depth (m)	Temperature (C)
250	90	76	32
500	70	152	21
1000	41	305	5
1500	43	457	6
2000	45	610	7
2100	46	640	8
2300	50	701	10
2400	110	732	43
2500	122	762	50
3000	170	914	77

To Convert	Into	Multiply by
feet	meters	0.304799
Fahrenheit (°F)-32	Celsius	0.555556



Ctlg. No.: UCA05.0401

Well Name 14-23
Latitude 4611367.49
Longitude 616960.61
TVD ft

Earth Science Laboratory
University of Utah Research Inst.
1988

mineralogy M= Major m= Minor <m= <5wt%

depth_ft	Quartz	Cristobal.	Tridimite	K-Spar	Plagioclase	Ilmenite	Hematite
444	m				M	<m	
816					M	<m	
1462					M		
1903		m			m		
2325	<m	m?	m	M	m		
2599					M		<m?
2998					M		

mineralogy

depth_ft	Magnetitie	Smectite	Illite/ Mica	Chlorite	Koal./ Serptn.	Calcite	Glass
444	<m?						m?
816							M
1462	<m?	m					m?
1903							M
2325		<m					
2599	<m?	M					
2998	<m?	<m					m?

mineralogy

depth_ft	Limonite	Pyrite	Clay	Zeolite	Trace amts.
444					cpx, opx, ap
816					ap, goe
1462					ap
1903					
2325					
2599					ap
2998					ap

APPENDIX 3

OBSERVATIONS AND INTERPRETATIONS FOR GMF 17A-6 AND SELECT BOREHOLES MENTIONED IN THE TEXT.

The observations and interpretations summarized below help to further illustrate the significance of the anomalous geochemical data in select boreholes and well GMF 17A-6. The distribution of the geochemical data is shown in Figure 7 for GMF 28-32, GMF 17A-6 (17-6), GMF 45-37, GMF 44-33 and ML 14-23, Figure 8 for GMF 56-3, and Figure 9 for GMF 87-13.

(1) GMF 28-32: The trace-element data are characterized by anomalous enrichment from 10' to 650' and 1910' to 3460'. No trace-element data were collected below 3460'. The oxygen-18 data are characterized by anomalous depletion at 440', and values that decrease uniformly from background levels at 3120' to strongly-depleted levels (D population) at 4252'. This is probably the result of a high-conductive temperature gradient over this interval. The coincidence of anomalous mercury and arsenic enrichment, and $\delta^{18}O$ values that decreases from background to low-level depletion in the 1910' to 3460' interval probably indicates of low to moderate hydrothermal activity. The occurrence of anomalous arsenic and $\delta^{18}O$ values in the 10' to 650' interval is probably indicative of the lateral flow of shallow, low to moderate-temperature thermal fluids.

(2) GMF 17A-6 (17-6): The geochemical data from GM 17A-6 is of particular interest because mafic to silicic intrusive rocks are present from 7720' to 9620' T.D. in the well. The data are characterized by arsenic enrichment in the 4000' to 6500' interval and strong oxygen depletion from 4750' to 9620'. The oxygen-18 values change abruptly from background levels to high-level depletion in the 4310' to 4750' interval.

The geochemical data indicate that at a depth $\geq$4000', high-temperature hydrothermal activity has probably occurred in the vicinity of GMF 17A-6. The best evidence for large-scale directed fluid flow occurs in the 4750' to 6500' interval where strong arsenic enrichment and oxygen depletion coincide. The oxygen data suggest that high-temperature fluids have also existed in the 6500' to 9620' interval. However, no arsenic enrichment is measured. This is possibly the result of either extremely high formation temperatures that have caused the arsenic to sublime, or the absence of large-scale directed fluid flow in this interval. The abrupt change of the oxygen-18 values in the shallower 4310' to 4750' interval does coincide with the occurrence of anomalous arsenic enrichment. This implies good formation permeability and suggests that a steep fluid temperature gradient (30 to 60°F/100') occurs in this interval and possibly results from the mixing of low and high-temperature fluids in the interval.

(3) GMF 45-36: The distribution of the geochemical data in this borehole is characterized by (a) minor mercury enrichment from 510' to 660', (b) arsenic enrichment from 2310' to 3060', and (c) oxygen-18 depletion from 2420' to 4000' TD. Although the oxygen data suggest that borehole temperatures generally increase with depth, the $\delta^{18}O$ values fluctuate widely in the 3020' to 4000' interval. This probably results from variations in either formation permeabilities, or fluid temperatures. The best evidence for large-scale directed fluid flow occurs in the 2310' to 3060' interval where arsenic and $\delta^{18}O$ anomalies coincide. However, the oxygen data suggest that temperatures in this interval probably range from low to moderate.

(4) GMF 44-33: The geochemical data from GMF 44-33 is of particular interest because this is the only borehole at MLH that flowed thermal fluids during drilling. Anomalous arsenic and mercury in GMF 44-33 generally correlate with intervals of lost circulation or hot-water entries. The longest interval of mercury enrichment is measured from 1245'-1545', and coincides with strong arsenic enrichment (C population) at 1485'-1515' and a lost circulation zone at 1440'.

