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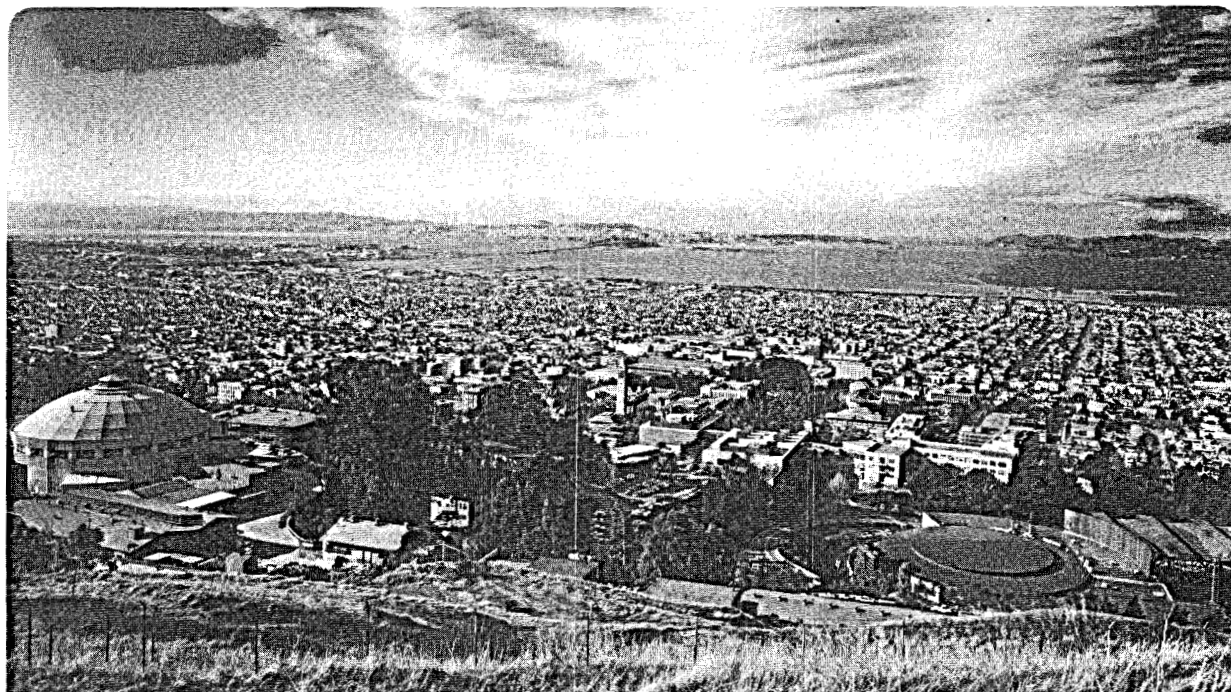
**The Ahuachapán Geothermal Field,
El Salvador—Reservoir Analysis**

Volume II: Appendices A through E

Z. Aunzo, G.S. Bodvarsson, C. Laky, M.J. Lippmann,
B. Steingrimsson, A.H. Truesdell, and P.A. Witherspoon

August 1989

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**The Ahuachapán Geothermal Field, El Salvador
— Reservoir Analysis —**

Volume II: Appendices A through E

by

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prepared for

**Earth and Space Science Division
Los Alamos National Laboratory
Los Alamos, New Mexico 87545**

August 1989

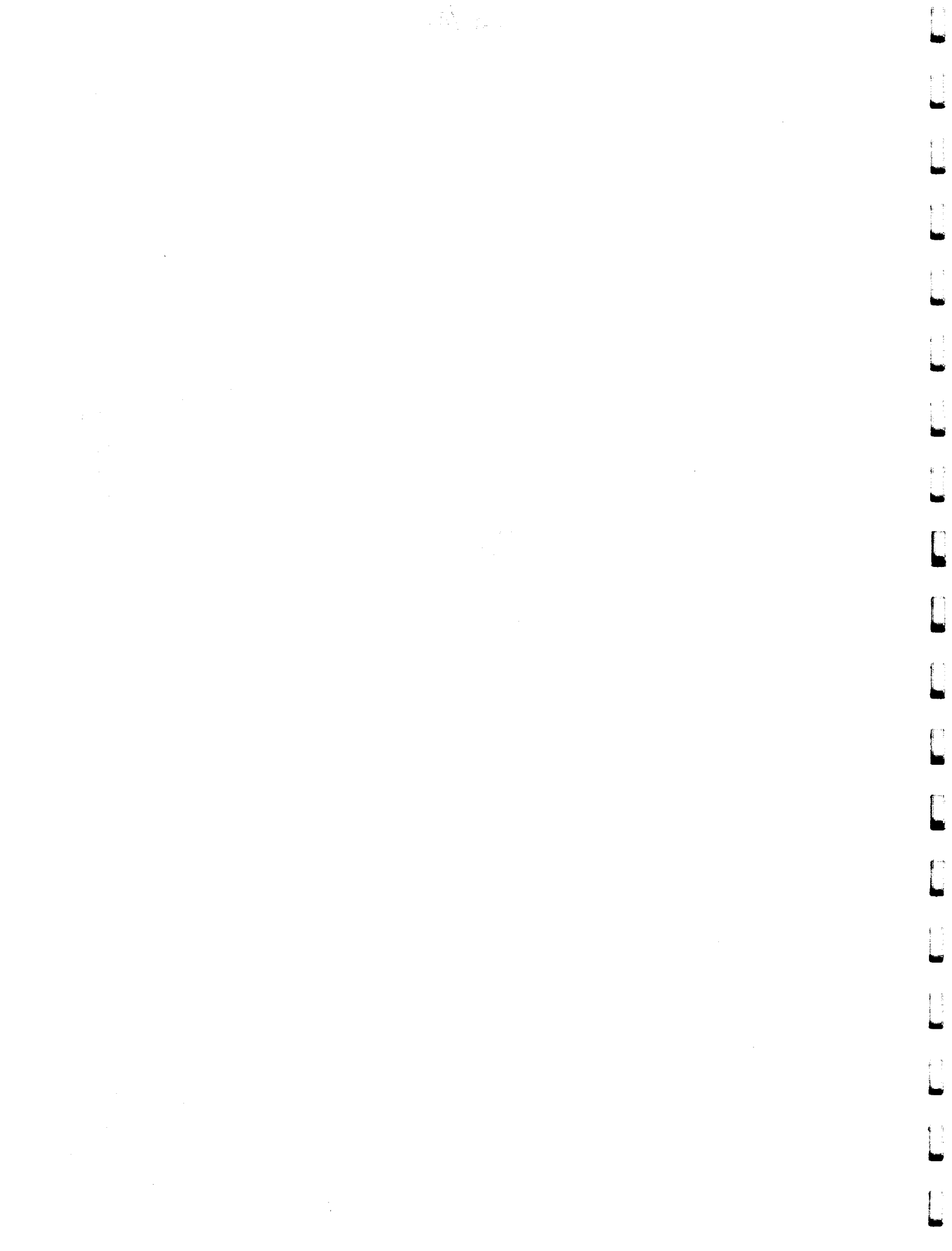
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APPENDIX A

(Mineralogy Contours)



KEY

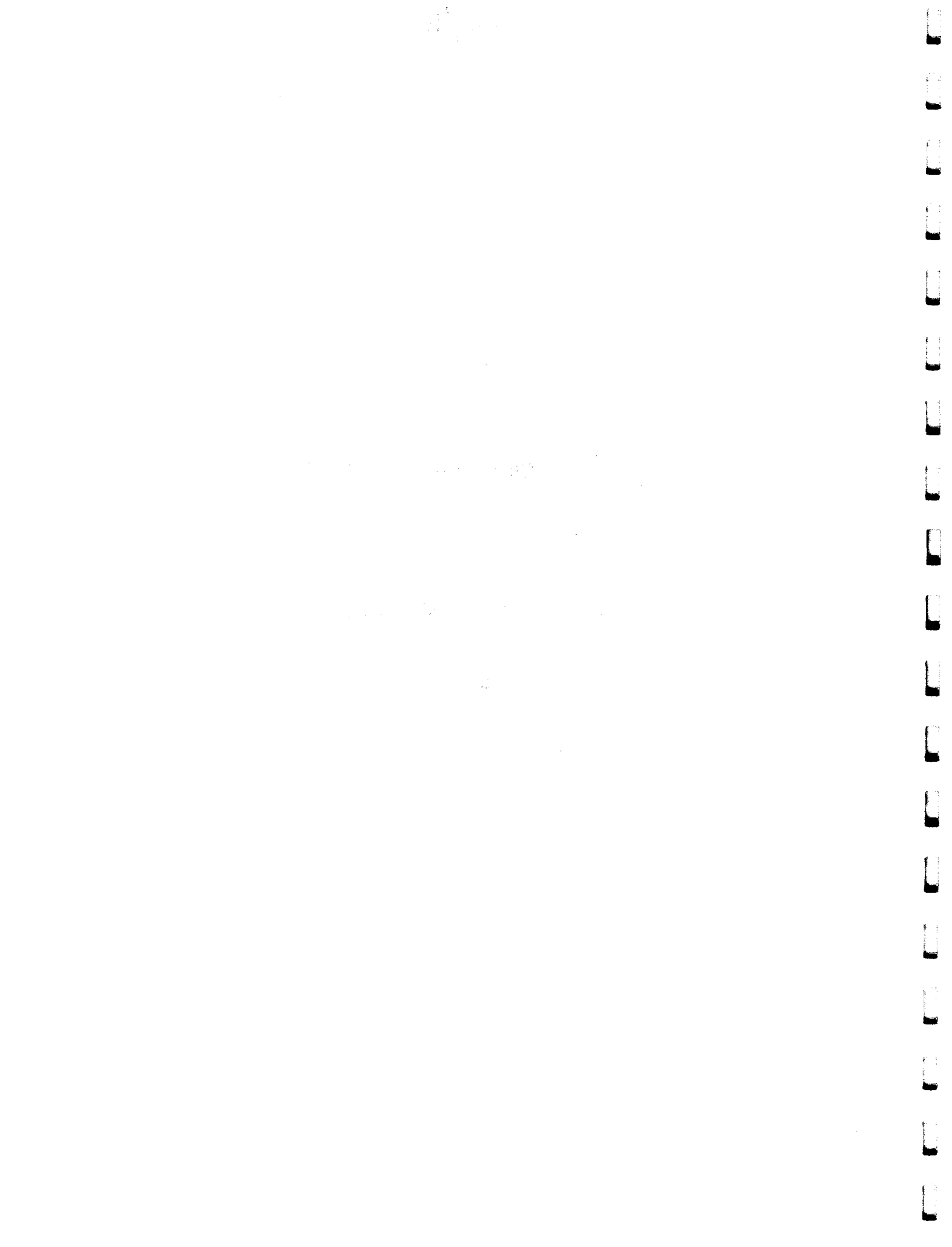
MA-SE : Clay minerals and Sericite

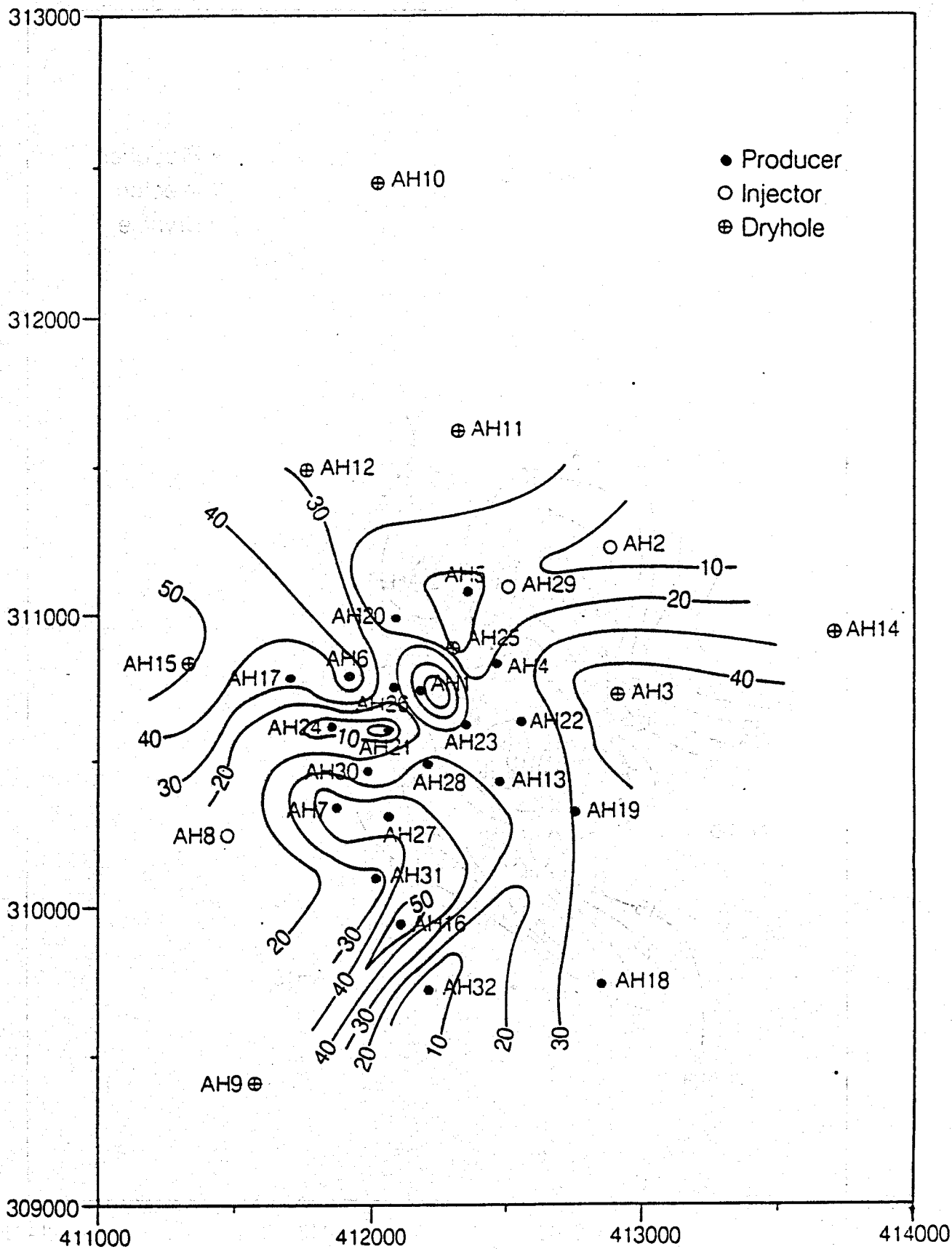
HE-OX : Hematite and Oxides

CL-PE : Chlorite and Pennantite

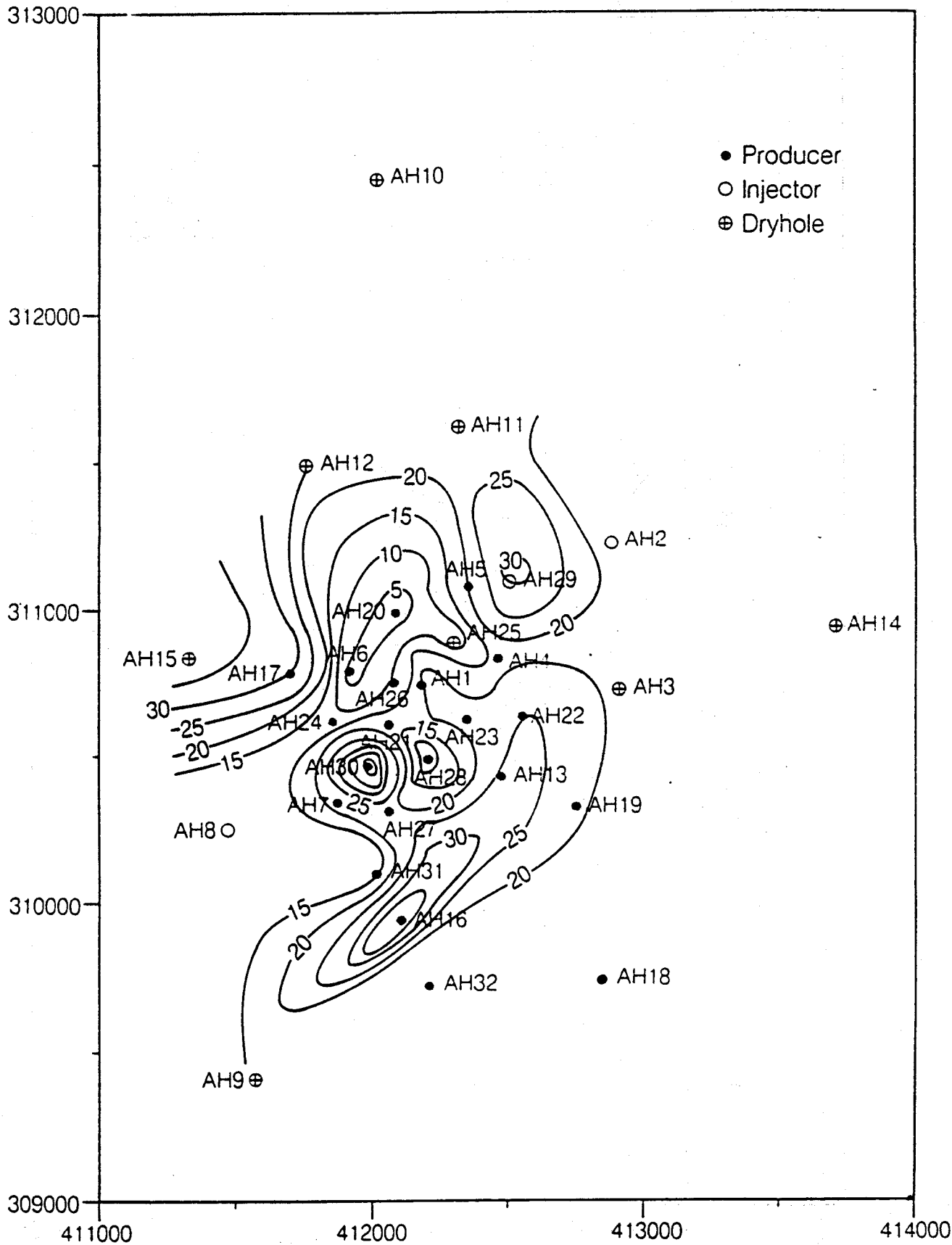
Q : Quartz

Ca : Calcite

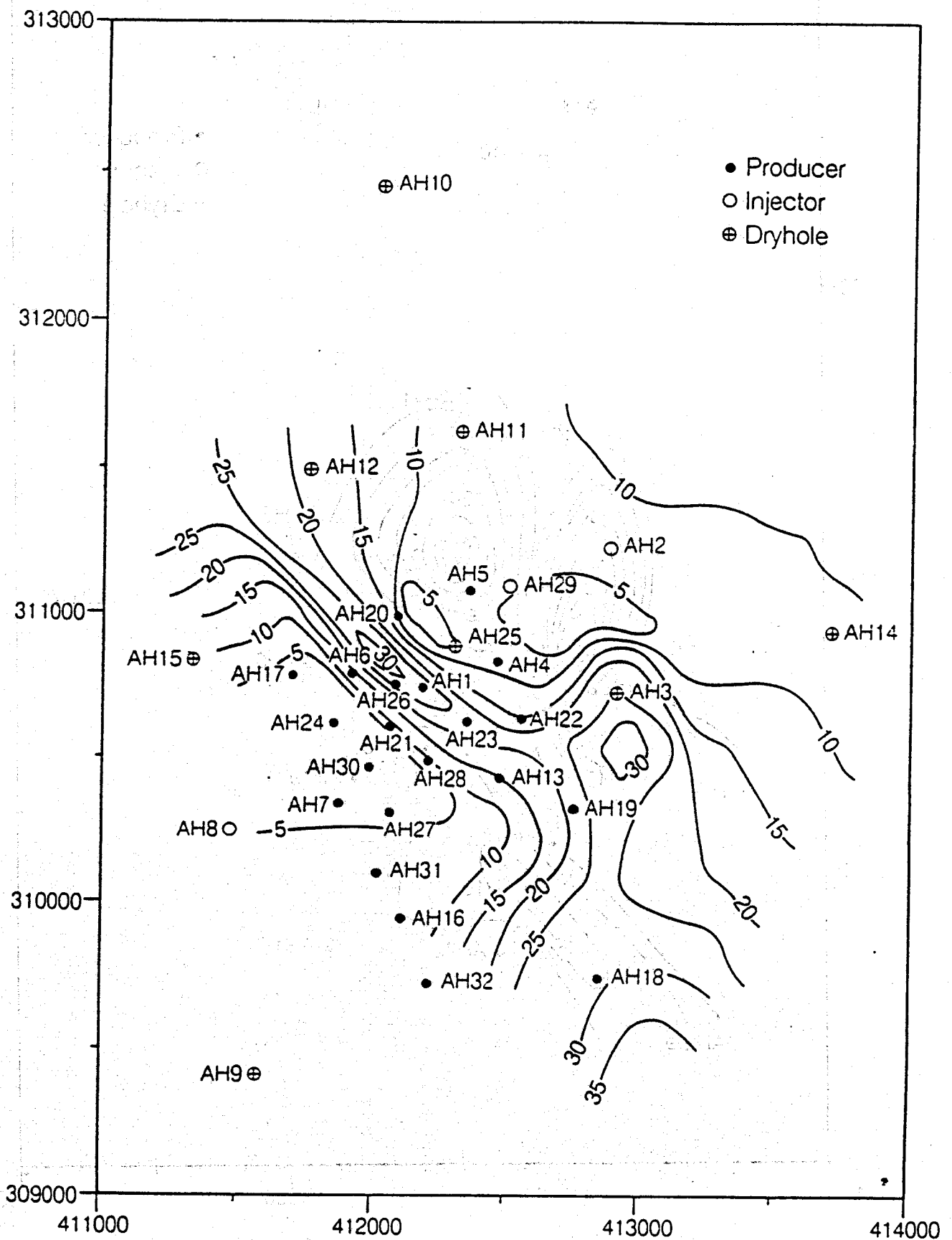




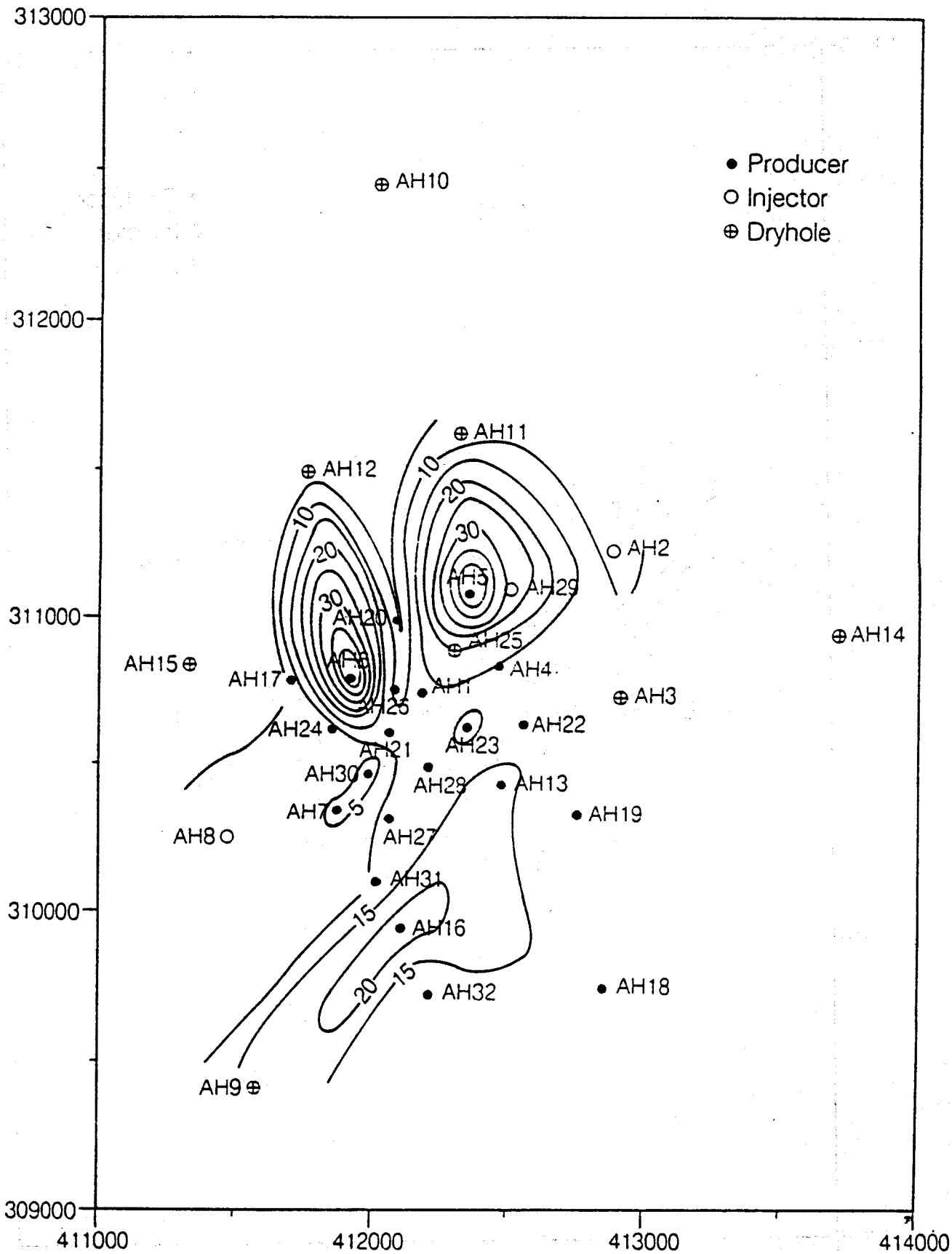
Contour of MA-SE 600 masl



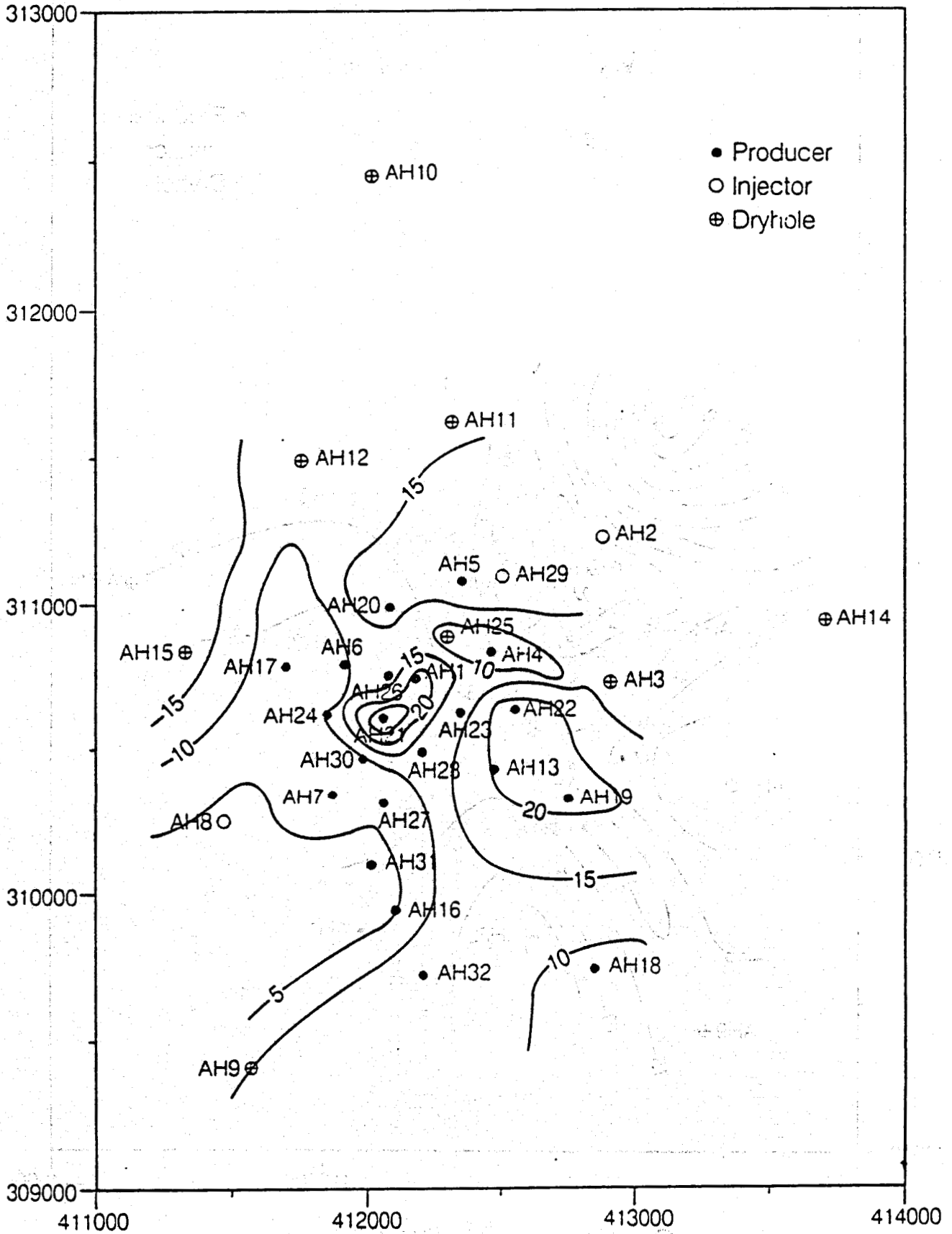
Contour of MA-SE 400 masl



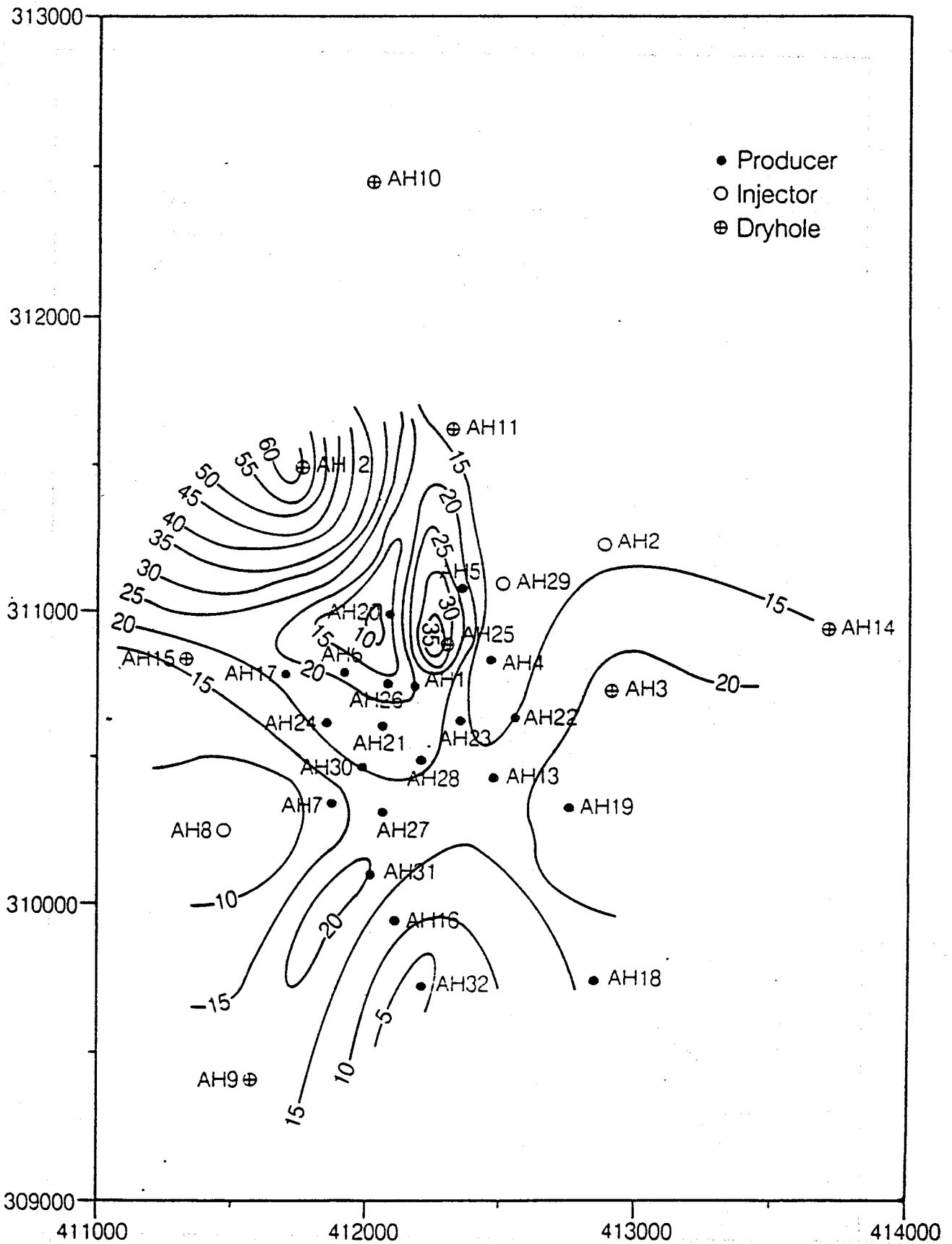
Contour of MA-SE 200 masl



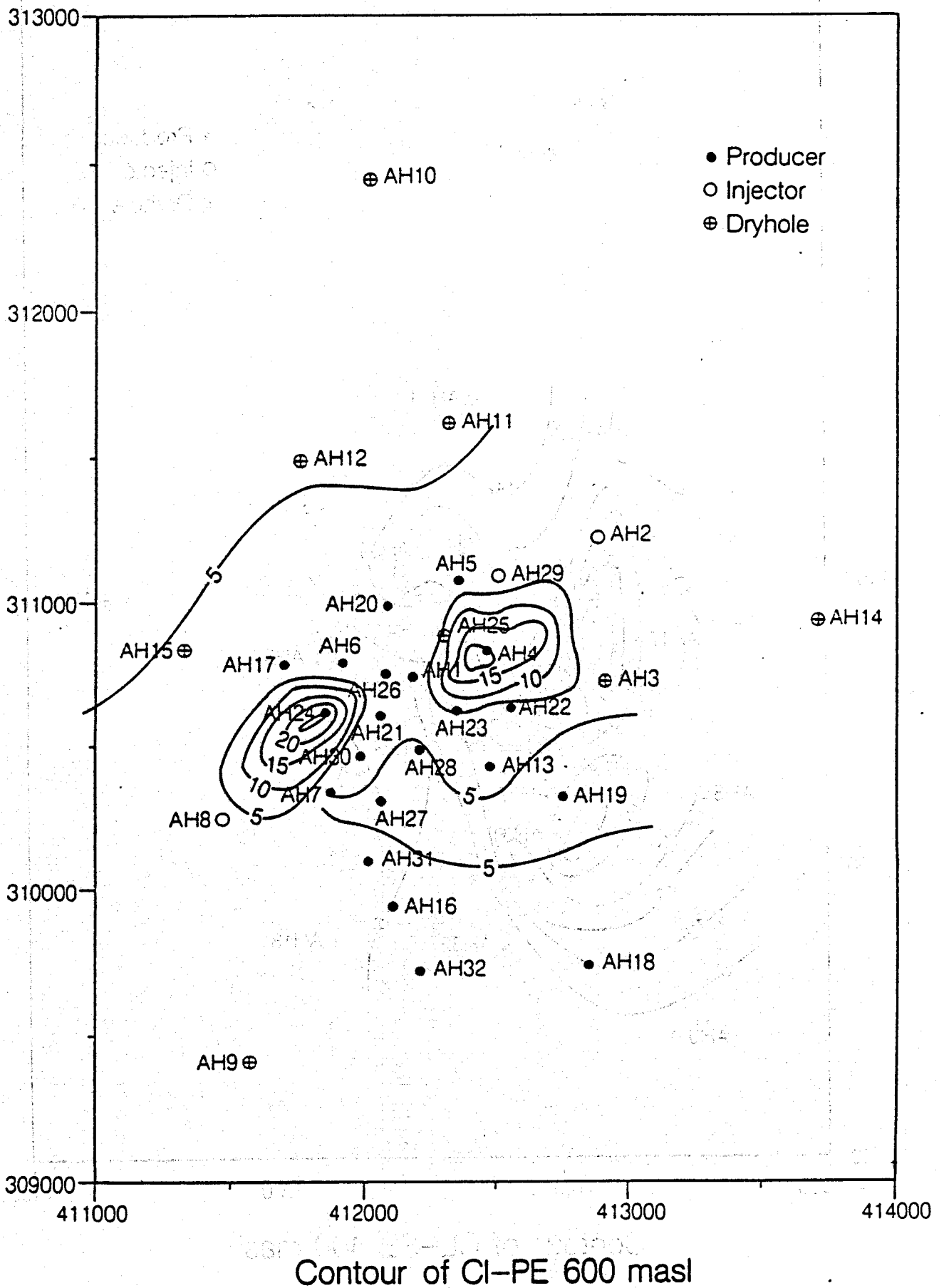
Contour of HE-OX 600 masl

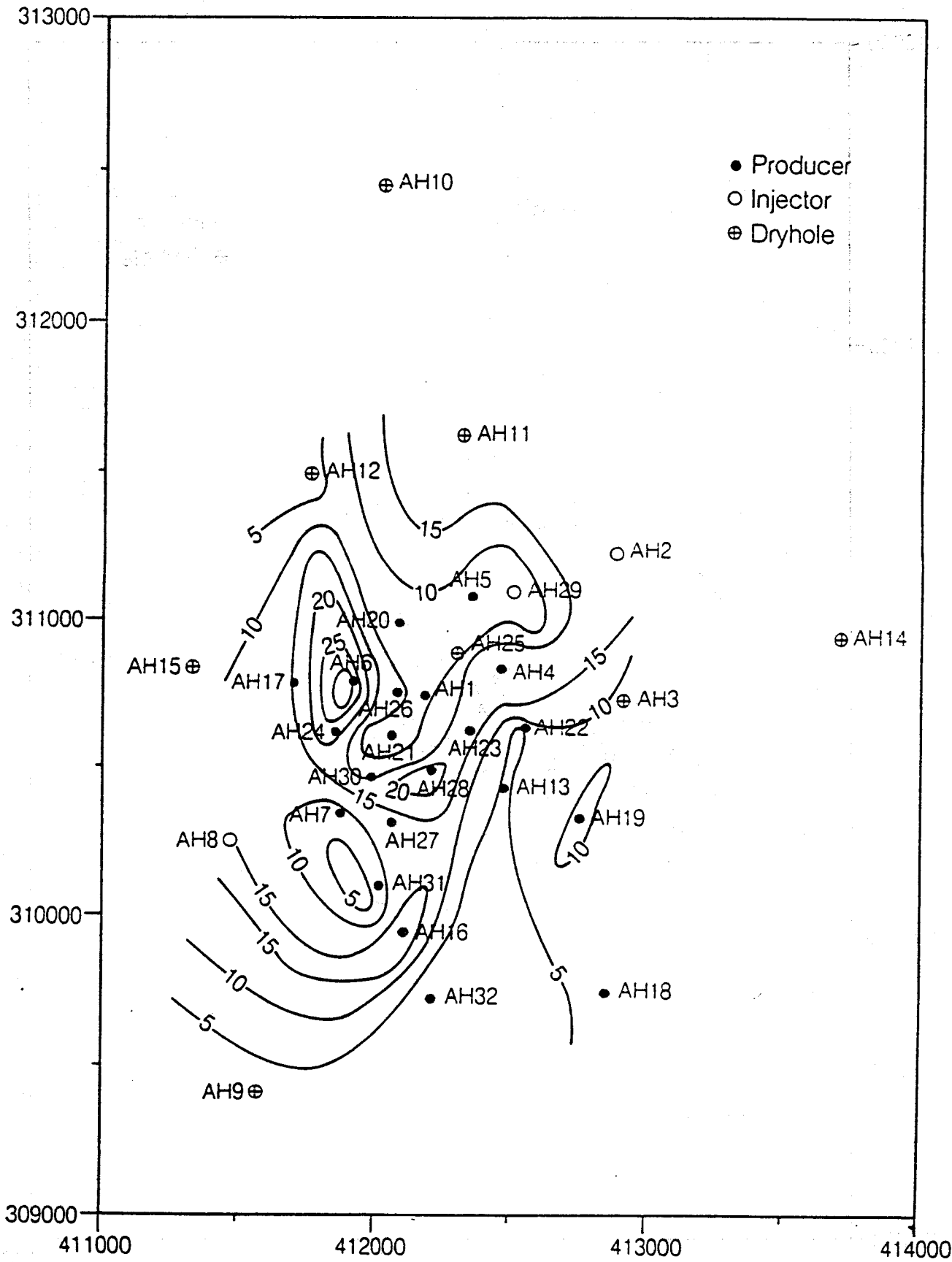