(5) ML 14-23: Anomalous arsenic enrichment is measured but anomalous mercury and anomalous oxygen-depletion are not. The arsenic enrichment occurs in the 2450'-2800' interval and is probably the result of the direct flow low-temperature thermal fluids.

(6) Borehole GMF 56-3: Oxygen-18 depletion and trace-element enrichments in GMF 56-3 support the contention that hydrothermal activity has occurred in the vicinity of the borehole. The pattern of oxygen-18 depletion and arsenic enrichment (Figure 8) indicate moderate-temperature geothermal fluids have been present at depths near 1636' and low-temperature thermal fluids at depths near 1341'. Mercury and arsenic enrichment coincide at 816'-933', and possibly indicate low-temperature and low-pH fluid flow. Some vertical separation of mercury and arsenic enrichment occurs in the 649'-781' interval. This probably indicates vapor partitioning from the hydrothermal fluids, and is

possibly the result of boiling. Mercury enrichment in the 258'-590' interval probably resulted from either HgS precipitation during steam condensation or from adsorption of mercury vapor on the surfaces of clay, organic, or organometallic compounds.

(7) <u>Borehole GMF 87-13</u>: Anomalous enrichment of mercury is found in 43% of the 242' to 908' interval of GMF 87-13 (Figure 9). However, arsenic enrichment and anomalous oxygen-18 depletion are not measured in the borehole. The mercury enrichment in GMF 87-13 has probably resulted from precipitation of HgS by steam condensation, or adsorption of mercury on the surface of clay, organic, and organometallic compounds. The anomalous distribution of mercury throughout the borehole and the magnitude of the enrichment (1000 ppb) probably indicates lateral or vertical partitioning of mercury from a nearby hydrothermal system.