Contour of HE-OX 400 masl

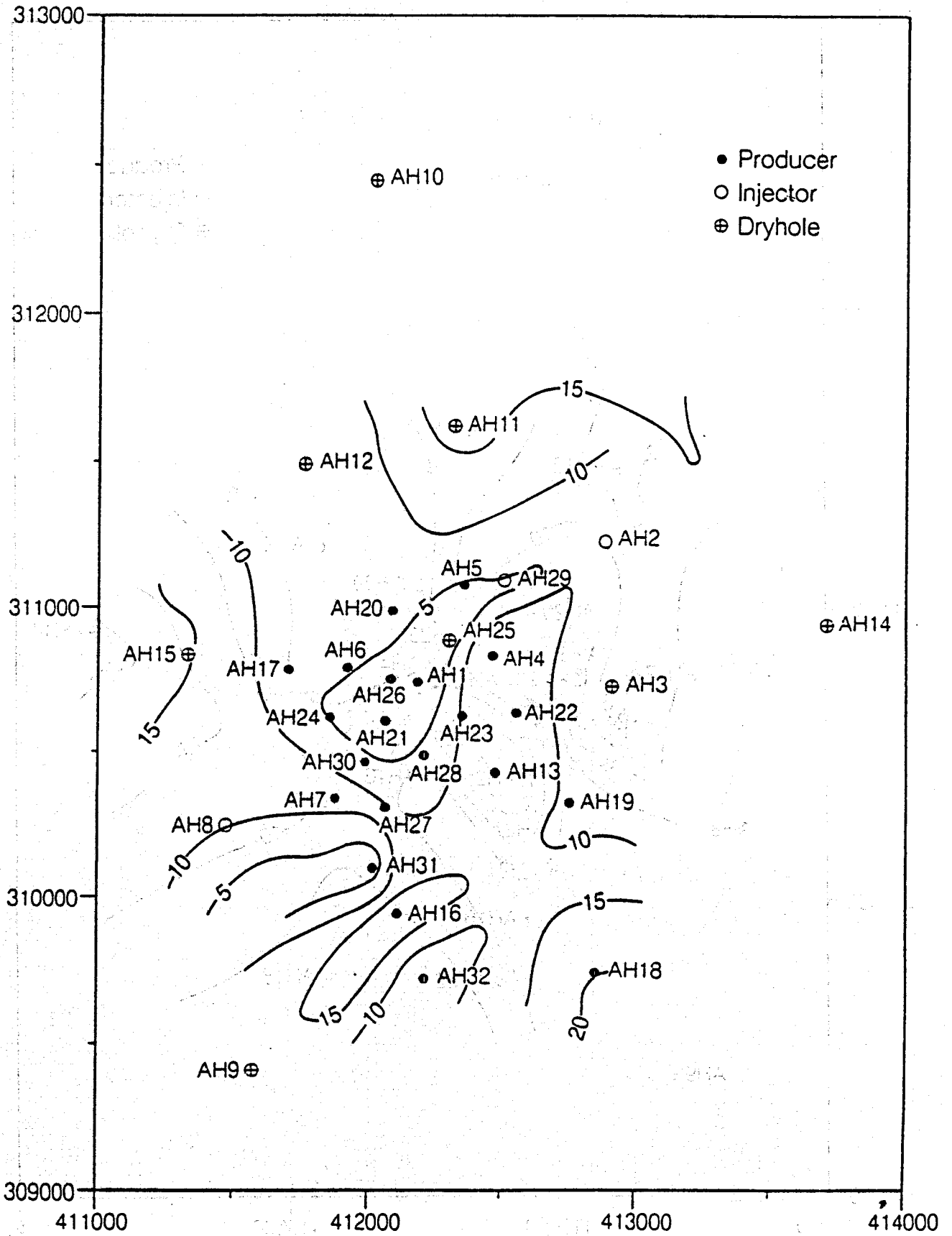


Contour of HE-OX 200 masl

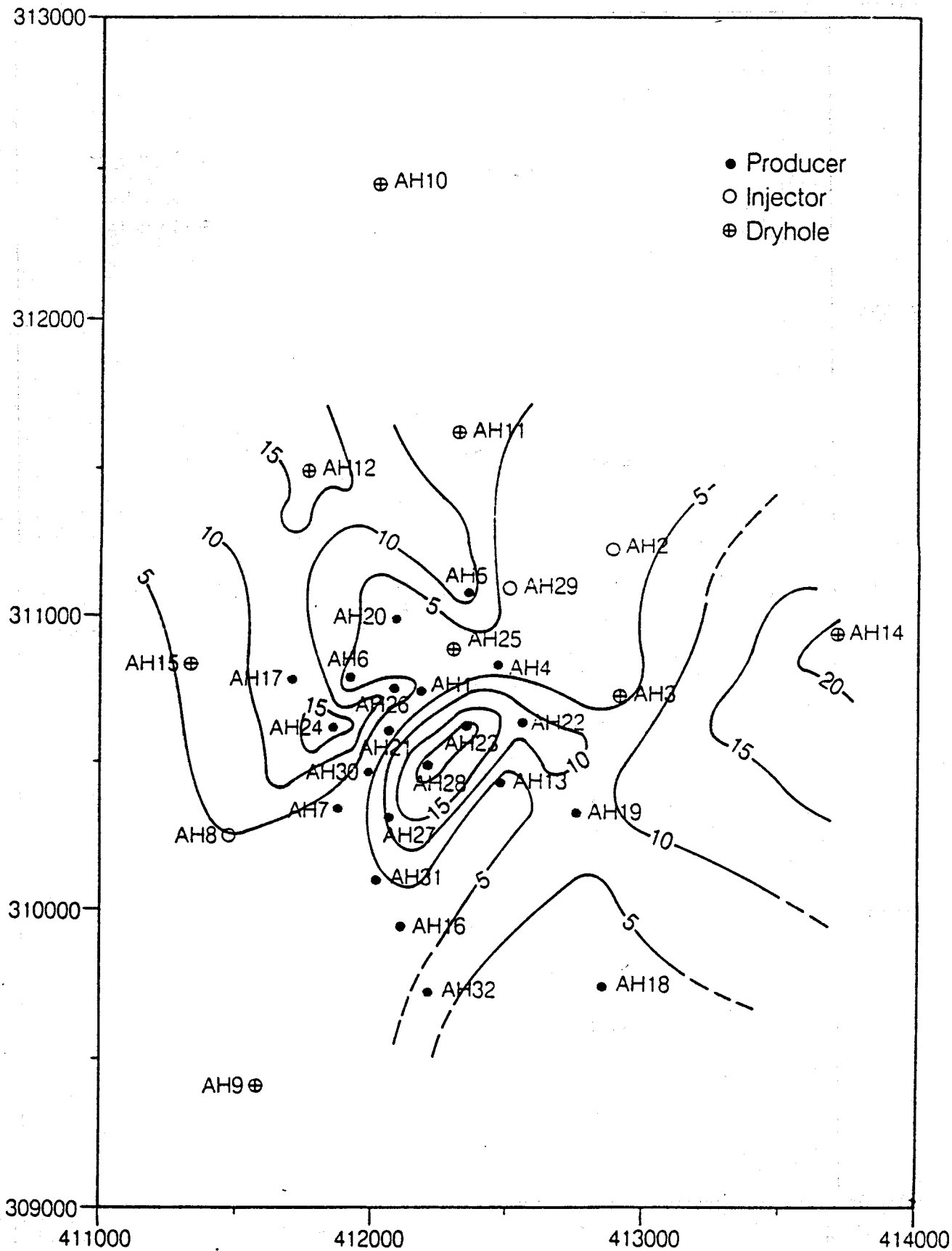




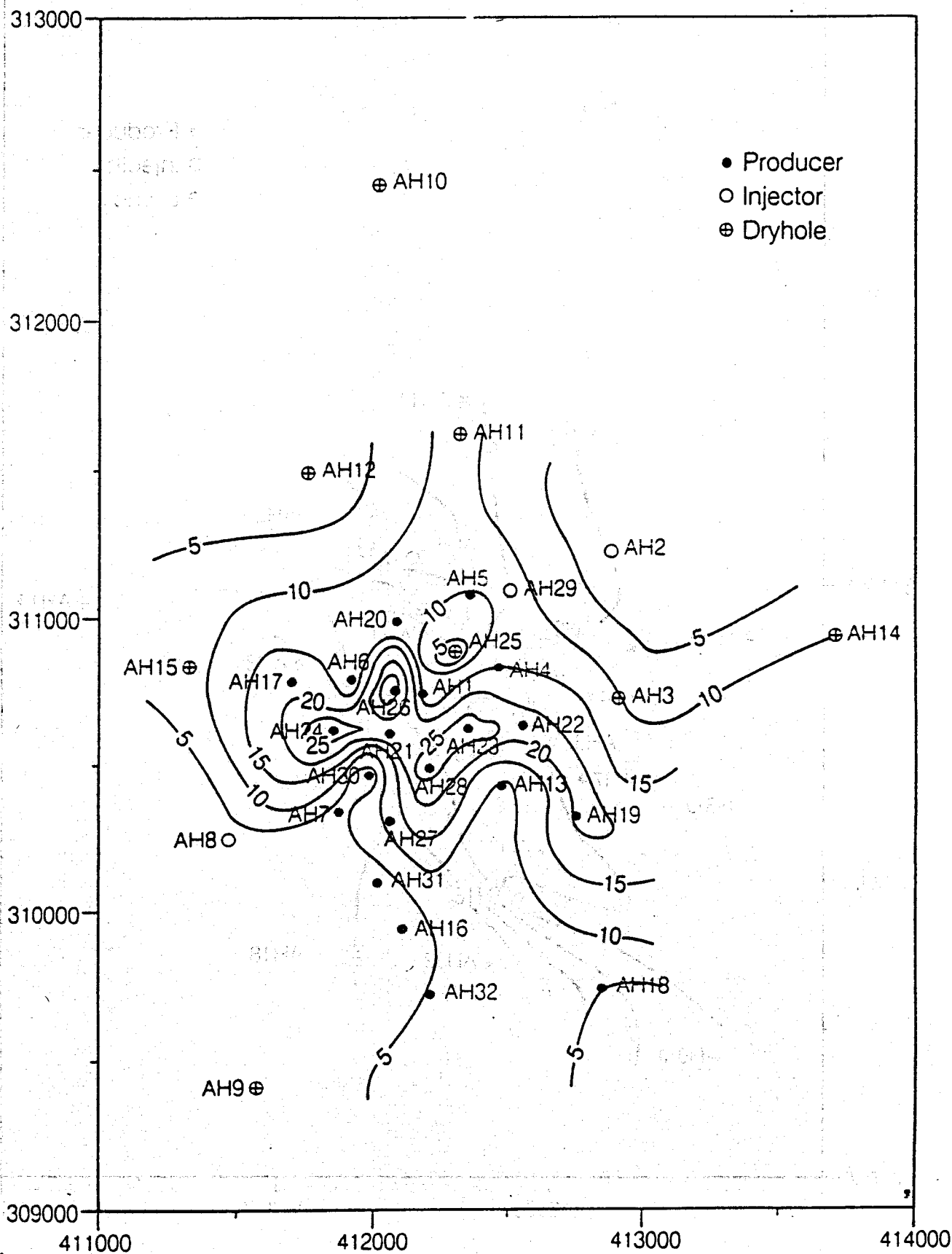
Contour of CL-PE 400 masl



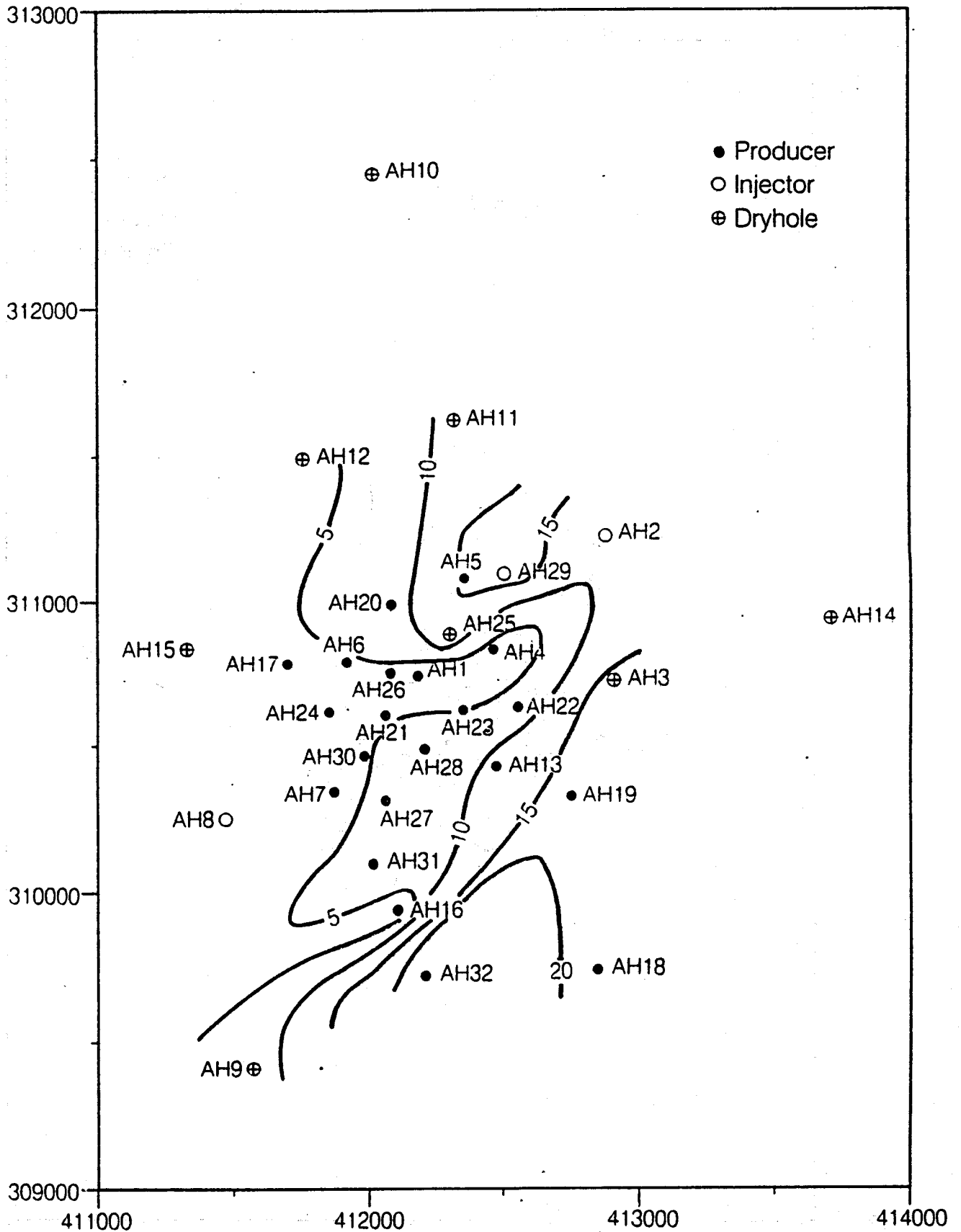
Contour of CL-PE 200 masl



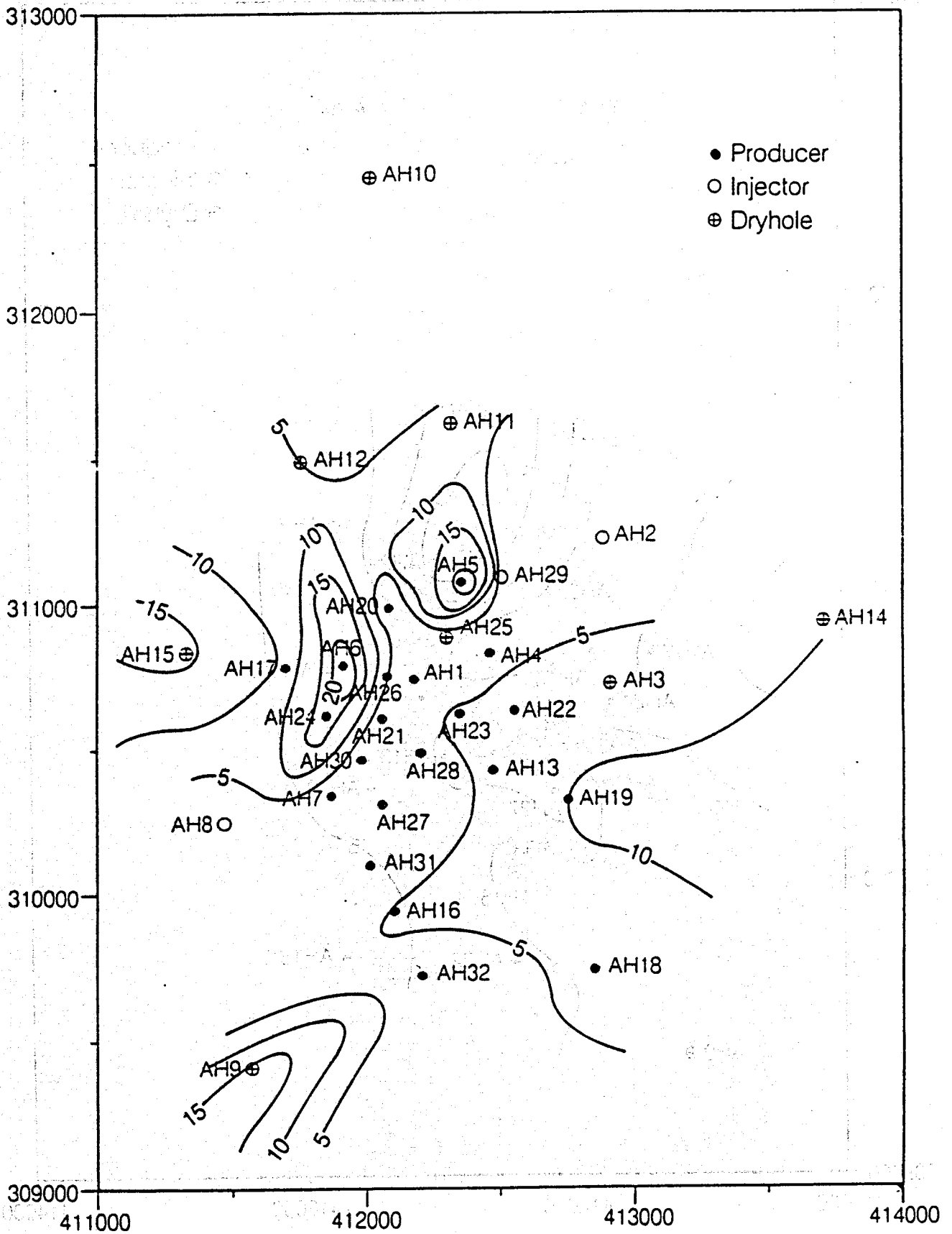
Contour of Q 600 masl



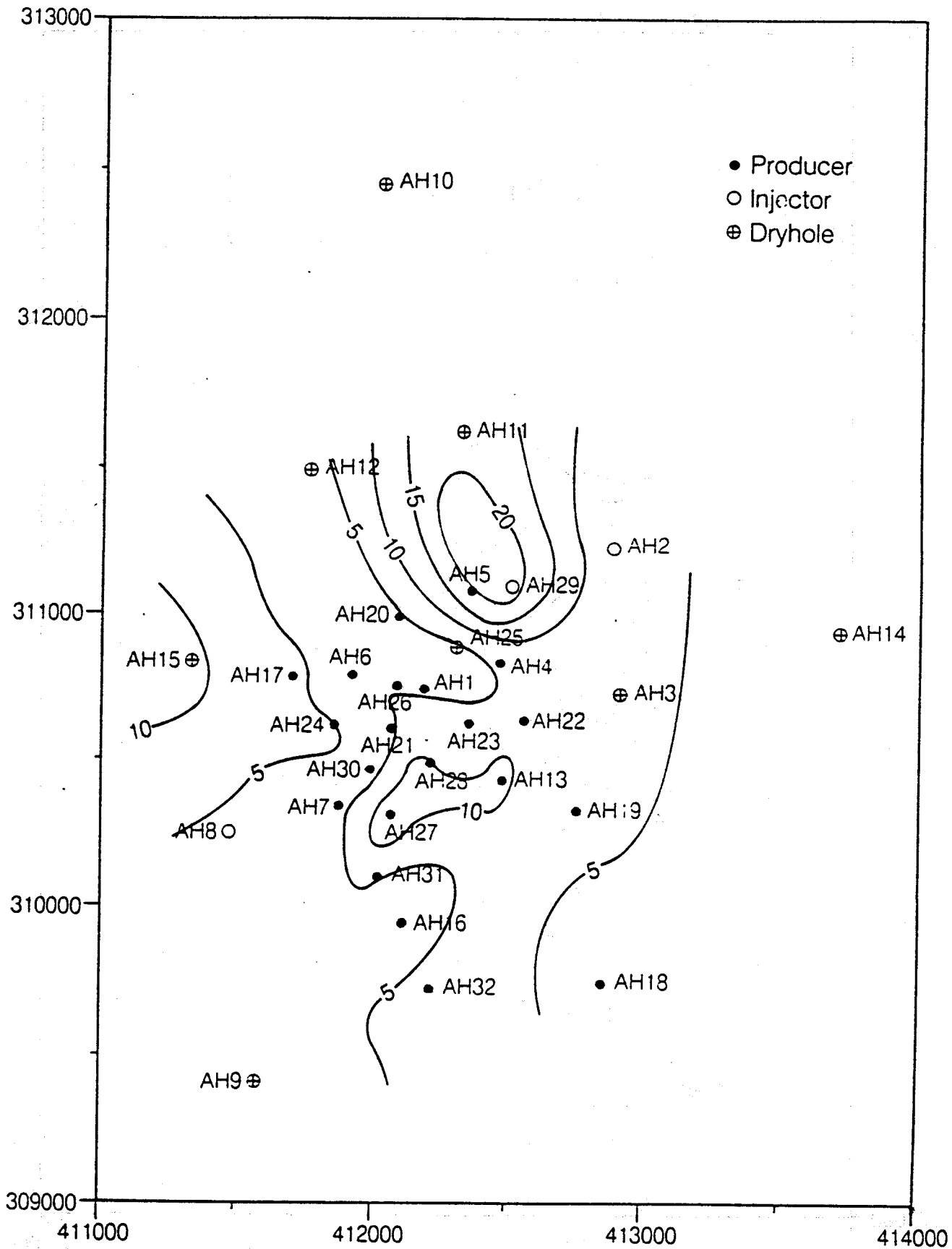
Contour of Q 400 masl



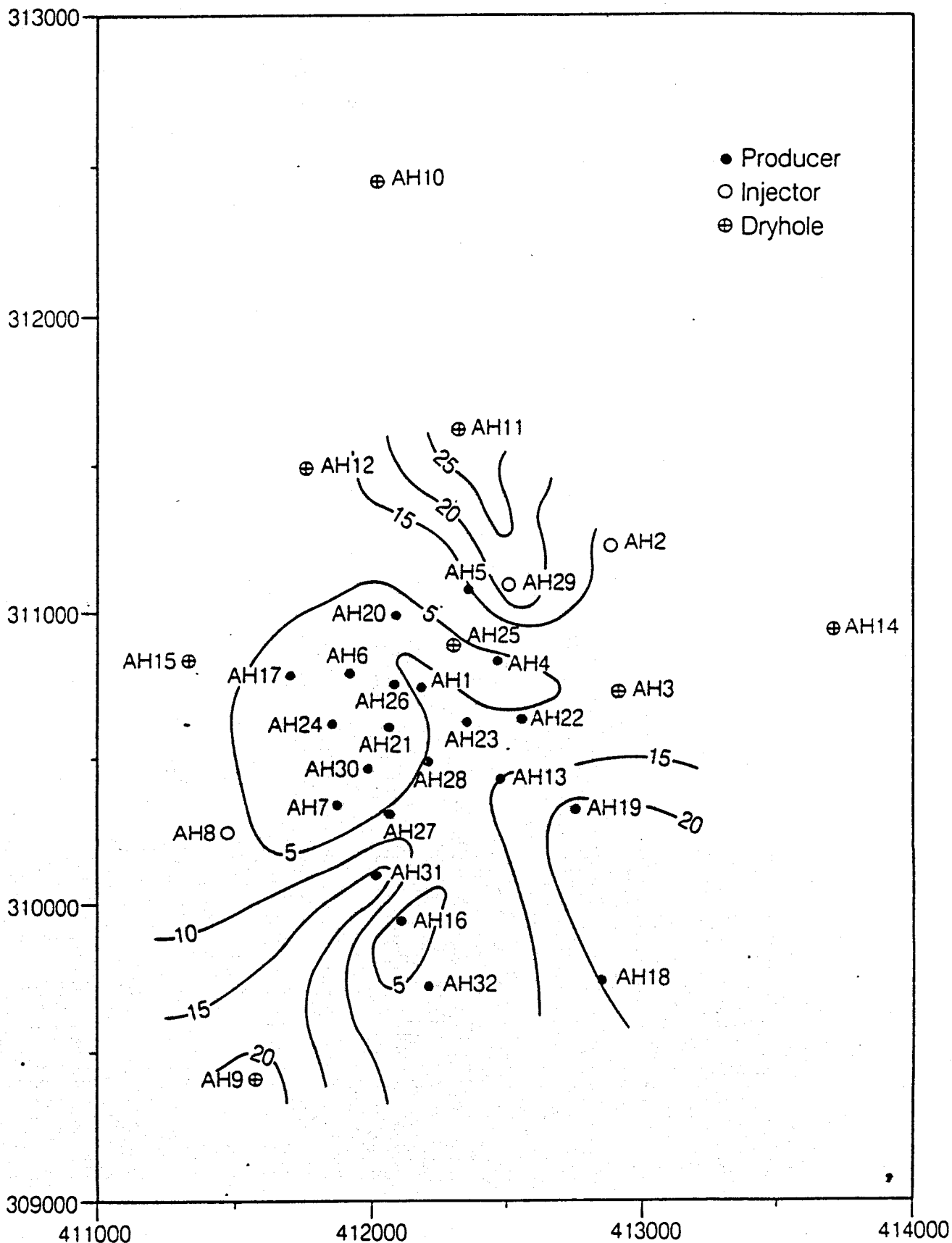
Contour of Q 200 masl



Contour of Ca 600 masl



Contour of Ca 400 masl



Contour of Ca 200 masl

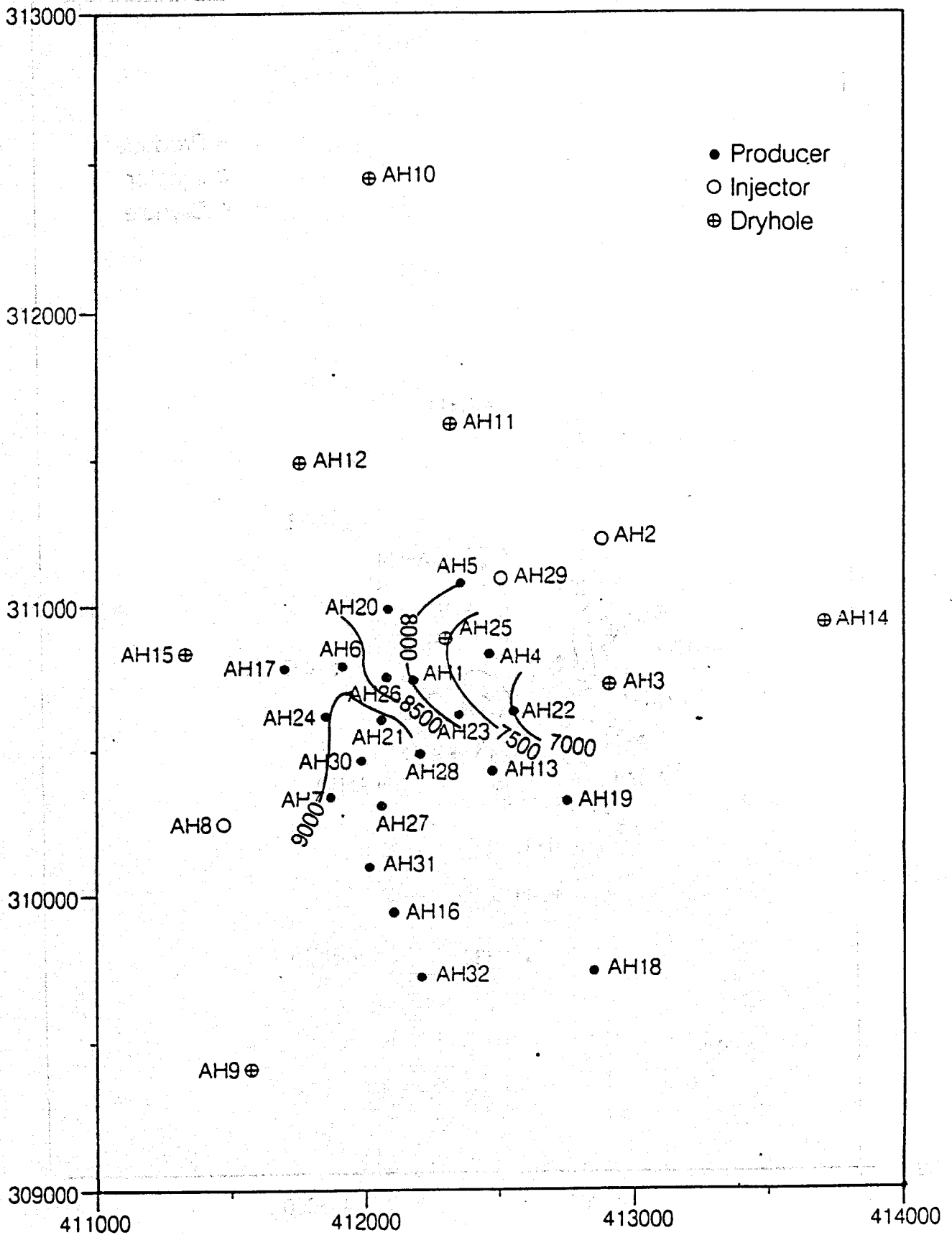
APPENDIX B

(Cl⁻ and SiO₂ Contours)

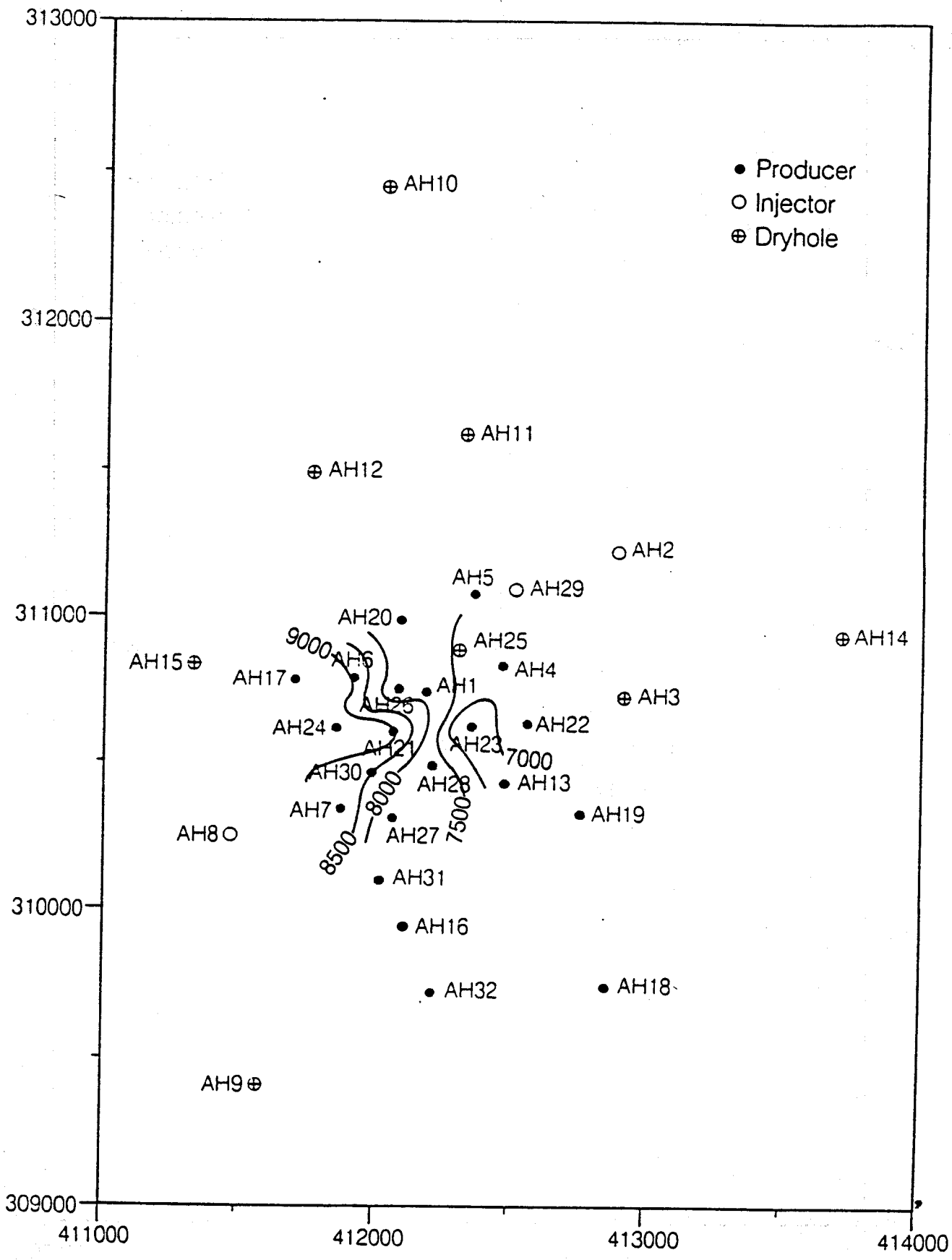
1950

1950

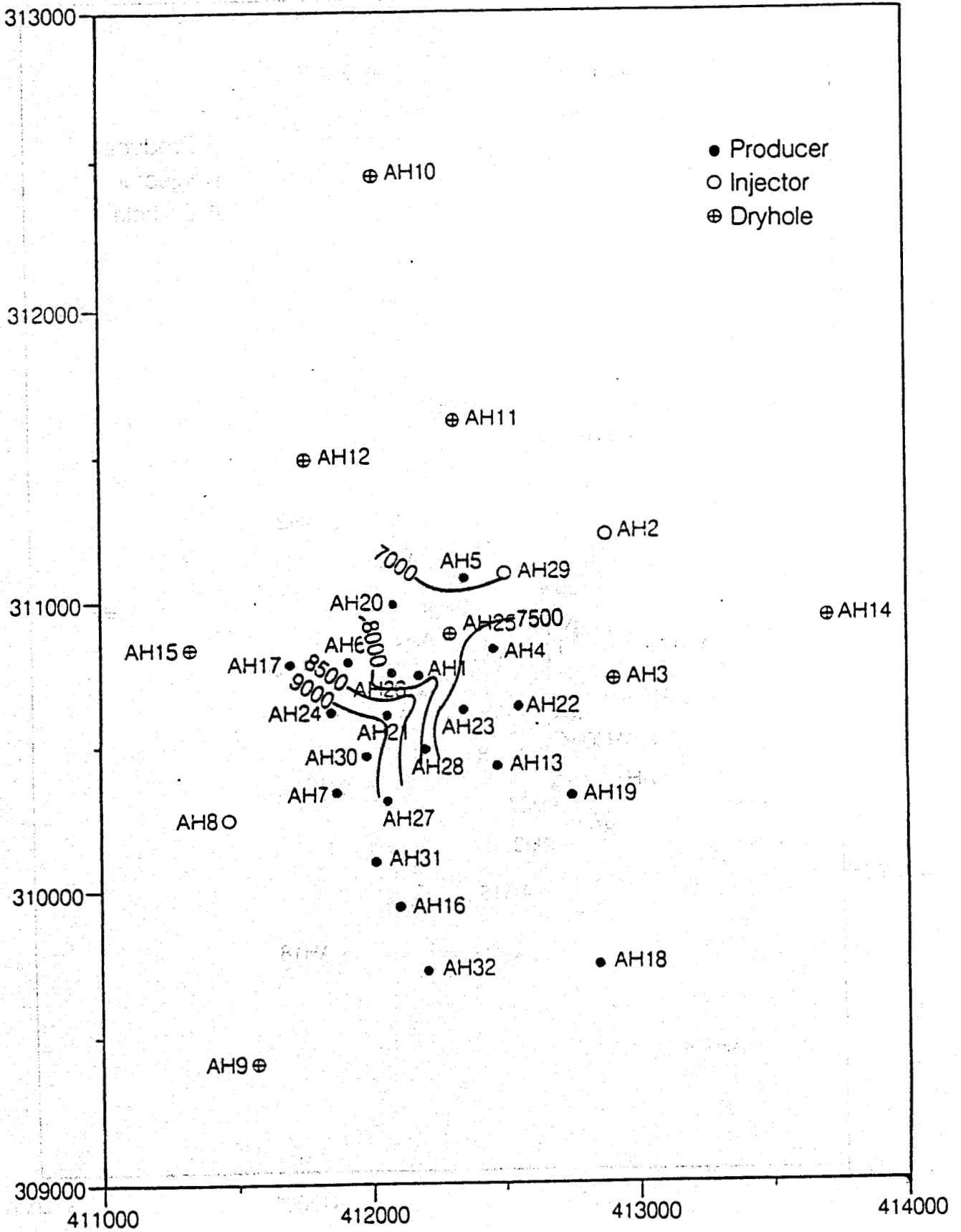




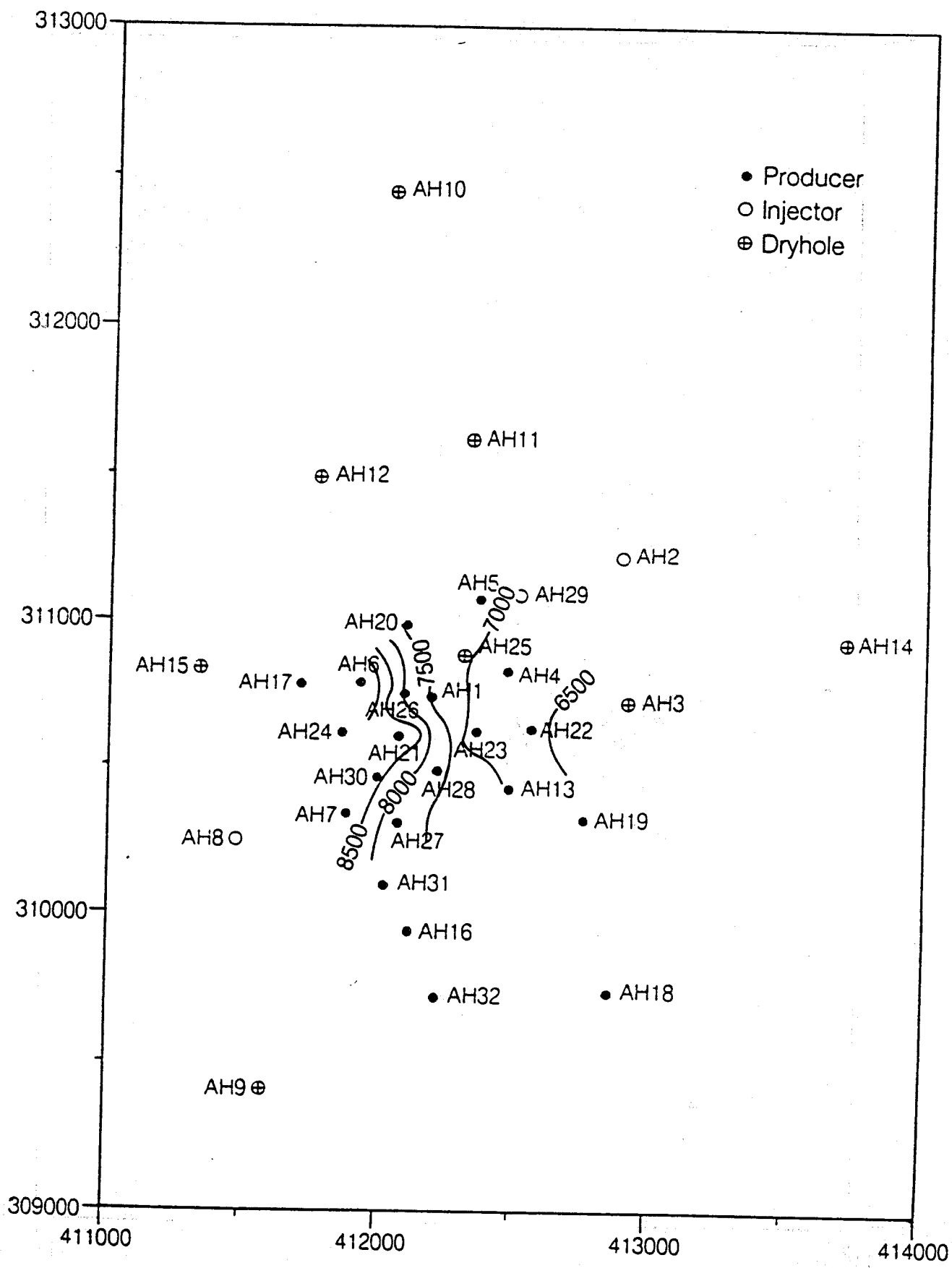
Contour of Cl⁻ (1978)



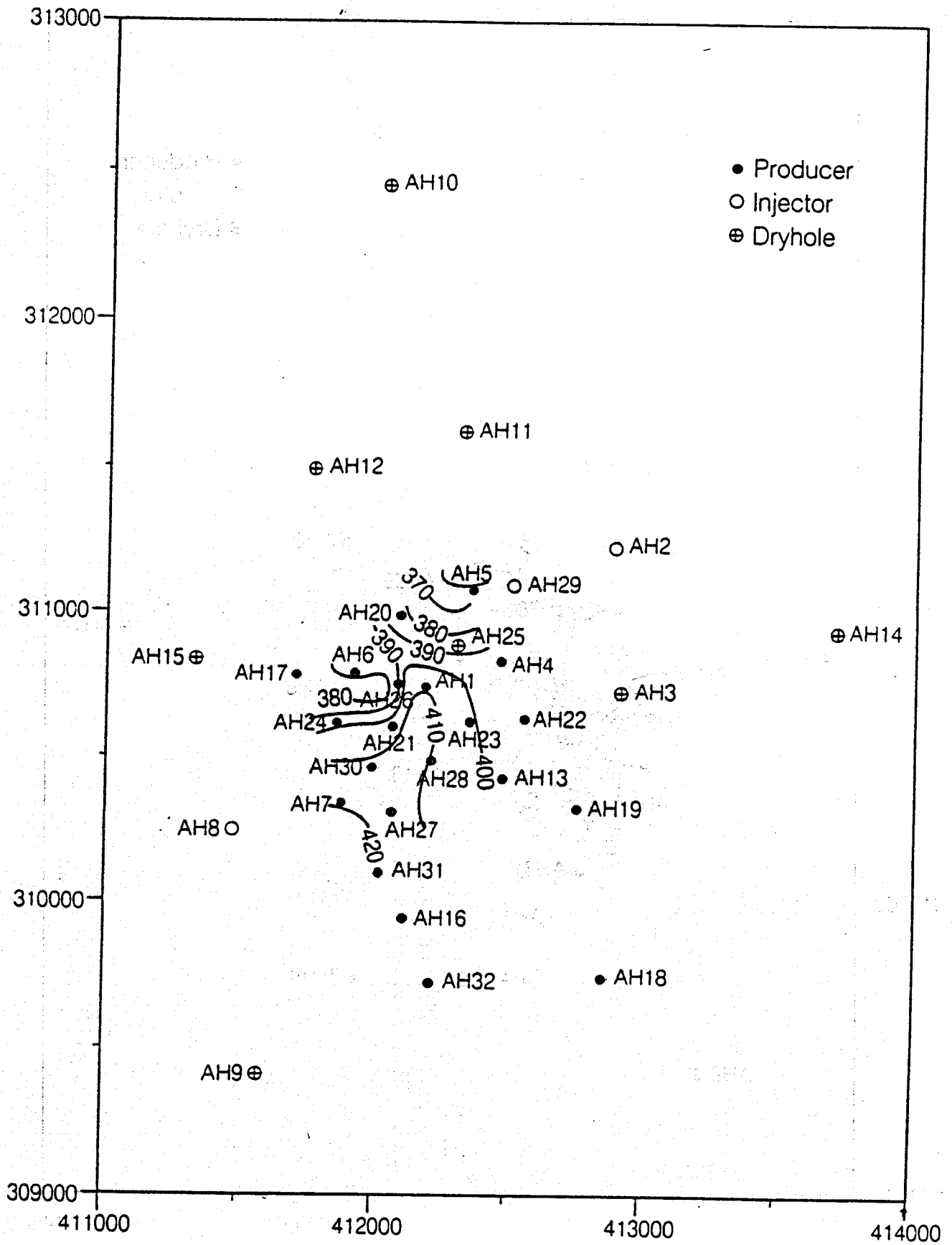
Contour of Cl⁻ (1980)



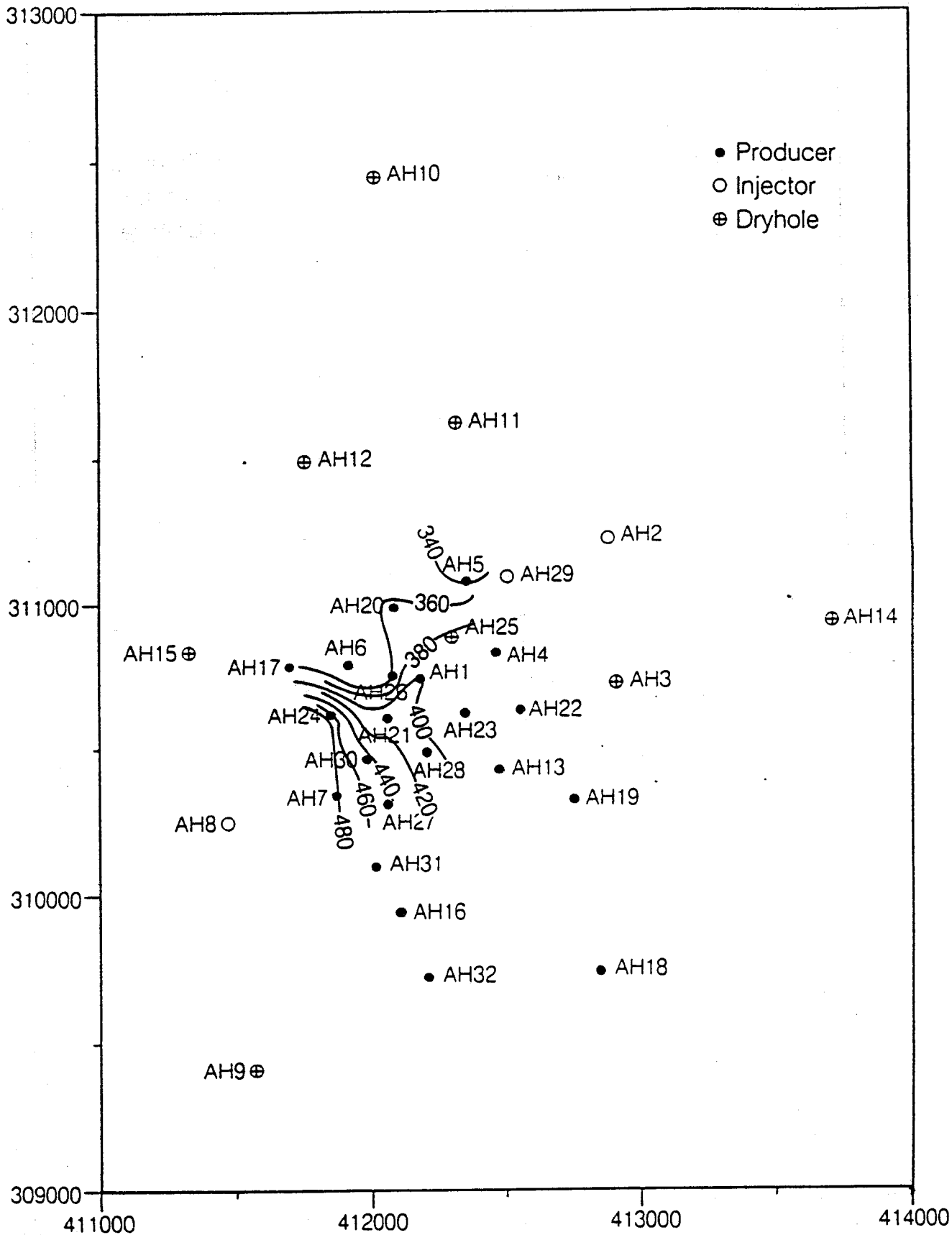
Contour of Cl⁻ (1982)



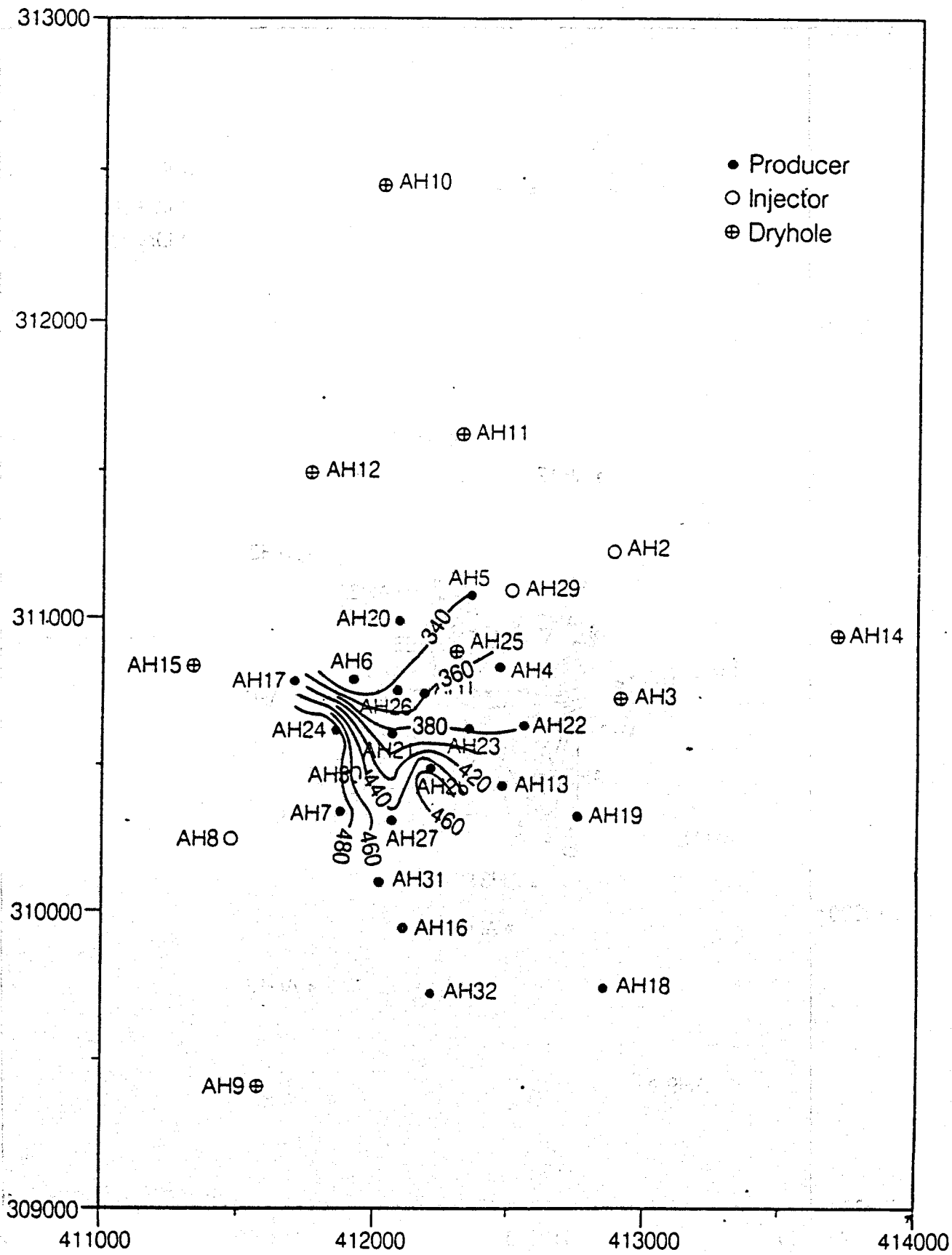
Contour of Cl⁻ (1984)



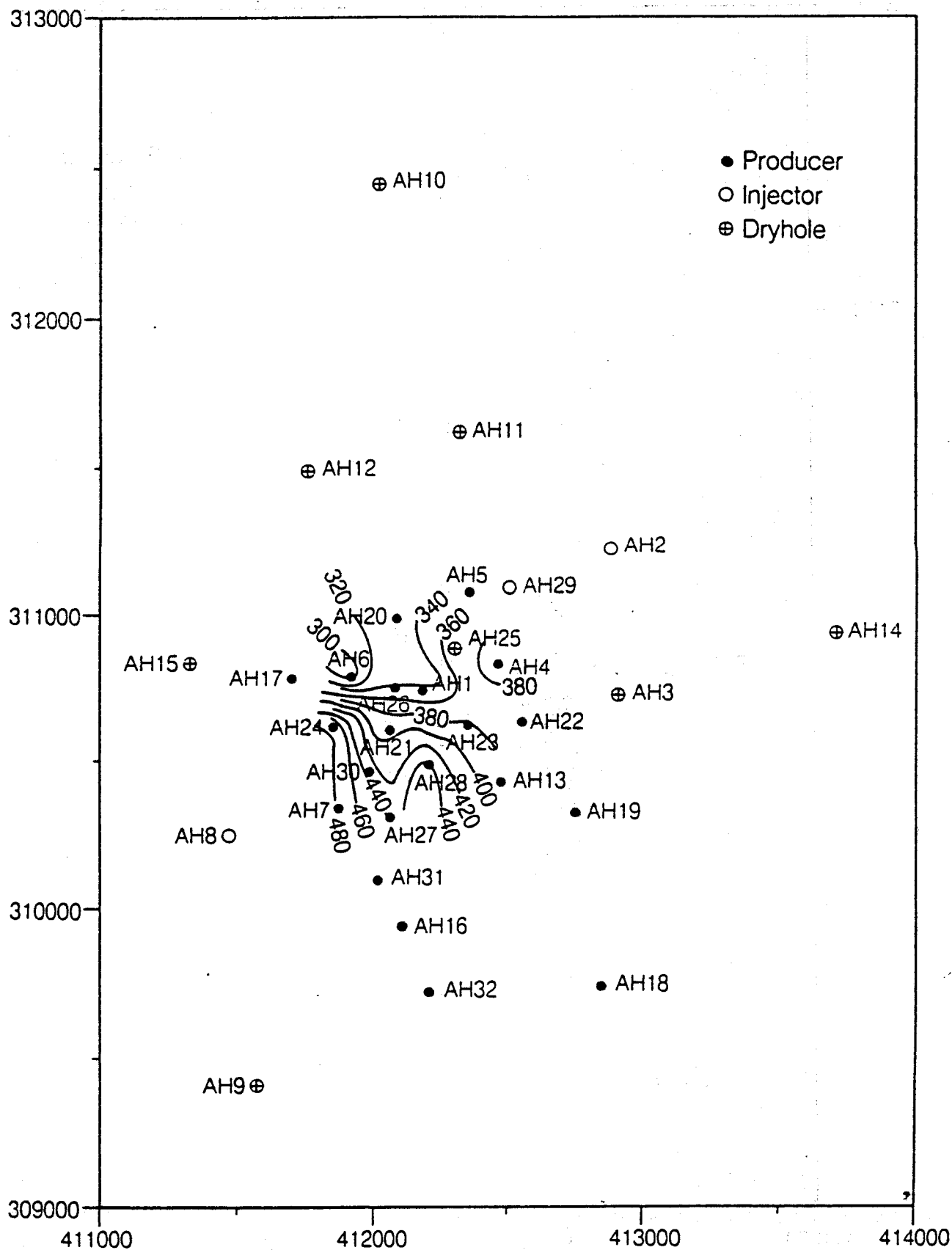
Contour of SiO₂ (1978)



Contour of SiO₂ (1980)



Contour of SiO₂ (1982)



Contour of SiO₂ (1984)

APPENDIX C

(Well Summaries)



WELL AH-1

PRODUCTION WELL

Coordinates:

Latitude : 310,740.74 m

Longitude: 412,185.10 m

Drilling Dates:

Started : April 30, 1968

Finished: June 4, 1968

Elevation: 802.79 m

Depth: 1195.12 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	35.02	13 $\frac{3}{8}$ "	23.21
12 $\frac{1}{4}$ "	488.90	9 $\frac{5}{8}$ "	486.46
8 $\frac{3}{4}$ "	1195.12		

No liner

Circulation losses:

Depth m	Type	Aquifer	Remarks
35			No cuttings at 20-75 m
550			No cuttings below 575 m

Relevant Information:

Pivot point can't be seen in the pressure logs.