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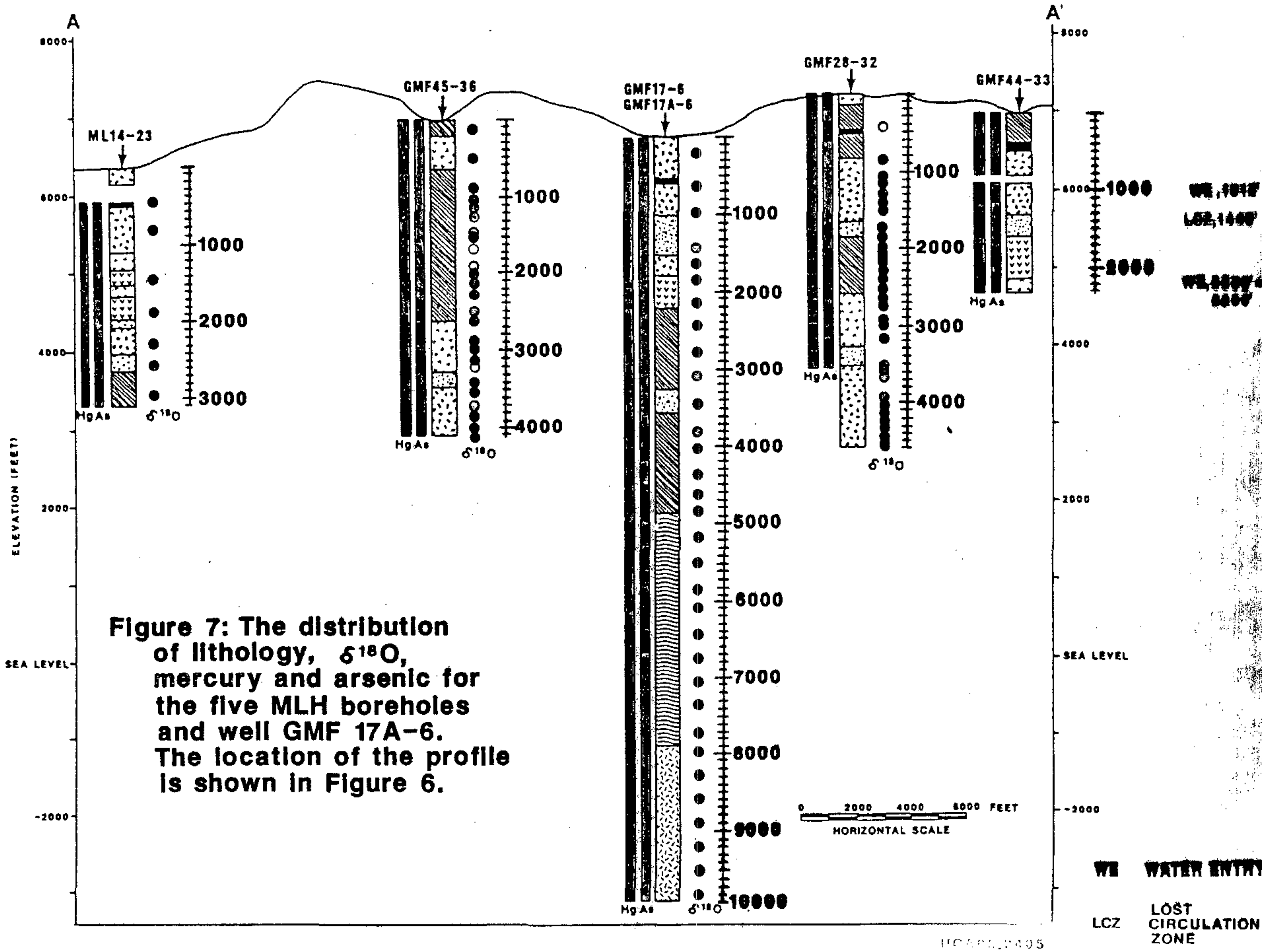
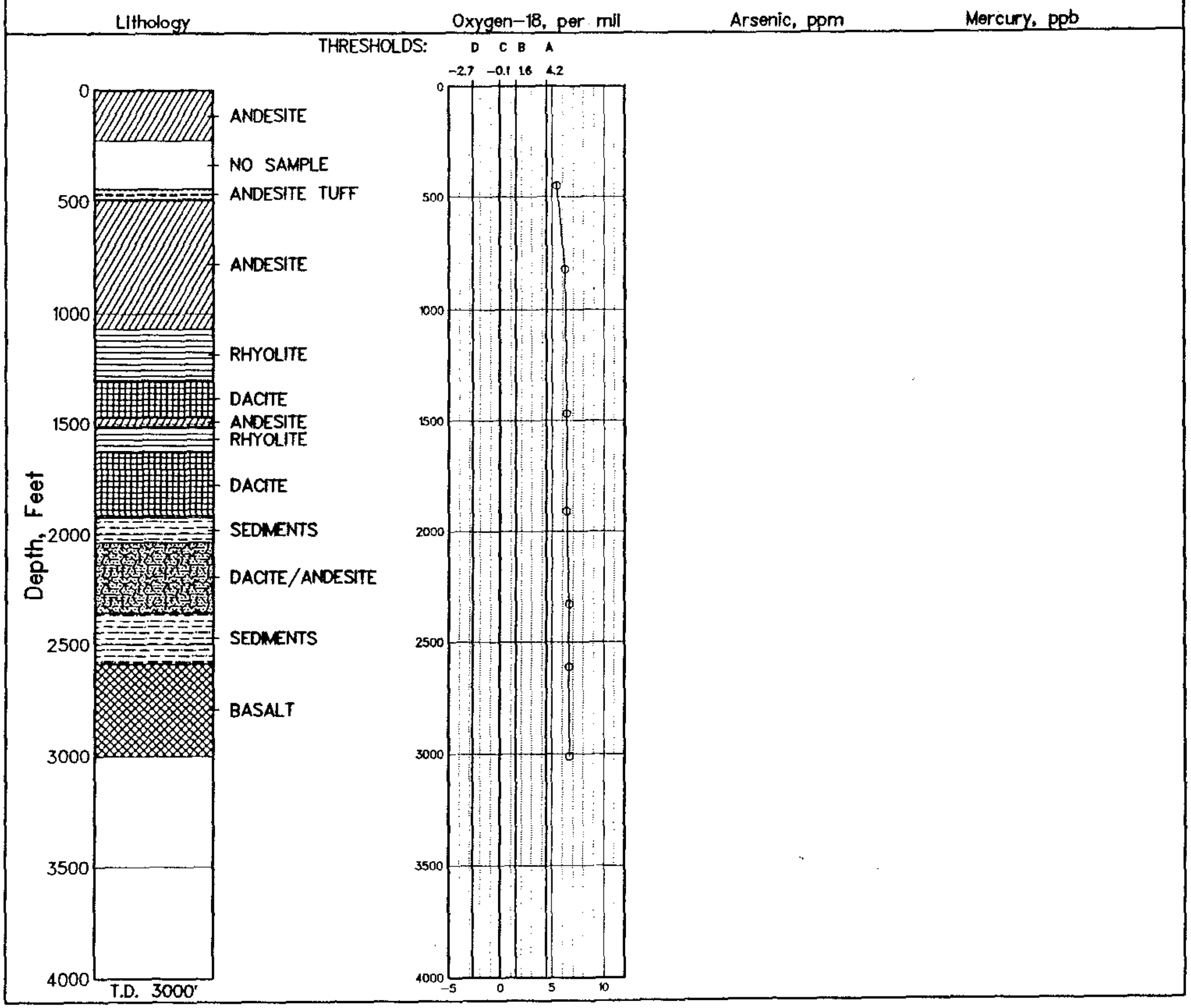


Figure 7: The distribution of lithology, $\delta^{18}O$, mercury and arsenic for the five MLH boreholes and well GMF 17A-6. The location of the profile is shown in Figure 6.

ML 14-23



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