Flowing pressure survey done in August 1979 with $Q=65$ kg/s shows the boiling level at 500-600 m depth. The log does not exclude a deep liquid inflow.

Flowing spinner survey with $Q=60$ kg/s shows that all the fluid enters the well above 552 m depth. (44% above 503, 12% between 503 and 512 m and finally 44% between 512 and 552 m depth). It should be noted though that the spinner signal disappears at the boiling level.

Two pairs of flowing temperature and pressure surveys done by Los Alamos in September 1987 at flowrates of 30 and 54 kg/s indicated feedzones at 750 and 775 m depth.

All available temperature run in the well showed full recovery after drilling. The location of the feed zones, therefore, does not show up in the logs. Maximum temperatures of 230- 239°C are found at 600-700 m depth in all the logs until 1979, with bottomhole temperature (BHT) around 225°C. Logs run after 1979 show no temperature inversion and decreasing temperatures (in time) at 500-800 m depth. In 1987 temperature of 215°C was measured at 700 m depth. BHT seems to have remained constant (within the measuring error) about 225°C.

Flowrates have decreased drastically but enthalpy has remained, more or less,

constant with most values around 1050 kJ/kg (250 kcal/kg). Other wells producing mainly from the shallow two phase zone have increased in enthalpy in the last ten years. This suggests that the main feed into AH-1 is actually deeper than what has been believed and within the liquid portion of the reservoir.

Aquifers:

Depth m	Aquifer	Contribution	Remarks
35	Ground water	Major	Cased-off
500	Reservoir	Major	Two phase
510	Reservoir	Minor	Two phase
550	Reservoir	Major	Two phase
750	Reservoir	Major	Liquid
775	Reservoir	Minor	Liquid

Geochemistry:

Data:

Chemical Data : 08/71-04/87 (complete from 10/73)

Physical Data : 01/75-12/84 (limited by enthalpy)

Initial Conditions:

255°C and 7700 ppm Cl.

Early analyses yielded Na-K-Ca temperatures near 260°C (1972-1976) and a few T_{SIL} values were near 250°C. Most silica and enthalpy temperatures were lower, near 240°C (1974-1976). This suggests that near-well temperatures were near 240°C, but at a distance from the well there were higher temperatures. Temperature logs suggest inflow at 240°C before 1979.

Chloride concentrations in the aquifer were constant from 1972 to 1981 at 7700 ± 200 ppm. This might be somewhat in error if the assumed separator pressure of $6.5 \text{ kg/cm}^2\text{g}$ used for samples without physical data (before 1/75) is incorrect.

Changes With Time:

After 1976, all indicated temperatures decreased. T_{NKC} decreased most rapidly from 1976 to 1980 and became nearly constant after 1980 at $240 \pm 6^\circ\text{C}$. T_{E} dropped more than T_{SIL} , especially after 1981. The order of these indices in 1985 was $T_{\text{NKC}} > T_{\text{SIL}} > T_{\text{E}}$, suggesting separate hot and cold entries but the similarity of T_{E} and T_{SIL} suggests that mixing also occurred in the reservoir. The 1985 temperatures were $T_{\text{NKC}} = 240^\circ\text{C}$, $T_{\text{SIL}} = 225^\circ\text{C}$ and $T_{\text{E}} = 215^\circ\text{C}$. Temperature logs in 1987 suggest a 215°C feed at 700m and a bottomhole temperature of 225°C .

Aquifer chloride showed a positive perturbation between 1977 and 1979, but stayed at 7700 ± 200 ppm. From 1981 to 1985, chloride dropped but apparently stabilized afterward at 6600 ± 200 ppm. Chloride calculated from measured enthalpy are about 500 ppm higher than chloride calculated from T_{NKC} .

Summary:

The decrease in chloride and the large decrease in T_{E} started in 1981, suggesting that the cooler entry affected the actual temperature and chloride from that time. Earlier indicated temperature decreases in 1976 (T_{NKC} and some T_{E} values) are not reflected in the aquifer Cl.

WELL AH-2

INJECTION WELL

Coordinates:

Latitude : 311,228.86 m

Longitude: 412,885.54 m

Drilling Dates:

Started : June 14, 1973

Finished: September 6, 1973

Elevation: 808.00 m

Depth: 1200.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	96	20"	94
17 $\frac{1}{2}$ "	700	13 $\frac{3}{8}$ "	686
12 $\frac{1}{4}$ "	1200		

No liner

Circulation Losses:

Depth m	Type	Aquifer	Remarks
20	Total		
75	Total		
325	Total		
700-800	Partial		
820-850	Total		

Relevant Information:

No cuttings below 900 m.

Early pressure surveys indicate a pivot point at 700 m depth.

Spinner survey shows 40% loss at 700 m depth, 40% loss at 900 m and the deepest loss between 950 and 1050 m depth.

The aquifer at 700 m depth is seen in temperature logs. The logs also show that the injected water cools the well down to the bottom (1200 m), indicating some fluid flow down to the bottom region. Before injection started the temperature profile showed maximum at 750 m depth 225°C. BHT (900 m) was less than 220°C. In 1987, several years after injection was stopped, the highest temperatures were found at 600 m depth, only 206°C. Temperature measured were 201°C at 750 m, 197°C at 900m and only 188°C at 1000m (present bottom).

Aquifers:

Depth m	Aquifer	Contribution	Remarks
20	Ground water	Major	Cased-off
75	Ground water	Major	Cased-off
325	Saturated zone	Major	Cased-off
700	Reservoir	Major	Liquid
900	Reservoir	Major	Liquid
1000	Reservoir	Minor	Liquid
1200	Reservoir	Minor	Liquid

Geochemistry:

No data.

Item No.	Description	Quantity	Unit Price	Total Price
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WELL AH-3

COLLAPSED DURING DRILLING AT 414 m.

Coordinates:

Latitude : 310,726.43 m

Longitude: 412,915.81 m

Drilling Dates:

Started : March 3, 1973

Finished: June 1, 1973

Work-over:

Started : January 17, 1974

Finished: January 28, 1974

Purpose : To remove blockage and place a liner

Elevation: 855.5 m

Depth: 802.20 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	105	20"	80
17 $\frac{1}{2}$ "	475	13 $\frac{3}{8}$ "	472
12 $\frac{1}{4}$ "	802.2	9 $\frac{5}{8}$ "	334-696

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
10	Partial	Ground water	Cased-off
55	Partial	Ground water	Cased-off
115	Partial	Ground water	Cased-off
155	Total	Saturated zone	Cased-off
330	Total	Saturated zone	Cased-off
585	Total	Reservoir	Major feed
750	Total	Reservoir	Major feed

Relevant Information:

The well collapsed during or shortly after drilling at 413 m depth. Only one temperature and a few pressure logs were available up to this depth. Water level is close to 280 m depth and the temperature was 84°C at the water table and 118°C at 413 m depth.

Aquifers:

The only available information on the location of the aquifers is the list of circulation losses.

Geochemistry:

No data

WELL AH-4

PRODUCTION WELL

Coordinates:

Latitude : 310,835.13 m

Longitude: 412,470.45 m

Drilling Dates:

Started : June 1, 1972

Finished: August 4, 1972

Work-over:

Started : October 23, 1982

Finished: November 25, 1982

Purpose : To remove blockage

Elevation: 812.23 m

Depth: 788.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	52	20"	50
17 $\frac{1}{2}$ "	485	13 $\frac{3}{8}$ "	481.55
12 $\frac{1}{4}$ "	514	9 $\frac{5}{8}$ "	509.65
8 $\frac{1}{2}$ "	788	7 $\frac{5}{8}$ "	472.43-788

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
50	Total	Ground water	Cased-off
170	?	Saturated zone	Cased-off
350	?	Saturated zone	Cased-off
485	Partial	Reservoir	
540	Total	Reservoir	

Relevant Information:

No cuttings below 540 m depth.

All logging runs before 1982 reached only to 540 m depth. These logs were run when the well had fully recovered after drilling and aquifers did not show up in the logs. The well produced fluids of high enthalpy with increasing enthalpy from 1200 kJ/kg in 1975 to more than 1800 kJ/kg in 1982. This indicates that the main production came from the two phase zone of the reservoir.

In 1982 a work-over was done on the well, after which the well had been open to 780 m depth. The work-over totally changed the characteristics of the well. Productivity decreased more than 50 % and enthalpy decreased to less than 1000 kJ/kg such that its enthalpy corresponds now to the liquid temperatures in the reservoir. What really happened during the work-over is not clear to us. But it seems that the feed zones in the two phase zone are now sealed and the well produces from a deeper liquid feed. The location of that feed can't be seen from the data we have received.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
50	Ground water	Major	Cased-off
170	Saturated zone	Minor	Cased-off
350	Saturated zone	Minor	Cased-off
485	Reservoir	Minor	Two phase (plugged?)
540	Reservoir	Major	Two phase (plugged?)
700	Reservoir	Major	Liquid

Geochemistry:

Data:

Chemical Data : 09/74-08/85

Physical Data : 01/75-12/84

Initial Conditions:

240°C and 7200 ppm Cl.

Scattered 1975 and all 1976 data indicate very constant Na-K-Ca temperatures of $240 \pm 3^\circ\text{C}$. Silica temperatures are also constant at $235 \pm 3^\circ\text{C}$. T_E values are 20°C higher than T_{NKC} , possibly suggesting boiling and heat transfer from rocks. The initial temperature is probably 240°C .

Aquifer chloride is also constant from mid-1977 to 1981 at 7200 ± 100 ppm. Earlier Cl values are lower except for a few values in late 1976. The low Cl values are considered an artifact. The initial value is probably 7200 ppm.

Changes With Time:

After early 1980, T_E , which had been about constant at $260 \pm 10^\circ\text{C}$, suddenly increased to about 370°C in mid-1981 and started to decrease in 1982. Lack of data interrupted our view of this decrease, but T_E values were 240°C or lower by 1985-86. The increase in enthalpy is mainly due to near-well boiling and heat transfer from rock (the temperature order $T_E \gg T_{NKC} > T_{SIL}$ indicates this) but there may also be addition of steam formed elsewhere (the differences between T_{NKC} and T_{SIL} are small). The small differences between indicated temperatures before 1980 suggest an equilibrated liquid with a small steam feed.

Chloride was constant at 7200 ± 100 ppm until mid-1980, then climbed a small amount and after mid-1981 decreased to 6500 ppm in 1985. The climb in Cl was simultaneous with the increase in enthalpy, indicating heat transfer from rock.

Summary:

The large increase in T_E without much difference between T_{NKC} and T_{SIL} suggests entry of steam formed elsewhere. This possibly resulted from the formation of a steam cap when pressures dropped due to the stopping of injection. The simultaneous increase then small decrease in chloride suggests boiling followed by limited cold-water entry also from pressure decrease.

WELL AH-5

PRODUCTION WELL

Coordinates:

Latitude : 311,081.09 m

Longitude: 412,357.66 m

Drilling Dates:

Started : June 6, 1970

Finished: June 30, 1970

Work-over:

Started : October 8, 1972

Finished: October 20, 1972

Purpose : To remove slotted liner

Elevation: 789.45 m

Depth: - 957.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	104.6	13 $\frac{3}{8}$ "	98.19
12 $\frac{1}{2}$ "	468.8	9 $\frac{5}{8}$ "	456.93
8 $\frac{3}{4}$ "	957		

No liner

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
50	?	Ground water	Cased-off
325	?	Saturated zone	Cased-off
565	?	Reservoir	
585	?	Reservoir	

Relevant Information:

No cuttings between 320-468 m and below 585 m depth.

Temperature logs show an internal flow in the well during recovery after drilling. Aquifers are seen at bottom (920 m), 720 m, 590 m and 515 m depths. The discharge enthalpy of the well has remained around 1000 kJ/kg indicating that the main feed zone might be in the liquid portion of the reservoir. Pressure logs from 1970 show scattering values, but in at least three logs, a pivot point is seen at around 700 m depth.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
50	Ground water	?	Cased-off
325	Saturated zone	Major	Cased-off
515	Reservoir	Minor	Two phase
590	Reservoir	Minor (?)	Two phase
720	Reservoir	Major	Liquid
920	Reservoir	Minor	Liquid

Geochemistry:

Data:

Chemical Data : 02/73-05/80 (plus few 1972 and 1987 analyses)

Physical Data : 04/75-05/80

Initial Conditions:

248°C and 8100 ppm Cl.

Changes in chemical temperatures occurred from the start of production. The earliest T_{NKC} are about 248°C and later data, despite scatter, extrapolates to near this value. Much earlier data on Cl are quite variable, but 1973 and 1978-1980 data are reasonably constant at 8100 ± 100 ppm.

Changes With Time:

We have no enthalpy before 1975 and the pre-1975 T_{NKC} and T_{SIL} values are highly variable. After 1975, all temperatures decrease rapidly with $T_{NKC} > T_{SIL} > T_E$, indicating cold fluid entry. Based on T_E , the fluid temperature was as low as 210-215°C in 1979-1980. The single 1987 measurement suggest a small heating up or at least no further cooling. The sharp drop in Cl in 1974 and recovery in 1978 suggest a break in the casing with entry of cold water. If this entry occurred below the casing, then it slowed (in 1976) and stopped (in 1978) with time.

Summary:

Scattered data suggesting cold-water entry starting as early as 1974.

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WELL AH-6

PRODUCTION WELL

Coordinates:

Latitude : 310,791.22 m

Longitude: 411,921.01 m

Drilling Dates:

Started : February 2, 1970

Finished: February 24, 1970

Elevation: 782.97 m

Depth: 591.16 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
$17\frac{1}{2}"$	95.25	$13\frac{3}{8}"$	90.68
$12\frac{1}{2}"$	455.22	$9\frac{5}{8}"$	454.30
$8\frac{3}{4}"$	591.16		

No liner

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
140	?	Saturated zone	Cased-off
250	?	Saturated zone	Cased-off
480	Total	Reservoir	

Relevant Information:

No cutting below 520 m.

This well was completed into the two phase zone of the reservoir. The discharge enthalpy was about 1000 kJ/kg when production started but has since increased to more than 2200 kJ/kg. The production zone of AH-6 is only 150 m long. Temperature logs during and just after drilling in 1970 indicate a minor aquifer at 460 m depth but the main aquifers are inferred to be at 480 m depth (the total loss of circulation) and 550 m depths.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
140	Saturated zone	Minor	Cased-off
250	Saturated zone	Minor	Cased-off
460	Reservoir	Minor	Two phase
480	Reservoir	Major	Two phase
550	Reservoir	Major	Two phase

Geochemistry:

Data:

Chemical Data : 02/72-04/87

Physical Data : 07/76-12/83 (limited by enthalpy measurement)

Initial Conditions:

255°C and 8200 ppm Cl.

Reasonably constant initial T_{NKC} of $255 \pm 5^\circ\text{C}$ and a few T_{SIL} values near 245°C suggest 255°C and with T_{SIL} affected by near-well boiling. Initial chloride values (in part extrapolated from later production) are also well behaved at 8200 ppm.

Changes With Time:

The first measured T_E values in 1976 are only 10°C higher than T_{NKC} values, but T_E increases rapidly due to near-well boiling and heat gain from rocks (with order $T_E > T_{NKC} > T_{SIL}$). Maximum T_E values of 370°C are reached in 1981-84. Enthalpy values continue to increase after 1984 but cannot be plotted as T_E values. T_{NKC} and T_{SIL} gradually decline from 255° and 230°C to 245° and 215°C . Chloride values are very scattered and show an apparent increase from 8000 ppm in 1974 to 9000 ppm in 1987 and increasing instability after 1978 and amounting to about 1000 ppm in 1987. This is probably due to near-well boiling related to the high excess enthalpy.

Summary:

AH-6 became an excess enthalpy well soon after production started and produced, after 1981, small flows with twice as much steam as water. These conditions and near-well boiling produced varying solute concentrations.

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WELL AH-7

PRODUCTION WELL

Coordinates:

Latitude : 310,342.10 m

Longitude: 411,868.14 m

Drilling Dates:

Started : May 22, 1970

Finished: June 4, 1970

Work-over:

Started : September 21, 1972

Finished: November 5, 1972

Purpose : To deepen the well

Elevation: 804.79 m

Depth: 950.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	103.63	13 $\frac{3}{8}$ "	96.73
12 $\frac{1}{2}$ "	486.33	9 $\frac{5}{8}$ "	483.36
8 $\frac{3}{4}$ "	950.00		

No liner

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
520	?	Reservoir	

Relevant Information:

No cuttings below 520 m depth.

Temperature logs after drilling show internal flow in the well between aquifers at 520-530 m and 750 m depth. Rapid recovery at the casing shoe at 485 m depth can be explained by a minor two phase feed. Both pressure and spinner logs were conducted during discharge. The spinner survey shows that the inflows are from aquifers above 525 m depth (80%) and from an aquifer at 700-750 m depth (20%).

The discharge enthalpy of AH-7 has varied between 1000 and 1200 kJ/kg. This indicates that the deeper feed might be contributing more than the spinner log suggests.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
490	Reservoir	Minor	Two phase
520	Reservoir	Major	Two phase
750	Reservoir	Major	Liquid

Geochemistry:

Data:

Chemical Data : 12/73-04/87

Physical Data : 02/77-10/84

Initial Conditions:

262°C and 8600 ppm Cl

The first T_{NKC} and T_{SIL} temperatures are near 255°C. These values diverge immediately, T_{NKC} to oscillate around 262±5°C and T_{SIL} around 245±5°C. T_{SIL} has been lowered by in-well dilution, so 262°C seems reasonable as the initial temperature. Initial aquifer Cl is near 8600 ppm with later values slightly lower (calculated from T_{NKC}) and higher (calculated from T_{SIL}). A reasonable initial value is 8600±200 ppm Cl.

Changes With Time:

As mentioned above, T_{NKC} values oscillate around 260±5°C until 1981-1982 when they decline slowly to 257±3°C in 1987. T_{SIL} oscillates around 245±5°C until 1981-82 then increases slightly to 250±2° in 1987. The T_E values are highly variable starting at 227±8°C and becoming bimodal in 1979-81, with most values centering on 235±5°C and some values following T_{SIL} at 250±5°C. The general patterns of $T_{NKC} > T_{SIL} > T_E$ and $T_{NKC} > T_{SIL} = T_E$ suggest mixture of cooler water alternately in and close to the well with higher temperature (255°C) fluid further from the well cooled by mixture with cooler water to 245°C near the well and possibly 230°C in the well. The calculated temperature of the cool water is near 85°C.

Chloride has also been relatively constant with 8600±200 ppm values declining after 1981 and possibly stabilizing after 1985 at 8350±200 ppm. Chloride calculated from measured enthalpy is more variable at 9200±400 ppm.

Summary:

This very well-behaved well shows evidence of constant mixing of cooler and warmer waters at a variable distance from the well.

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WELL AH-8

INJECTION WELL

Coordinates:

Latitude : 310,251.43 m

Longitude: 411,457.71 m

Drilling Dates:

Started : August 8, 1972

Finished: September 18, 1972

Work-over:

Started : September 12, 1973

Finished: October 13, 1973

Purpose : To remove blockage

Elevation: 810.99 m

Depth: 988.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	110	20"	107
17 ¹ / ₂ "	467	13 ³ / ₈ "	463.75
12 ¹ / ₄ "	988	10 ³ / ₄ "	354-434
9 ⁵ / ₈ "	434-582		

Redrilled with 8 1/2"bit at 582-710 m. Liner Slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
235	Partial	Saturated zone	Cased-off
350	Partial	Saturated zone	Cased-off
485	Partial	Reservoir	
865	Partial	Reservoir	
890	Partial	Reservoir	
950	Partial	Reservoir	
988	Total	Reservoir	

Relevant Information:

All available logs reached only as deep as 675 m. In 1975 the pressure at 200 masl was 36 bar but had declined to 25 bar in 1987. Extremely high pressure values in the years 1976 to 1982 are due to reinjection into the well. Temperature logs show an aquifer at 510 m. Reinjection cools the well as deep as the logs were run so the deep loss zone was probably receiving some of the reinjection despite the obstruction at 675 m depth.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
235	Saturated zone	?	Cased-off
350	Saturated zone	?	Cased-off
485	Reservoir	?	Two phase
510	Reservoir	?	Two phase
865	Reservoir	?	Liquid
890	Reservoir	?	Liquid
950	Reservoir	?	Liquid
988	Reservoir	?	Liquid

Geochemistry:

No data.

WELL AH-9

DRY HOLE

Coordinates:

Latitude : 309,408.23 m

Longitude: 411,572.57 m

Drilling Dates:

Started : March 1, 1970

Finished: March 27, 1970

Work-over:

First:

Started : March 1, 1970

Finished: March 27, 1970

Second:

Started : July 2, 1970

Finished: July 18, 1970

Purpose : To deepen the well

Elevation: 871.33 m

Depth: 1424.03 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	94.64	13 $\frac{3}{8}$ "	90.83
12 $\frac{1}{4}$ "	488.14	9 $\frac{5}{8}$ "	484.48
8 $\frac{5}{8}$ "	1424.03	7 $\frac{5}{8}$ "	469.43-961
7"	1140.6	5"	1424.03

Liner slotted below 634 m depth.

Circulation Losses: None.

Relevant Information:

Several temperature logs were obtained from this well just after drilling in 1970 and then almost every year since 1977. In 1970, the well was open to about 1200 m depth. No aquifers are seen in the logs during the recovery. The temperatures are above 200°C below 700 m depth with a maximum of 235°C at 1170 m. Since 1977, no logs have reached deeper than 732 m depth. There appeared to be several obstructions in the well and most logs only reached to 611 m depth. Temperature at that depth is about 180°C but in the few logs that reach to 732 m temperature as high as 225°C was measured. In the depth interval 500-700 m temperature show a linear gradient of 0.3°C/m.

In 1976-78, the water level in the well was close to 300 m depth (294 m). This corresponds to a pressure of approx. 35 bars at 200 masl or similar pressure as in the geothermal reservoir. In later years, however, the water level has risen to 210-220 m depth. This is a similar pressure potential as in the saturated zone.

Aquifers:

There are "no" aquifers in AH-9.

Geochemistry:

No data.

WELL AH-10

DRY HOLE			

Coordinates:

Latitude : 312,447.81 m

Longitude: 412,014.72 m

Drilling Dates:

Started : March 31, 1970

Finished: May 18, 1970

Elevation: 723.78 m

Depth: 1524.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	102.11	13 $\frac{3}{8}$ "	96.37
12 $\frac{1}{2}$ "	492.86	9 $\frac{5}{8}$ "	485.59
8 $\frac{3}{4}$ "	1542	7 $\frac{5}{8}$ "	460.31-1524

Slotted below 1162 m

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
375	Total	Saturated zone	Cased-off

Relevant Information:

No cuttings 375-492 m depth.

We have only three temperature log from this well and no pressure logs. Two of the temperature logs were run two months apart in 1970 when the well was open to 1250 m depth. They differ by about 10°C indicating heating up after drilling. Maximum temperature at 1250 m (bottom) is only 122°C. The temperature gradient in the deepest 500 m is 0.09 C/m. No aquifers can be seen in the logs. The water level in the well is not noted on the graphs we received for the logs run in 1970. The third log is from 1975. At that time the well was blocked at 414 m depth with water table at 105 m depth. As the elevation of the well is 724 masl, this corresponds to a pressure of 42 bar at 200 masl.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
375	Saturated zone		Cased-off

This well is truly a dry well.

Geochemistry:

No data.

WELL AH-11

DRY HOLE

Coordinates:

Latitude : 311,619.32 m

Longitude: 412,319.08 m

Drilling Dates:

Started : October 25, 1972

Finished: January 11, 1973

Work-over:

Started : October 18, 1973

Finished: October 30, 1973

Purpose : To clean out the well

Elevation: 759.3 m

Depth: 943.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	100	20"	96.60
17 $\frac{1}{2}$ "	464	13 $\frac{3}{8}$ "	462
12 $\frac{1}{4}$ "	943	10 $\frac{3}{4}$ "	600

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
30	Total	Ground water	Cased-off
325	Total	Saturated	Cased-off
610	Partial	Reservoir	
760	Partial	Reservoir	
785	Absorpt.	Reservoir	
806	Absorpt.	Reservoir	

Relevant Information:

In 1973-75, the well was open to 940 m depth, but since 1976, the well has been blocked at about 340 m depth. The water level was at 195 m depth in this well after drilling but has sunk to 295 m depth in 1987. This is about 2/3 of the draw-down observed in the main well field. It is possible that the reinjection into well AH-2 has influenced the pressure in AH-11.

The early temperature logs, when the well was open to total depth, do not show any internal flow in the well and the only location where the logs indicate a possible aquifer is around 500 m depth. Although well AH-11 seems to reflect the pressure in the reservoir zone, maximum temperatures at 940 m depth are relatively low, only 190°C. In the saturated zone temperatures of 100-140°C are seen.

Aquifers:

Well AH-11 has no major feed zone.

Depth (m)	Aquifer	Contribution	Remarks
30	Ground water	?	Cased-off
325	Saturated zone	?	Cased-off
500	Saturated zone	?	
610	Reservoir	?	
760	Reservoir	?	
785	Reservoir	?	
806	Reservoir	?	

Geochemistry:

No data.

SECRET

CONFIDENTIAL - SECURITY INFORMATION

Name	Position	Grade	Status
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]
[Name]	[Position]	[Grade]	[Status]

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WELL AH-12

DRY HOLE			
Coordinates:			

Latitude : 311,493.50 m

Longitude: 411,758.10 m

Drilling Dates:

Started : January 15, 1973

Finished: March 16, 1973

Elevation: 758.80 m

Depth: 1003.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	100.00	20"	96.00
17 $\frac{1}{2}$ "	500.56	13 $\frac{3}{8}$ "	496.00
12 $\frac{1}{2}$ "	728.50	8 $\frac{3}{4}$ "	1003.00

No liner

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
0-50	Total	Ground water	Cased-off
710	Absorption	Reservoir	
740	Absorption	Reservoir	

Relevant Information:

No well logs penetrated to total depth in this well. After drilling in 1973 to 1977 all logging tools reached only to 562 m depth. In 1978 the well was found to be blocked at 183 m depth. No logs are available after 1978.

The logs show temperatures of 100-135°C down to 562 m depth. Water level remained stable in this 5 year period at 142 m depth and pressures at 200 masl is approximately 43 bar. The well is not connected to the geothermal reservoir, but gives on the other hand information on temperature and pressure conditions in the saturated zone. The high water table indicates that the pressure potential of the saturated zone is much higher than that of the reservoir.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
0-50	Ground water	?	Cased-off
710	Reservoir	?	
740	Reservoir	?	

Geochemistry:

No data.

WELL AH-13

PRODUCTION WELL

Coordinates:

Latitude : 310,428.40 m

Longitude: 412,479.68 m

Drilling Dates:

Started : August 9, 1974

Finished: August 21, 1974

Elevation: 859.60 m

Depth: 831.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	98.00	20"	97.00
17 $\frac{1}{2}$ "	490.00	13 $\frac{3}{8}$ "	480.00
12 $\frac{1}{4}$ "	831.00	10 $\frac{3}{4}$ "	453.53-812.00

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
50	Absorption	Ground water	Cased-off
75	Total	Ground water	Cased-off
98	Total	Ground water	Cased-off
450	Total	Saturated(?)	Cased-off
490	Partial	Reservoir	
540	Total	Reservoir	
560	Total	Reservoir	
580	Total	Reservoir	
660	Absorption	Reservoir	
770	Total	Reservoir	

Relevant Information:

No cuttings below 770 m depth.

Temperature logs shortly after drilling in January 1974 and work-over in August 1974 show at least three aquifers. These found at about 550, 600 and 750 m depth and are in good agreement with the list of circulation losses. The fast recovery of the feed zone at 550 m indicates small cooling during drilling. This is therefore judged to be a minor feed. We have no data to determine which of the deeper two feeds dominates. This could possibly be seen from the discharge enthalpy as the aquifer at 600 m depth and is in the two phase portion of the reservoir where as the feed at 770 m depth is in the liquid portion. Despite the fact that this well is characterized as a production well we have no data on productivity and enthalpy.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
50	Ground water	?	Cased-off
75	Ground water	?	Cased-off
98	Ground water	?	Cased-off
450	Saturated(?)	?	Cased-off
490	Reservoir	?	Two phase
540	Reservoir	Two phase	
560	Reservoir	Two phase	
580	Reservoir	Two phase	
660	Reservoir	Liquid(?)	
770	Reservoir	Liquid	

Geochemistry:

No data.

Date	Particulars	Amount
10/10/10
10/11/10
10/12/10
10/13/10
10/14/10
10/15/10
10/16/10
10/17/10
10/18/10
10/19/10
10/20/10
10/21/10
10/22/10
10/23/10
10/24/10
10/25/10
10/26/10
10/27/10
10/28/10
10/29/10
10/30/10
10/31/10
	Total	...

WELL AH-14

DRY HOLE

Coordinates:

Latitude : 310,938.58 m

Longitude: 413,705.56 m

Drilling Dates:

Started : February 1, 1974

Finished: May 12, 1974

Work-over:

Started : October 19, 1976

Finished: November 25, 1976

Elevation: 821.77 m

Depth: 1056.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	97.00	20"	96.00
17 $\frac{1}{2}$ "	550.00	13 $\frac{3}{8}$ "	348.00
12 $\frac{1}{4}$ "	570.00	9 $\frac{5}{8}$ "	464.60
8 $\frac{1}{2}$ "	800.00	7 $\frac{5}{8}$ "	450-698
6 $\frac{1}{8}$ "	1056.00		

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
90	Total	Ground water	Cased-off
150	Partial	Saturated(?)	Cased-off
260	Total	Saturated(?)	Cased-off
360	Total	Saturated(?)	Cased-off
420	Partial	Saturated(?)	Cased-off
550	Partial	Reservoir(?)	
600	Total	Reservoir(?)	
640	Total	Reservoir(?)	

Relevant Information:

No cuttings below 640 m depth.

This well is considered dry despite of the total losses of circulation. The well is in pressure communication with the geothermal reservoir and a pressure drawdown of 6 bar has been observed since 1975. The temperature profile is conductive down to 800 m depth with a gradient of about 0.2°C/m. Temperature at the total loss zones at 600-640 m depth is 185-190°C. The well has been plugged at about 800 m depth since 1980. Earlier logs show that the temperature increases only slightly from 800 to 1000 m depth reaching a maximum of about 240°C at bottom. The temperatures in AH-14 are well below boiling at all depths. Further it should be noted that the temperature at 1000 m depth is one of the hottest temperature measured in Ahuachapan.

Temperature logs run right after drilling show aquifers around 550, 650 and 720 m depth. There seems to be an internal flow between these aquifers. The total loss zone at 600 m depth is not seen in the logs. Temperature profiles in the well after full recovery from drilling didn't show any internal flow. We have no data other than the circulation losses to determine the relative productivity of these aquifers.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
90	Ground water	Major	Cased-off
150	Ground water/Saturated(?)	Minor	Cased-off
260	Saturated	Major	Cased-off
360	Saturated	Major	Cased-off
420	Saturated	Minor	Cased-off
550	Reservoir	Minor(?)	Liquid.
640	Reservoir	Major(?)	Liquid
720	Reservoir	Minor(?)	Liquid

Geochemistry:

No data.

Year	1974	1975	1976	1977	1978	1979	1980
Jan	100	100	100	100	100	100	100
Feb	100	100	100	100	100	100	100
Mar	100	100	100	100	100	100	100
Apr	100	100	100	100	100	100	100
May	100	100	100	100	100	100	100
Jun	100	100	100	100	100	100	100
Jul	100	100	100	100	100	100	100
Aug	100	100	100	100	100	100	100
Sep	100	100	100	100	100	100	100
Oct	100	100	100	100	100	100	100
Nov	100	100	100	100	100	100	100
Dec	100	100	100	100	100	100	100



WELL AH-15

DRY HOLE

Coordinates:

Latitude : 310,834.44 m

Longitude: 411,334.22 m

Drilling Dates:

Started : August 26, 1974

Finished: October 19, 1974

Elevation: 772.68 m

Depth: 704.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	99.72	20"	98.00
17- $\frac{1}{2}$ "	505.00	13- $\frac{3}{8}$ "	491.00
12- $\frac{1}{4}$ "	704.00		

No liner

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
505	Absorption	Saturated zone(?)	

Relevant Information:

In 1974 to 1976, all logging runs reached to 558 m depth. Later logs only reached down to 390 m. This is within the 9 5/8" casing. The water level is at about 140 m depth and has not changed since 1974. The well is obviously not connected to the geothermal reservoir but the question is whether the water level corresponds to the pressure in the saturated zone or the well is totally plugged at 390 m depth. Temperatures are close to 100°C at the water table increasing to 125-130°C at 390 m depth. This is one of the few wells where information on temperatures is available in the saturated zone.

Aquifers:

This seems to truly a dry well. The only indication of an aquifer is the absorption of the circulating at:

Depth (m)	Aquifer	Contribution	Remarks
505	Saturated zone	Minor	

Geochemistry:

No data.

WELL AH-16

PRODUCTION WELL

Coordinates:

Latitude : 309,948.09 m

Longitude: 412,106.16 m

Drilling Dates:

Started : May 19, 1974

Finished: August 5, 1974

Work-over:

Started : December 1, 1976

Finished: February 28, 1977

Purpose : To deepen the well

Elevation: 868.76 m

Depth: 1006.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	101.00	20"	101.00
17 $\frac{1}{2}$ "	510.00	13 $\frac{3}{8}$ "	510.00
12 $\frac{1}{4}$ "	1006.00	10 $\frac{3}{4}$ "	485.10-750
9 $\frac{5}{8}$ "	1006		

The liner is slotted from top to bottom.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
60	Total	Ground water	Cased-off
140	Total	Saturated(?)	Cased-off
300	Total	Saturated	Cased-off
600	Partial	Reservoir	
650	Total	Reservoir	

Relevant Information:

No cuttings below 930 m depth.

We have several temperature logs after work-over in 1977. The heat recovery after the work-over is dominated in the upper portion of the well by a steam rich aquifer at about 620 m. The fast recovery indicates small cooling of this aquifer during the work-over. Below 620 m, the temperature profile is near isothermal indicating an internal flow in the well. The flow direction can't be determined from the logs but normally a downflow is observed in wells after drilling and work-over. In this well, the flow seems to be from the total loss zone at 650 m depth to an aquifer close to bottom at 1000 m. Further, the logs show an anomaly at about 850 m indicating an aquifer at this depth.

The well produces a high enthalpy fluid (1800 kJ/kg). This indicates that the main feed zone is located in the two phase portion of the well.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
60	Ground water	Major	Cased-off
140	Ground/Saturated	Major	Cased-off
300	Saturated zone	Major	Cased-off
600	Reservoir	Minor	Two phase
650	Reservoir	Major	Two phase
850	Reservoir	Minor	Liquid
1000	Reservoir	Minor	Liquid

Geochemistry:

Data:

Chemical Data : 12/86-03/87 (2 analyses)

Physical Data : none

Summary:

The few data indicate a T_{NKC} of $243 \pm 3^\circ\text{C}$ and T_{SIL} of $237 \pm 3^\circ\text{C}$. These are reasonable when compared to other wells. The data are too few to suggest changes with time or production mechanism.

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Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Income	100	120	150	180	200	220	250	280	300	320	350	380
Expenses	80	90	100	110	120	130	140	150	160	170	180	190
Balance	20	30	50	70	80	90	110	130	140	150	170	190

1945

1946

1945

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Income	110	130	160	190	210	230	260	290	310	330	360	390
Expenses	90	100	110	120	130	140	150	160	170	180	190	200
Balance	20	30	50	70	80	90	110	130	140	150	170	190

1946

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Income	120	140	170	200	220	240	270	300	320	340	370	400
Expenses	100	110	120	130	140	150	160	170	180	190	200	210
Balance	20	30	50	70	80	90	110	130	140	150	170	190

WELL AH-17

INJECTION/PRODUCTION WELL

Coordinates:

Latitude : 310,781.95 m

Longitude: 411,697.32 m

Drilling Dates:

Started : June 29, 1976

Finished: August 30, 1976

Work-over:

Started : February 22, 1979

Finished: March 8, 1979

Purpose : To place a slotted liner

Elevation: 773.00 m

Depth: 1200.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	105	13 $\frac{3}{8}$ "	104.5
12 $\frac{1}{4}$ "	452	9 $\frac{5}{8}$ "	450.0
8 $\frac{1}{2}$ "	1200	7 $\frac{5}{8}$ "	440-1200

The liner is slotted from top to bottom.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
130	Total	Saturated(?)	Cased-off
468	Total	Reservoir	

Relevant Information:

No cuttings below 780 m depth.

Spinner log shows that 98% of the injected fluid reaches 773 m depth but no spinner signal was detected at 873 m depth. Almost none of the injected fluid enters the feed zone at 468 m depth. This is rather unusual as the liner is slotted at that depth. When discharged the well produces dry steam so the main feed zone during discharge must be the aquifer at 468 m. Temperature logs shortly after drilling show clearly the aquifer at 468 m depth. Logs in 1980/81 show aquifer at about 600 m depth. The loss zone during reinjection is not easily seen in the logs. Earlier logs show, though, small cooling below the 468 m aquifer down to about 870 m depth. Bottom hole temperatures in AH-17 have been fairly stable since 1976 at 210-215°C.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
130	Saturated(?)	Major aquifer	Cased-off
468	Reservoir	Major feed	Two phase
600	Reservoir	Minor feed	Two phase
870	Reservoir	Major (injection)	Liquid

Geochemistry:

Data:

Chemical Data : 02/85-04/87

Physical Data : 12/81-12/86

Summary:

The well produces dry steam. The few water analyses are of condensate and a small amount (5%) of deep water. They do not yield useful geothermometers or aquifer chlorides.

100

100

100

100

100

100



WELL AH-18

PRODUCTION WELL

Coordinates:

Latitude : 309,745.32 m

Longitude: 412,852.31 m

Drilling Dates:

Started : March 9, 1977

Finished: May 24, 1977

Elevation: 926.28 m

Depth: 1256.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	108	13 $\frac{3}{8}$ "	105.0
12 $\frac{1}{4}$ "	625	9 $\frac{5}{8}$ "	624.2
8 $\frac{1}{2}$ "	1256	7 $\frac{5}{8}$ "	614-1256

Liner is slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
31	Total	Ground water	Cased-off
43	Total	Ground water	Cased-off
53	Total	Ground water	Cased-off
175	Total	Ground water(?)	Cased-off
225	Total	Ground water	Cased-off
325	Partial	Saturated	Cased-off
540	Partial	Saturated	Cased-off
790	Total	Reservoir	
906	Total	Reservoir	

Relevant Information:

No cuttings below 930 m depth.

Very good temperature and pressure logs are available for this well during the heating up period after drilling. The pressure logs show a pivot point at about 800-850 m depth, in good agreement with the circulation losses. The temperature logs show gradual increasing temperatures and the recovery seems to be disturbed only to a small degree by internal flow. We have very little productivity data from this well. A flow test report from 1984 does not say anything about flow rate and enthalpy as no lip pressure readings were obtained because of the large lip pipe used (6"). It is clear, though, that the flow rate is low and as the main loss zones during drilling are relatively deep, liquid enthalpy is to be expected. Logs run shortly after the flow test show cooling down to at least 1000 m depth. The well has therefore boiled during discharge to at least that depth indicating a feed zone below 1000 m.

It should be noted that the temperature logs show increasing temperature with depth. Before 1983, bottom hole temperature was measured at approximately 240°C but later most values show temperature of 244-245°C. This increase is large enough to be explained solely as a calibration error of the gauges, so possibly the temperatures in the south around well AH-18 has increased with time.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
31	Ground water	Major	Cased-off
43	Ground water	Major	Cased-off
53	Ground water	Major	Cased-off
175	Ground/Saturated(?)	Major	Cased-off
225	Ground/Saturated(?)	Major	Cased-off
325	Saturated zone	Minor	Cased-off
540	Saturated zone	Minor	Cased-off
790	Reservoir	Major	Two phase/liquid
906	Reservoir	Major	Liquid

Geochemistry:

No data.

No.	Name	Address	City	State	Zip
1	John Doe	123 Main St	New York	NY	10001
2	Jane Smith	456 Elm St	Los Angeles	CA	90001
3	Bob Johnson	789 Oak St	Chicago	IL	60601
4	Alice Brown	101 Pine St	Houston	TX	77001
5	Frank White	202 Cedar St	Phoenix	AZ	85001
6	Grace Green	303 Birch St	Philadelphia	PA	19101
7	Henry Black	404 Maple St	San Antonio	TX	78101
8	Ivy Gold	505 Walnut St	San Diego	CA	92101
9	Jack Silver	606 Spruce St	San Jose	CA	95101
10	Karen Bronze	707 Ash St	Portland	OR	97201
11	Leo Iron	808 Hickory St	Seattle	WA	98101
12	Mia Steel	909 Cypress St	Denver	CO	80201
13	Noah Lead	1010 Sycamore St	San Francisco	CA	94101
14	Olivia Tin	1111 Dogwood St	Washington	DC	20001
15	Peter Zinc	1212 Magnolia St	Boston	MA	02101
16	Quinn Nickel	1313 Tulip St	San Francisco	CA	94101
17	Rachel Copper	1414 Rose St	Los Angeles	CA	90001
18	Sam Silver	1515 Iris St	Chicago	IL	60601
19	Tina Gold	1616 Sunflower St	Phoenix	AZ	85001
20	Uma Platinum	1717 Dandelion St	Philadelphia	PA	19101
21	Victor Iron	1818 Poppy St	San Antonio	TX	78101
22	Wendy Steel	1919 Clover St	San Diego	CA	92101
23	Xavier Lead	2020 Orchid St	San Jose	CA	95101
24	Yara Tin	2121 Zinnia St	Portland	OR	97201
25	Zoe Zinc	2222 Hibiscus St	Seattle	WA	98101
26	Adam Nickel	2323 Begonia St	Denver	CO	80201
27	Bella Copper	2424 Petunia St	San Francisco	CA	94101
28	Charlie Silver	2525 Marigold St	Washington	DC	20001
29	Diana Gold	2626 Aster St	Boston	MA	02101
30	Ethan Platinum	2727 Gladiolus St	San Francisco	CA	94101
31	Fiona Iron	2828 Iris St	Los Angeles	CA	90001
32	Gavin Steel	2929 Sunflower St	Chicago	IL	60601
33	Hannah Lead	3030 Dandelion St	Phoenix	AZ	85001
34	Ian Tin	3131 Poppy St	Philadelphia	PA	19101
35	Jessica Zinc	3232 Clover St	San Antonio	TX	78101
36	Kevin Nickel	3333 Orchid St	San Diego	CA	92101
37	Laura Copper	3434 Zinnia St	San Jose	CA	95101
38	Michael Silver	3535 Hibiscus St	Portland	OR	97201
39	Nancy Gold	3636 Begonia St	Seattle	WA	98101
40	Oscar Platinum	3737 Petunia St	Denver	CO	80201
41	Pamela Iron	3838 Marigold St	San Francisco	CA	94101
42	Quinn Steel	3939 Aster St	Washington	DC	20001
43	Rachel Lead	4040 Iris St	Boston	MA	02101
44	Sam Tin	4141 Sunflower St	San Francisco	CA	94101
45	Tina Zinc	4242 Dandelion St	Los Angeles	CA	90001
46	Uma Nickel	4343 Poppy St	Chicago	IL	60601
47	Victor Copper	4444 Clover St	Phoenix	AZ	85001
48	Wendy Silver	4545 Orchid St	Philadelphia	PA	19101
49	Xavier Gold	4646 Zinnia St	San Antonio	TX	78101
50	Yara Platinum	4747 Hibiscus St	San Diego	CA	92101
51	Zoe Iron	4848 Begonia St	San Jose	CA	95101
52	Adam Steel	4949 Petunia St	Portland	OR	97201
53	Bella Lead	5050 Marigold St	Seattle	WA	98101
54	Charlie Tin	5151 Aster St	Denver	CO	80201
55	Diana Zinc	5252 Iris St	San Francisco	CA	94101
56	Ethan Nickel	5353 Sunflower St	Washington	DC	20001
57	Fiona Copper	5454 Dandelion St	Boston	MA	02101
58	Gavin Silver	5555 Poppy St	San Francisco	CA	94101
59	Hannah Gold	5656 Clover St	Los Angeles	CA	90001
60	Ian Platinum	5757 Orchid St	Chicago	IL	60601
61	Jessica Iron	5858 Zinnia St	Phoenix	AZ	85001
62	Kevin Steel	5959 Hibiscus St	Philadelphia	PA	19101
63	Laura Lead	6060 Begonia St	San Antonio	TX	78101
64	Michael Tin	6161 Petunia St	San Diego	CA	92101
65	Nancy Zinc	6262 Marigold St	San Jose	CA	95101
66	Oscar Nickel	6363 Aster St	Portland	OR	97201
67	Pamela Copper	6464 Iris St	Seattle	WA	98101
68	Quinn Silver	6565 Sunflower St	Denver	CO	80201
69	Rachel Gold	6666 Dandelion St	San Francisco	CA	94101
70	Sam Platinum	6767 Poppy St	Washington	DC	20001
71	Tina Iron	6868 Clover St	Boston	MA	02101
72	Uma Steel	6969 Orchid St	San Francisco	CA	94101
73	Victor Lead	7070 Zinnia St	Los Angeles	CA	90001
74	Wendy Tin	7171 Hibiscus St	Chicago	IL	60601
75	Xavier Zinc	7272 Begonia St	Phoenix	AZ	85001
76	Yara Nickel	7373 Petunia St	Philadelphia	PA	19101
77	Zoe Copper	7474 Marigold St	San Antonio	TX	78101
78	Adam Silver	7575 Aster St	San Diego	CA	92101
79	Bella Gold	7676 Iris St	San Jose	CA	95101
80	Charlie Platinum	7777 Sunflower St	Portland	OR	97201
81	Diana Iron	7878 Dandelion St	Seattle	WA	98101
82	Ethan Steel	7979 Poppy St	Denver	CO	80201
83	Fiona Lead	8080 Clover St	San Francisco	CA	94101
84	Gavin Tin	8181 Orchid St	Washington	DC	20001
85	Hannah Zinc	8282 Zinnia St	Boston	MA	02101
86	Ian Nickel	8383 Hibiscus St	San Francisco	CA	94101
87	Jessica Copper	8484 Marigold St	Los Angeles	CA	90001
88	Kevin Silver	8585 Aster St	Chicago	IL	60601
89	Laura Gold	8686 Iris St	Phoenix	AZ	85001
90	Michael Platinum	8787 Sunflower St	Philadelphia	PA	19101
91	Nancy Iron	8888 Dandelion St	San Antonio	TX	78101
92	Oscar Steel	8989 Poppy St	San Diego	CA	92101
93	Pamela Lead	9090 Clover St	San Jose	CA	95101
94	Quinn Tin	9191 Orchid St	Portland	OR	97201
95	Rachel Zinc	9292 Zinnia St	Seattle	WA	98101
96	Sam Nickel	9393 Hibiscus St	Denver	CO	80201
97	Tina Copper	9494 Marigold St	San Francisco	CA	94101
98	Uma Silver	9595 Aster St	Washington	DC	20001
99	Victor Gold	9696 Iris St	Boston	MA	02101
100	Wendy Platinum	9797 Sunflower St	San Francisco	CA	94101

Signature: _____

Date: _____

WELL AH-19

PRODUCTION WELL

Coordinates:

Latitude : 310,331.55 m

Longitude: 412,759.49 m

Drilling Dates:

Started : October 20, 1977

Finished: February 28, 1978

Elevation: 873.3 m

Depth: 1415.50 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 1/2"	92.0	13 3/8"	92.0
12 1/4"	707.3	9 5/8"	676.0
8 1/2"	1415.5	7 5/8"	655-1009.5

The liner is not slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
40	Total	Ground water	Cased-off
50	Total	Ground water	Cased-off
60	Total	Ground water	Cased-off
80	Total	Ground water	Cased-off
120	Partial	Ground/Saturated	Cased-off
220	Partial	Saturated	Cased-off
290	Total	Saturated	Cased-off
300	Total	Saturated	Cased-off
700	Total	Reservoir	
770	Total	Reservoir	

Relevant Information:

The well was cased to the bottom of the two phase zone. During heating up after drilling in 1978, temperature logs show an internal flow in the well between the aquifers at 700, 770, 1100 m depth and possibly the bottom (1370 m depth). Reservoir temperature is approximately 230°C. and the discharge enthalpy about is 1050 kJ/kg, which is close to the liquid enthalpy of 230°C water. It is inferred that the total loss at 700 m depth is the main feed zone but we have very little data to support this.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
40	Ground water	Major	Cased-off
50	Ground water	Major	Cased-off
60	Ground water	Major	Cased-off
80	Ground water	Major	Cased-off
120	Ground/Saturated	Minor	Cased-off
220	Saturated zone	Minor	Cased-off
290	Saturated zone	Major	Cased-off
300	Saturated zone	Major	Cased-off
700	Reservoir	Major	Two phase/Liquid
770	Reservoir	Major(?)	Two phase/Liquid
1100	Reservoir	Minor(?)	Liquid
1370(?)	Reservoir	Minor(?)	Liquid

Geochemistry:

Data:

Chemical Data : 07/84-04/87

Physical Data : 12/83-12/86

Initial Conditions:

233°C and 6100 ppm Cl.

T_{NKC} and T_{SIL} are remarkably constant and nearly the same for the entire chemical record except for the first 6 months. T_{NKC} is $240 \pm 5^\circ\text{C}$ from July 1984 to February 1985 and $234 \pm 3^\circ\text{C}$ from February 1985 to April 1987. T_{SIL} is $230 \pm 3^\circ\text{C}$ for the entire period. It seems most likely that the initial

temperature was 233°C. The aquifer Cl was also constant at 6100±100 ppm until 1986. Initial aquifer Cl was therefore 6100±100 ppm.

Changes With Time:

Enthalpy temperatures (T_E) were 233°C when first measured but declined to 220±5°C rapidly and remained constant thereafter. The T_{NKC} exceeded T_{SIL} by about 5°C, except late in 1985 when they were fairly similar. The T_E is about 10°C lower than other indicated temperatures, which suggests a small amount of cooler water mixture. The differences are small and it seems likely that the well produces from a single-phase, equilibrated fluid without either boiling or major mixing with cold water. Chloride was constant at 6100±100 ppm from 1984-86 and then decreased to 5700 ppm in 1987.

Summary:

An unusual behavior for Ahuachapan well with no excess or deficiency in enthalpy. A well-behaved single-phase, single-feed well.

WELL AH-20

PRODUCTION WELL

Coordinates:

Latitude : 310,986.42 m

Longitude: 412,087.47 m

Drilling Dates:

Started : October 24, 1974

Finished: December 20, 1974

Work-over:

Started : July 27, 1982

Finished: August 8, 1982

Purpose : To place a slotted liner

Elevation: 792.93 m

Depth: 850.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	86	20"	86.0
17 $\frac{1}{2}$ "	455	13 $\frac{3}{8}$ "	449.5
12 $\frac{1}{4}$ "	850	9 $\frac{5}{8}$ "	426.0-850

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
50	Absorption	Ground water	Cased-off
460	Total	Reservoir	

Relevant Information:

No cuttings below 600 m depth.

Temperature logs show an aquifer at 500 m depth. A pivot point is seen at that depth from the pressure logs in 1976. As the well produces a high enthalpy fluid (1200-1500 kJ/kg), most of the fluid must be from the two phase portion above 600 m depth. The work-over in 1982 did not change the production characteristics of the well.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
50	Ground water	Minor	Cased-off
460	Reservoir	Major	Two phase
500	Reservoir	Major(?)	Two pahse

Geochemistry:

Data:

Chemical Data : 06/76-04/87 (+2 analyses in early 1975)

Physical Data : 06/76-12/86

Initial Conditions:

252°C and 7900 ppm Cl.

Values of T_{NKC} were $260 \pm 5^\circ\text{C}$ for early 1975 and $257 \pm 1^\circ\text{C}$ for June to October 1976 with a steady decline afterward. T_{SIL} was $234 \pm 2^\circ\text{C}$ for the same period. Initial T_E values were $247 \pm 6^\circ\text{C}$ but increased rapidly after a year. This well probably had near-well boiling (indicated by increase in T_E) so T_{SIL} is probably low. The likely initial temperature is $252 \pm 5^\circ\text{C}$. Initial chloride values of 7700 ± 100 ppm (April 1975-March 1977) are probably low. Constant Cl of 7900 ± 100 ppm measured from April 1977 to August 1978 are more likely to reflect initial values.

Changes With Time:

After a year of production, T_E rapidly increased to a maximum of 360°C in 1982 and declined afterward to about 300°C . T_{NKC} and T_{SIL} declined steadily from 260°C and 234°C to 240°C and 220°C , respectively. This temperature behavior ($T_E > T_{NKC} > T_{SIL}$) indicates near-well boiling from January 1977 (and possibly earlier) with heat transfer from the rock. This process declined in intensity after 1982. Chloride in the aquifer fluid declined steadily after 1977. The declines in T_{NKC} , T_{SIL} and chloride may indicate increasing dilution with cooler, more dilute water.

Summary:

A classical excess-enthalpy well with near-well boiling.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In addition, the document outlines the procedures for handling discrepancies. If there is a difference between the recorded amount and the actual amount received or paid, it is crucial to investigate the cause immediately. This could be due to a clerical error, a missing receipt, or a more serious issue like fraud.

The final section of the document provides a summary of the key points discussed. It reiterates the need for diligence and accuracy in all financial reporting. The document concludes by stating that these guidelines are intended to help the organization maintain the highest standards of financial integrity.

The second part of the document details the specific steps for reconciling bank statements. It starts with a comparison of the opening and closing balances. If they do not match, the next step is to review all deposits and withdrawals recorded during the period.

It is also important to check for any outstanding checks or deposits in transit. These items may not yet be reflected in the bank's records but should be accounted for in the company's books. The document provides a clear checklist for these tasks to ensure nothing is overlooked.

Furthermore, the document discusses the importance of regular reconciliations. Monthly reconciliations are recommended to catch any errors early on. This practice helps in identifying trends and preventing small mistakes from becoming larger problems.

The document also touches upon the use of technology in financial management. It suggests that using accounting software can significantly reduce the risk of human error and streamline the reconciliation process. However, it also notes that users must ensure the software is properly configured and updated.

The third part of the document focuses on the internal control system. It describes how a strong internal control system can protect the organization's assets and prevent fraud. Key components include segregation of duties, where no single individual has control over all aspects of a transaction.

Another important element is the requirement for proper authorization. All significant transactions should be approved by a designated manager before being processed. This helps in ensuring that resources are used wisely and in accordance with the organization's goals.

The document also highlights the role of regular audits. Internal audits can provide an objective assessment of the internal control system's effectiveness. They can identify weaknesses and recommend improvements. External audits, conducted by independent firms, provide an additional layer of assurance for stakeholders.

Finally, the document stresses the importance of a strong ethical culture. Employees should be encouraged to report any suspicious activity or potential conflicts of interest. A commitment to integrity is essential for the long-term success and reputation of the organization.

WELL AH-21

PRODUCTION WELL

Coordinates:

Latitude : 310,601.15 m

Longitude: 412,059.04 m

Drilling Dates:

Started : December 27, 1974

Finished: March 4, 1975

Elevation: 795.0 m

Depth: 849.40 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
26"	96.0	20"	94.0
17 $\frac{1}{2}$ "	500.0	13 $\frac{3}{8}$ "	472.0
12 $\frac{1}{4}$ "	849.4	9 $\frac{5}{8}$ "	444-849.4

Liner slotted below 500 m depth.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
430	Total	Saturated/Reservoir	Cased-off
510	Total	Reservoir	

Relevant Information:

Temperature logs after drilling in 1975 and work-over in 1976 show aquifers at 450-500 m. The cooling after work-over also indicates loss of circulation fluid at 550-600 and 849 m depths. The enthalpy is relatively high, 1100-1200 kJ/kg, indicating that most of the fluid produced must be from the two phase portion of the reservoir.

Flowing temperature and pressure surveys conducted in 1983 at a rate of 76 kg/s showed main feedzone at 500-600 and a minor inflow at the bottom of the well.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
430	Saturated/Reservoir(?)	Major	Cased-off
500-550	Reservoir	Major	Two phase
600	Reservoir	Major	Two phase/Liquid
800-849	Reservoir	Minor	Liquid

Geochemistry:

Data :

Chemical Data : 04/75-04/87

Physical Data : 08/76-10/86

Initial Conditions:

257°C and 8500 ppm Cl.

Temperatures indicated for this well are difficult to interpret. T_{NKC} suggests 257°C but both T_{SIL} and T_E suggest much lower temperatures near 230°C. Although higher temperature fluids were not far away, mixing with cooler water has reduced the temperature feeding the well to 230°C. Initial chlorides oscillated but must have been near 8500 ppm.

Changes With Time:

As noted above, cooler water mixture is indicated from the start but rising values of T_E until 1981 with T_E falling afterward could result from decreasing and increasing cold-water mixture. Chloride contents showed a slow decline, however, without evidence of decreased dilution so it appears probable that the enthalpy perturbation was due to addition of excess steam. T_{NKC} , T_{SIL} and chloride show a slow decline, suggesting stable inflow of water from cooler parts of the reservoir. After 1979, the $T_{NKC} > T_E = T_{SIL}$ pattern indicates mixture with cooler water far enough from the well for silica to be fully equilibrated.

Summary:

An unusual well with both cold-water at a distance (high T_{NKC}) and excess enthalpy probably from addition of steam.

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WELL AH-22

PRODUCTION WELL			
Coordinates:			
Latitude : 310,632.21 m			
Longitude: 412,558.65 m			

Drilling Dates:

Started : March 9, 1975

Finished: April 21, 1975

Elevation: 842.0 m

Depth: 659.50 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	93.0	13 $\frac{3}{8}$ "	89.5
12 $\frac{1}{4}$ "	517.0	9 $\frac{5}{8}$ "	508.8
8 $\frac{3}{4}$ "	659.5		

No liner.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
20-70	Total	Ground water	Cased-off
89	Partial	Ground water	Cased-off
130	Partial	Saturated(?)	Cased-off
270	Partial	Saturated	Cased-off
310	Partial	Saturated	Cased-off
500	Partial	Reservoir	Cased-off
520	Partial	Reservoir	

Relevant Information:

This well has a high discharge enthalpy of 1200 kJ/kg indicating that the main feed zone is within the two phase region. The loss zone at 520 m depth is most likely the main feed. This aquifer doesn't show up in the temperature logs but irregularities in the logs at about 600 m depth indicate a feed zone at that depth.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
20-70	Ground water	Major	Cased-off
89	Ground water	Minor	Cased-off
130	Saturated zone	Minor	Cased-off
270	Saturated zone	Minor	Cased-off
310	Saturated zone	Minor	Cased-off
500	Reservoir	Minor	Cased-off
520	Reservoir	Major	Two phase
600	Reservoir	Minor(?)	Two phase/Liquid

Geochemistry:

Data:

Chemical Data : 07/76-04/87

Physical Data : 07/76-12/86

Initial Conditions:

240°C and 6900 ppm Cl.

T_{NKC} and T_{SIL} are remarkably similar and constant, indicating initial temperatures of $240 \pm 4^\circ\text{C}$ and $236 \pm 4^\circ\text{C}$. T_E is higher, suggesting boiling (and steam entry), which might explain the slightly lower T_{SIL} value. 240°C seems a good initial temperature. Chloride initially at 6900 ± 100 ppm shows a slow rise.

Changes With Time:

High and variable T_E values suggest boiling or the addition of excess steam. Near concordance of T_{NKC} and T_{SIL} suggests limited boiling, so the major cause of high enthalpy is probably addition of steam ($T_E > T_{NKC} = T_{SIL}$). Chloride shows a rapid decrease in 1981, indicating the arrival of the chemical (or "hydraulic") front. Chloride values more or less stabilize after 1983, suggesting that the cooler water (now heated by reservoir rock) had about 6200 ppm Cl.

Summary:

Addition of steam causing high T_E with no effects on T_{NKC} or T_{SIL} and the arrival of a lower chloride water without effect on indicated temperatures suggests both independent steam entry and arrival of a chemical front.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author outlines the various methods used to collect and analyze the data. This includes both primary and secondary data collection techniques. The analysis focuses on identifying trends and patterns over time.

The third part of the document provides a detailed breakdown of the results. It shows that there has been a significant increase in sales volume over the period studied. This is attributed to several factors, including improved marketing strategies and a strong economic environment.

The fourth section discusses the challenges faced during the data collection process. One major challenge was the inconsistency in the quality of the data provided by different sources. This required additional time and effort to clean and validate the information.

Another challenge was the limited availability of certain types of data. Some key variables were not tracked consistently across all periods, which affected the depth of the analysis.

Despite these challenges, the study successfully identified several key insights. These include the impact of seasonal fluctuations on sales and the effectiveness of different promotional campaigns.

The final part of the document offers recommendations for future research and data collection. It suggests that more standardized data collection protocols should be implemented to improve the reliability of the information.

In conclusion, this study has provided a comprehensive overview of the data collection and analysis process. It highlights the importance of rigorous data management practices and the need for continuous improvement in data collection methods.

The findings suggest that with the right approach, it is possible to gather high-quality data that can be used to make informed business decisions.

The author expresses their appreciation to the participants and staff who assisted in the data collection process. Their cooperation was essential for the success of the study.

Finally, the author notes that this document is intended to serve as a guide for others who may be interested in similar data collection projects.

WELL AH-23

PRODUCTION WELL

Coordinates:

Latitude : 310,621.45 m

Longitude: 412,349.73 m

Drillind Dates:

Started : July 7, 1977

Finished: September 10, 1977

Elevation: 825.4 m

Depth: 924.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	101.0	13 $\frac{3}{8}$ "	98.0
12 $\frac{1}{4}$ "	459.5	9 $\frac{5}{8}$ "	459.5
8 $\frac{5}{8}$ "	875.0	7 $\frac{5}{8}$ "	437-924.0
8 $\frac{1}{2}$ "	924.0		

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
50	Total	Ground water	Cased-off
125	Total	Saturated(?)	Cased-off
225	Partial	Saturated(?)	Cased-off
240	Total	Saturated(?)	Cased-off
270	Total	Saturated(?)	Cased-off
350	Partial	Saturated(?)	Cased-off
460	Partial	Reservoir	
525	Total	Reservoir	

Relevant Information:

No cuttings below 775 m depth.

Early temperature logs show an aquifer at 525 m depth. High discharge enthalpy of 1200 kJ/kg indicates that the main feed zone is in the two phase portion of the reservoir but the temperature logs do not exclude a minor deep liquid inflow.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
50	Ground water	Major	Cased-off
125	Ground/Saturated(?)	Major	Cased-off
225	Saturated zone	Minor	Cased-off
240	Saturated zone	Major	Cased-off
270	Saturated zone	Major	Cased-off
350	Saturated zone	Minor	Cased-off
460	Reservoir	Minor	Two phase
525	Reservoir	Major	Two phase

Geochemistry:

Data:

Chemical Data : 01/80-04/87

Physical Data : 01/80-12/86

Initial Conditions:

245°C and 7100 ppm Cl.

Although the earliest T_E and T_{SIL} indicate 227°C, all T_{NKC} and some T_{SIL} and T_E values (at times when there is no excess enthalpy and no expansion of boiling) are near 245°C; this seems to be the real initial temperature. Initial chloride (extrapolated from later measurements) is near 7100 ppm from T_{NKC} and 7400 ppm from T_{SIL} . The best guess is 7100 ppm.

Changes With Time:

This well shows clear evidence of episodic boiling and heat transfer as the boiling zone expanded. At various times, $T_E = T_{NKC} > T_{SIL}$, indicating near-well boiling without heat transfer from the rock (in 1981 and 1983); $T_E > T_{NKC} > T_{SIL}$, indicating boiling with heat transfer (in 1981 and after 1984); and $T_E = T_{NKC} = T_{SIL}$, indicating an all-liquid feed (in 1982). Chloride decreased steadily (with a small increase in from 1983-1984 related to boiling and increase in T_E) from 7100 ppm in 1980 to 6100 ppm in 1981.

Summary:

A well with excess enthalpy due to boiling not addition of steam.

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

WELL AH-24

PRODUCTION WELL

Coordinates:

Latitude : 310,616.08 m

Longitude: 411,852.48 m

Drilling Dates:

Started : April 27, 1975

Finished: June 23, 1975

Work-over:

Started : March 22, 1976

Finished: June 14, 1976

Purpose : To repair casing break. Well has now a constriction.

Elevation: 783.1 m

Depth: 850.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	98	13 $\frac{3}{8}$ "	95.0
12 $\frac{1}{4}$ "	453	9 $\frac{5}{8}$ "	258.5
		9 $\frac{5}{8}$ "	307.6-411
		7"	234-435
8 $\frac{1}{2}$ "	850	7 $\frac{5}{8}$ "	435-844

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
96	Total	Ground water	Cased-off
452	Total	Reservoir	

Relevant Information:

No cuttings below 730 m depth.

Early temperature logs show an aquifer at 450 m depth with a temperature of 225°C. No internal flow was observed in the well during recovery after drilling and temperatures at 630 m depth increase slowly from 120°C in May 1975 to 215°C in March 1976. After work-over in spring of 1976, a temperature minimum is seen at 650 m.

Low discharge enthalpies (800-900 kcal/kg) in 1977 are hard to explain unless the main inflow came from the cooled interval around 650 m.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
96	Ground water	Major aquifer	Cased-off
452	Reservoir	Minor(?)	Two phase
650	Reservoir	Major(?)	Two phase/Liquid

Geochemistry:

Data:

Chemical Data : 07/78-04/87

Physical Data : 11/78-12/86

Initial Conditions:

260°C and 8500 ppm Cl.

This is a high-temperature well that was cooled almost from the start by cold water. Initial T_{NKC} is near 260°C with the first T_E near 257°C and T_{SIL} near 250°C. Initial chloride is 8500 ppm.

Changes With Time:

T_E is extremely variable but appears to have decreased rapidly to about 220°C, much lower than other indicators. $T_{NKC} > T_{SIL} > T_E$, indicating mixture with cold water in the wellbore and near the well and partial re-equilibration of T_{SIL} . The fraction of cold water has varied a bit as indicated by higher Cl when T_E is higher (as in January 1981 and June 1982, as well as the reverse in September 1981). The partial re-equilibration of T_{SIL} prevents calculation of the cool water temperature.

Summary

A deficient enthalpy well with evidence of variable cold-water admixture.

1950

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WELL AH-25

DRY HOLE

Coordinates:

Latitude: 310,887.24 m

Longitude: 412,303.58 m

Drilling Dates:

Started : May 29, 1975

Finished: August 27, 1975

Elevation: 798.5 m

Depth: 943.30 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	96.5	13 $\frac{3}{8}$ "	94.8
12 $\frac{1}{4}$ "	507.0	9 $\frac{5}{8}$ "	506.0
8 $\frac{3}{4}$ "	943.0	7 $\frac{5}{8}$ "	485-928

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
50	Total	Ground water	Cased-off
175	Partial	Saturated zone	Cased-off
200	Partial	Saturated zone	Cased-off
425	Partial	Saturated zone	Cased-off
590	Partial	Reservoir	
675	Total	Reservoir	

Relevant Information:

This well is considered dry, however, a total circulation loss occurs at 675 m depth during drilling. Temperature logs shortly after drilling indicate no internal flow in the well. A minor feed zone is inferred at 800 m depth and a feed zone at 500-600 m depth. As the logs do not show any anomaly at 675 m depth, it is suspected that the total loss might have occurred shallower at 500-600 m depth. The latest logs show an isothermal temperature profile from 550 m depth down to the bottom at a temperature of 210-215°C. The highest temperature of 230°C was measured in 1975-77 at 500-650 m depth and at the bottom at 220°C.

A pair of pressure logs from 1975 and 1977 show a pivot point at 600 m depth. This indicates that the circulation loss at 590 m depth is the "best" feed of this well.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
50	Ground water	Major	Cased-off
175	Saturated zone	Minor	Cased-off
200	Saturated zone	Minor	Cased-off
425	Saturated/Reservoir(?)	Minor	Cased-off
590	Reservoir	"Best" feed	Two phase
67	Reservoir	?	Liquid
800	Reservoir	Minor	Liquid

Geochemistry:

No data.

10/10/2020

Item	Description	Quantity	Unit Price	Total
1
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3
4
5
6
7
8
9
10

10/10/2020

10/10/2020

10/10/2020

10/10/2020

10/10/2020

10/10/2020

10/10/2020

10/10/2020

WELL AH-26

PRODUCTION WELL

Coordinates:

Latitude : 310,750.00 m

Longitude: 412,080.00 m

Drilling Dates:

Started : September 5, 1975

Finished: October 30, 1975

Elevation: 791.1 m

Depth: 804.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	97	13 $\frac{3}{8}$ "	96.0
12 $\frac{1}{4}$ "	413	9 $\frac{5}{8}$ "	399.0
8 $\frac{1}{2}$ "	804		

No liner.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
48	Partial	Ground water	Cased-off
54	Total	Ground water	Cased-off
411	Total	Reservoir	
413-461	Partial	Reservoir	
470	Total	Reservoir	

Relevant Information:

A spinner log was run in this well during discharge in 1979. The log show half of the inflow was from the interval 410-450 m and the rest from 450-500 m depth. These were in good agreement with the circulation losses. High discharge enthalpies of 1600-2200 kJ/kg also indicate that most of the fluid is from the two phase zone that extends in this well to about 550 m depth. Pressure log during discharge show that the well boils to the deepest measuring point at 616 m. Some inflow must, therefore, be below that depth but it is difficult to estimate the amount of fluid coming from this deep feed from the log profile. The exact location of this feed is believed to be at 650 m based from the temperature logs.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
48	Ground water	Minor	Cased-off
54	Ground water	Major	Cased-off
411	Reservoir	Major	Two phase
470	Reservoir	Major	Two phase
650	Reservoir	Minor	Liquid

Geochemistry:

Data:

Chemical Data : 07/76-04/87

Physical Data : 08/76-12/87

Initial Conditions:

254°C and 8000 ppm Cl.

This well had elevated T_E and depressed T_{SIL} (due to boiling) from the start of data collection. The initial T_{NKC} was $254 \pm 3^\circ\text{C}$, which was near constant until 1979. Except some initial scatter, aquifer chloride was constant at 8000 ± 100 ppm from 1977 to 1979.

Changes With Time:

The entire history of this well shows the pattern $T_E > T_{NKC} > T_{SIL}$ and near constant temperature differences, suggesting stable boiling and heat transfer from rock. The near stable temperature values suggest that the boiling was at some distance from the well (but not far enough for NKC re-equilibration). The start of boiling is not shown in our data and may have been caused by production of another well or during well tests. A slow decrease of $8-10^\circ\text{C}$ is seen in T_{NKC} and T_{SIL} (1977-1987), with an increase in T_E in 1978 followed by a slow decrease (and decreasing scatter). Chloride decreased slowly to 7000 ± 150 ppm in 1987.

Summary:

A well with uniform boiling and conductive heating at a moderate distance from the well. Some cold-water addition (and boiling?) has slowly decreased temperatures and chloride concentrations.

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WELL AH-27

PRODUCTION WELL

Coordinates:

Latitude : 310,313.00 m

Longitude: 412,067.00 m

Drilling Dates:

Started : March 6, 1978

Finished: April 29, 1978

Elevation: 822.47 m

Depth: 800.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	112	13 $\frac{3}{8}$ "	110.0
12 $\frac{1}{4}$ "	424	9 $\frac{5}{8}$ "	412.0
8 $\frac{1}{2}$ "	800	7 $\frac{5}{8}$ "	333.5-729.2

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
0-90	Partial	Ground water	Cased-off
50	Total	Ground water	Cased-off
425	Partial	Reservoir	
500	Total	Reservoir	

Relevant Information:

No cuttings below 500 m depth.

Temperature and pressure logs indicate the "water level" under pressure at 550 m depth. WHP has decreased from 23 bar in 1979 to 17 bar in 1987. Pressure decline at bottom during this period is 6 bar.

In the temperature logs, a 10°C temperature peak at 722 to 772 m depth indicates a feed zone in this interval. Bottom hole temperature values are among the highest measured in the field (240°C at 796 m depth) and it is likely that the well boils up to the bottom during discharge. The discharge enthalpy is between 1060-1200 kJ/kg.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
0-90	Ground water	Minor	Cased-off
50	Ground water	Major	Cased-off
425	Reservoir	Minor	Two phase
500	Reservoir	Major	Two phase
750	Reservoir	Major(?)	Two phase/Liquid

Geochemistry:

Data:

Chemical Data : 01/81-04/87

Physical Data : 10/80-12/86

Initial Conditions:

260°C and 7500 (7900?) ppm Cl.

The first six months of production show the influence of near-well boiling and excess enthalpy from rock heating, but this changes to stabilized boiling soon with $T_E = T_{NKC}$. Until 1983, T_{NKC} is $260 \pm 5^\circ\text{C}$. Earliest aquifer chloride is near 7900 ppm but rapidly decreases to 7500 ± 200 ppm. The higher concentrations may be influenced by boiling.

Changes With Time:

Chloride and enthalpy tend to change together with peaks in 1980-81, 1983-84 and possibly (with scatter) in 1986-87 and valleys in 1982-83 and 1985. T_E drops below T_{NKC} and T_{SIL} in 1983 but is above them in 1981 and 1985. The order changes from $T_E > T_{NKC} > T_{SIL}$ to $T_{NKC} > T_{SIL} > T_E$ and back but remains at $T_E = T_{NKC} > T_{SIL}$ for much of the time. All this suggests boiling with and without heat transfer from rock and sporadic near-well mixing with cool water. The reverse could also be true or the process could alternate because $T_{NKC} > T_{SIL}$ (found throughout) is characteristic of both.

Summary:

An interesting well on the border of boiling and mixing zones.

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WELL AH-28

PRODUCTION WELL

Coordinates:

Latitude : 310,490.00 m

Longitude: 412,207.22 m

Drilling Dates:

Started : September 16, 1978

Finished: November 29, 1978

Elevation: 829.29 m

Depth: 1000.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	112.0	13 $\frac{3}{8}$ "	110.9
12 $\frac{1}{4}$ "	431.5	9 $\frac{5}{8}$ "	428.0
8 $\frac{3}{4}$ "	904.0	8 $\frac{1}{2}$ "	1000.0
7 $\frac{5}{8}$ "	416.5-994.5		

Liner slotted.

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
190	Partial	Saturated	Cased-off
210	Partial	Saturated	Cased-off
440	Partial	Reservoir	
450	Total	Reservoir	
500	Total	Reservoir	

Relevant Information:

Temperature logs show aquifers at 600 and 850 m depth. The well has been on line since 1981 producing fluids with enthalpy of 240 kcal/kg (1000 kJ/kg). This correlates well with the liquid temperature of 225-230°C at 700-800 m depth. Bottom temperature is 220°C. The well has showed little or no temperature decline but pressure drawdown during the period 1979-1987 is 7 bar. The "water level" under pressure has sunk from about 550 m depth in 1979 to 600 m depth in 1987.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
190	Saturated zone	Minor	Cased-off
210	Saturated zone	Minor	Cased-off
440	Reservoir	Minor	Two phase
450	Reservoir	Major	Two phase
500	Reservoir	Major	Two phase
600	Reservoir	?	Two phase/Liquid
850	Reservoir	?	Liquid

Geochemistry:

Data:

Chemical Data : ---

Physical Data : ---

Initial Conditions:

253°C and 7400 ppm Cl.

Initial T_{NKC} was $253 \pm 2^\circ\text{C}$; T_E (except for one value) and T_{SIL} were not much lower at 249°C and 246°C . Initial aquifer chloride based on both T_{NKC} and T_E was 7400 ± 200 ppm.

Changes With Time:

After 6 months of production, T_E started to drop and the order remained $T_{NKC} > T_{SIL} > T_E$ for the rest of the history, indicating mixture of cooler water in the wellbore that lowered actual fluid temperatures (T_E), lowered T_{SIL} by dilution, but affected T_{NKC} very little. Calculated cool water temperature was $60 \pm 40^\circ\text{C}$ throughout (see figure 8.1, Chapter 8).

Chloride calculated from measured enthalpy is possibly a bit more constant than chloride calculated from T_{NKC} and significantly higher, averaging 7700 ppm rather than 6800 ppm.

Summary:

Drawdown rapidly caused inflow of cooler water into the well from an overlying aquifer.

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

WELL AH-29

INJECTION WELL

Coordinates:

Latitude : 311,096.89 m

Longitude: 412,510.50 m

Drilling Dates:

Started : November 6, 1975

Finished: February 11, 1976

Elevation: 794.75 m

Depth: 1198.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	101	13 $\frac{3}{8}$ "	99.0
12 $\frac{1}{4}$ "	550	9 $\frac{5}{8}$ "	545.5
8 $\frac{1}{2}$ "	1198	7 $\frac{5}{8}$ "	486.82-816

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
85	Total	Ground water	Cased-off
570	Total	Reservoir	
580-630	Partial	Reservoir	
610	Total	Reservoir	
680	Total	Reservoir	

Relevant Information:

Reinjection was stopped since it is close to AH-5.

Spinner survey shows that almost half of the injected water disappears at the end of the liner. It is likely that this water flows upwards in the annulus behind the liner towards the aquifers at 570-680 m depth. The spinner shows also that about 20% of the water leaks out at 840-870 m depth and 35% continues down to the deeper portion of the well.

The temperature logs show that the injection cools the well to the "bottom" (1144 m). All earlier logs show the same characteristics: sharply rising temperatures to a maximum at 500 m depth (200-220°C) but with an isothermal or a slight negative gradient from 600 to 1144 m depth (170-180°C). After reinjection was stopped, the well developed a 20 bar pressure on top with "water table" around 600 m depth. The temperature measured was 210°C in 1987 decreasing to 180°C at 1050 m depth, the deepest point measured in the well.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
85	Ground water	Major	Cased-off
570	Reservoir	Major	Two phase
580-630	Reservoir	Minor	Two phase
680	Reservoir	Major	Two phase/Liquid
840-870	Reservoir	Major	Liquid
1140	Reservoir	Major(?)	Liquid

Geochemistry:

No data.

Account Name	Balance	Debit	Credit	Total
1970				
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				

Grand Total

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WELL AH-30

PRODUCTION/STAND-BY WELL

Coordinates:

Latitude : 310,461.09 m

Longitude: 411,989.59 m

Drilling Dates:

Started : December 5, 1978

Finished: February 17, 1979

Work-over:

Started : September 17, 1985

Finished: October 4, 1985

Purpose : To deepen the well

Elevation: 803.97 m

Depth: 1200.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	117.5	13 $\frac{3}{8}$ "	115.0
12 $\frac{1}{4}$ "	462.5	9 $\frac{5}{8}$ "	460.0
8 $\frac{3}{4}$ "	1200.0	7 $\frac{5}{8}$ "	434.78-1195

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
25	Partial	Ground water	Cased-off
70	Partial	Ground water	Cased-off
260-450	Partial	Saturated zone(?)	Cased-off
465	Partial	Reservoir(?)	
500	Partial	Reservoir	
525	Partial	Reservoir	
550	Total	Reservoir	

Relevant Information:

No cuttings were obtained below 675 m depth.

No production data is available from this well (discharge measurements, spinner, flowing temp. and pressure logs).

The well was drilled in 1978/9 and worked over in September 1985. The well was deepened during the work-over from 900 to 1200 m. No pivot point could be obtained from the pressure logs. Pressure drawdown during 1979-1986 is in the order of 5 bar. This drawdown developed during the first three years.

Aquifers seen in the temperature logs, just after drilling and work-over, are at the following depths: 450, 500, 550, 600 and 1150 m. Prior to the work-over, temperatures in the liquid part of the well were almost constant at 220°C (down to 900 m). Since fall of 1985, the liquid portion showed the same isothermal profile but the temperature dropped to 215°C. This can be explained by an upward cross flow in the well. Before the work-over the aquifer close to 900 m depth is the source for this flow (T=220°C). Later as the well was deepened, fluids from colder aquifers at 1050 and 1150 contributed to the upflow.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
25	Ground water	Minor	Cased-off
70	Ground water	Minor	Cased-off
260-450	Saturated zone	Minor	Cased-off
465	Reservoir	Minor	Two phase
500	Reservoir	Minor	Two phase
525	Reservoir	Minor	Two phase
550	Reservoir	Major	Two phase
600	Reservoir	Major(?)	Two phase
900	Reservoir	?	Liquid
1050	Reservoir	?	Liquid
1150	Reservoir	?	Liquid

Geochemistry:

No data.

Item	Description	Quantity	Unit Price	Total
1
2
3
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WELL AH-31

PRODUCTION WELL

Coordinates:

Latitude : 310,098.48 m

Longitude: 412,021.66 m

Drilling Dates:

Started : August 1, 1981

Finished: September 29, 1981

Elevation: 845 m

Depth: 1502.00 m

Casing Design:

Depth (m)	Type	Aquifer	Remarks
17 $\frac{1}{2}$ "	110.5	13 $\frac{3}{8}$ "	109
12 $\frac{1}{4}$ "	492.0	9 $\frac{5}{8}$ "	489.8
8 $\frac{1}{2}$ "	1500.0	7 $\frac{5}{8}$ "	468.7-1495
6 $\frac{1}{8}$ "	1502.0		

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
30	Total	Ground water	Cased-off
50	Total	Ground water	Cased-off
250	Partial	Saturated	Cased-off
560	Total	Reservoir	

Relevant Information:

No cuttings were obtained below 1000 m depth.

No flowing surveys were available from this well (temperature, pressure and spinner).

The first pressure survey available was run in January 1982 about 3 months after completion. The well had recovered at that time and no pivot point can be seen in the later pressure logs. Pressure drawdown between 1982 and 1986 is in the order of 2-3 bar.

Maximum temperature of 230-235°C was measured at about 800 m depth. Below 1000 m an almost constant temperature is observed in the logs down to the present bottom at 1450 m depth (220-225°C). Earlier surveys (1981/2) reached down to 1475 m depth and showed a temperature inversion of few degrees between 1450 and 1475 m. The temperature profiles indicate a crossflow down the well with the deepest inflow at 1000 m and the deepest outflow at 1450 m depth.

Reservoir temperatures around this well seem to have remained unchanged since it was drilled in 1981.

From the information on circulation losses, one would expect the main production aquifer to be at 560 m depth where total loss was encountered or around 1000 m depth where drill cutting recovery ceased. The aquifer at 560 m is within the two phase region of the reservoir and pressure and temperature in the well were less than 20 bar and 210°C respectively. As discharging enthalpies (240-260 kJ/kg) indicate a liquid water inflow during discharge, it is unlikely that the main inflow is within the two phase zone.

Aquifers:

Depth (m)	Aquifer	Contribution	Remarks
30	Ground water	Major	Cased-off
50	Ground water	Major	Cased-off
250	Saturated zone	Minor	Cased-off
560	Reservoir	Minor	Two phase
1000	Reservoir	Major	Liquid
1450	Reservoir	Minor	Liquid

Geochemistry:*Data:*

Chemical Data : 01/85-04/87

Physical Data : 04/85-12/86

Initial Conditions:

258°C and ?.

The data on this well is scant and starts with $T_{NKC} > T_{SIL} \gg T_E$, suggesting mixing in the well from start of production. Fluid not affected by mixing was near 258°C (T_{NKC}) or 250°C (T_{SIL}) and after mixing wellbore liquid was near 228°. Chloride calculated from enthalpy was near 8700 ppm. This was after mixing.

Changes With Time:

From the start, temperatures and chloride concentrations were nearly constant, suggesting that mixing in the well occurred from the start. No calculation could be made of the cool water chloride because T_{SIL} was too close to T_{NKC} (see figure 8.1, Chapter 8). This behavior could also result from conductive cooling in the wellbore.

Summary:

A well with cold-water mixing or conductive cooling in the wellbore.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy auditing of the accounts.

In addition, it is noted that regular reconciliation of the books is essential. This process involves comparing the internal records with the bank statements to identify any discrepancies. Promptly addressing these differences helps prevent errors from compounding over time.

Furthermore, the document highlights the need for clear communication with all stakeholders. Providing regular updates to investors and partners keeps them informed of the company's financial health and operational progress.

The second section focuses on budgeting and financial forecasting. It states that a well-defined budget serves as a roadmap for the organization, helping to allocate resources effectively and identify areas of potential overspending.

Financial forecasting is also discussed as a critical tool for long-term planning. By analyzing historical data and current market trends, the company can make informed decisions about future investments and operational costs.

It is also mentioned that maintaining a healthy cash flow is paramount for the survival and growth of any business. Implementing strict credit control policies and ensuring timely payments to suppliers are key strategies to manage liquidity.

The final part of the document addresses tax compliance and reporting. It stresses the importance of staying up-to-date with the latest tax regulations to avoid penalties and ensure full compliance with all legal requirements.

Accurate and timely reporting to the relevant authorities is also emphasized. This not only fulfills the company's legal obligations but also provides valuable insights into its overall financial performance.

In conclusion, the document reiterates that a strong financial foundation is the key to a successful and sustainable business. By adhering to these principles, the company can ensure its long-term growth and success.

WELL AH-32

PRODUCTION WELL

Coordinates:

Latitude : 309,721.00 m

Longitude: 412,210.00 m

Drilling Dates:

Started : October 13, 1981

Finished: December 31, 1981

Work-over:

Started : August 15, 1985

Finished: August 30, 1985

Elevation: 882.03 m

Depth: 1504.00 m

Casing Design:

Casing size	Depth (m)	Casing size	Depth (m)
17 $\frac{1}{2}$ "	140	13 $\frac{3}{8}$ "	136.48
12 $\frac{1}{4}$ "	491	9 $\frac{5}{8}$ "	487.46
8 $\frac{1}{2}$ "	1500	7 $\frac{5}{8}$ "	472.25-1499
7 $\frac{7}{8}$ "	1504		

Circulation losses:

Depth (m)	Type	Aquifer	Remarks
142.3-146	Partial	Ground water	Cased-off
148.38-155	Partial	Ground water	Cased-off
159.25-191.25	Partial	Ground/Saturated	Cased-off
211.3-227	Partial	Saturated zone	Cased-off
246-256	Partial	Saturated zone	Cased-off
260.8-262	Partial	Saturated zone	Cased-off
279.5-288	Partial	Saturated zone	Cased-off
312.5-359	Partial	saturated zone	Cased-off
391.5-393	Partial	Saturated zone	Cased-off
407-473.49	Partial	Saturated zone	Cased-off
689.9-694	Partial	Reservoir	
694-848.49	Total	Reservoir	
1003.5-1500	Total	Reservoir	

Relevant Information:

No cuttings below 775 m depth were obtained.

Temperature logs shortly after drilling indicate a cross flow in the well from aquifers at about 800 m and 1000 m depth into the aquifer at about 1400 m depth. The dominant aquifers are inferred to be at 1000 and 1400 m depths. Similar temperature profiles were obtained after work-over in 1985.

Analysis of flowing temperature and pressure surveys conducted in April 1988 at flowrates of 20 and 45 kg/s showed a major feedzone at 975 m and a high enthalpy inflow at 775-800 m.

No pivot point is seen in the pressure logs either after drilling in 1981 or after work-over in 1985 not only due to small temperature variations in the well between logs but also because most of the pressure logs were run only to 700-800 m depth.

The pressure logs in 1982 and 1986/7 show little or no drawdown. There were no pressure logs from 1983 and 1984. Pressures after work-over in 1985 are low and may have indicated some drawdown at that time. These low pressures can, on the other hand, be explained as a cooling effect after the work-over, if the best feed zone is much deeper in the well than the deepest pressure values.

Aquifers:

Inferred locations of the production aquifers are:

Depth (m)	Aquifer	Contribution	Remarks
775-800	Reservoir	Minor	Two phase
975-1000	Reservoir	Major	Liquid
1100	Reservoir	Minor	Liquid
1400	Reservoir	Minor	Liquid

Geochemistry:

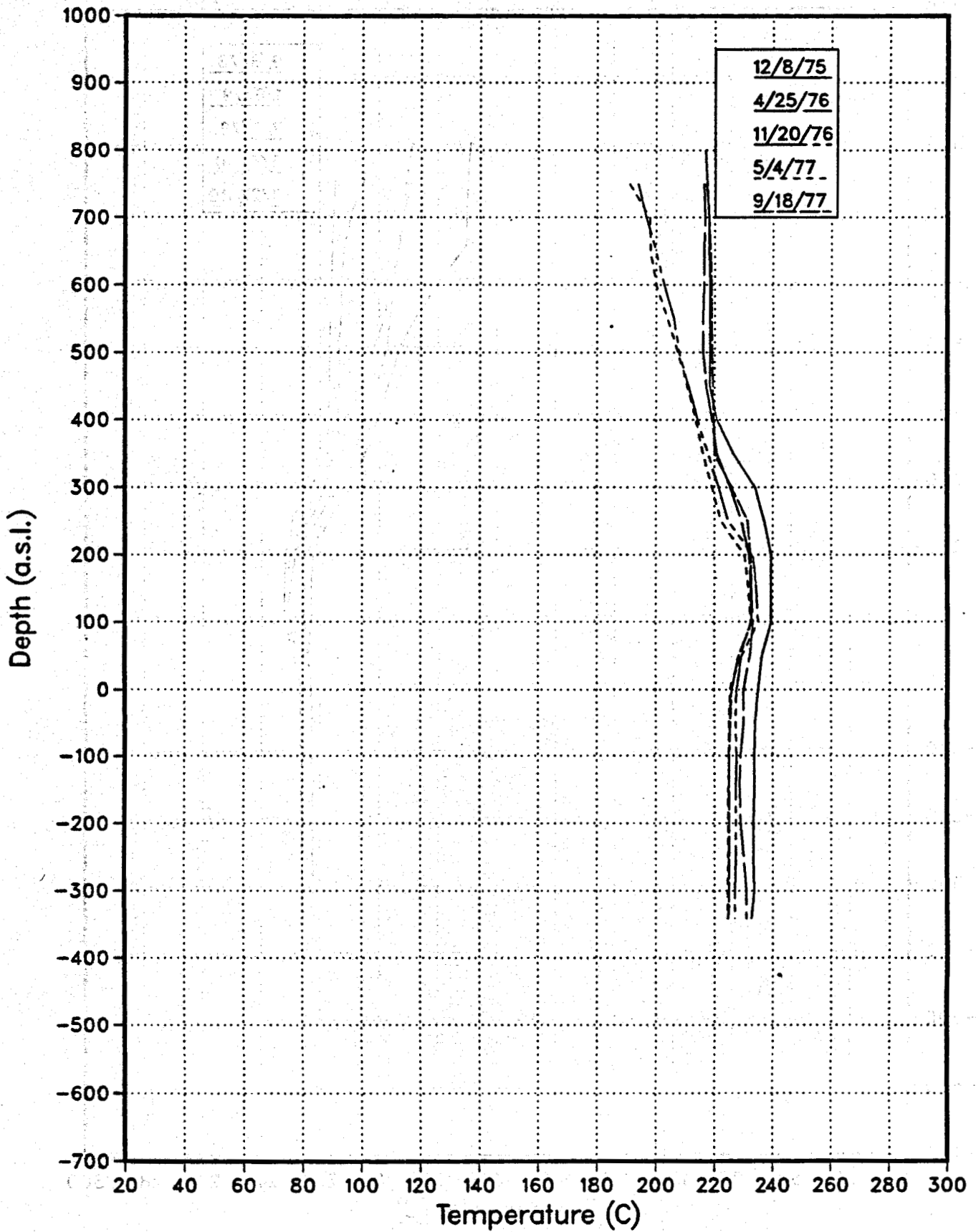
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APPENDIX D

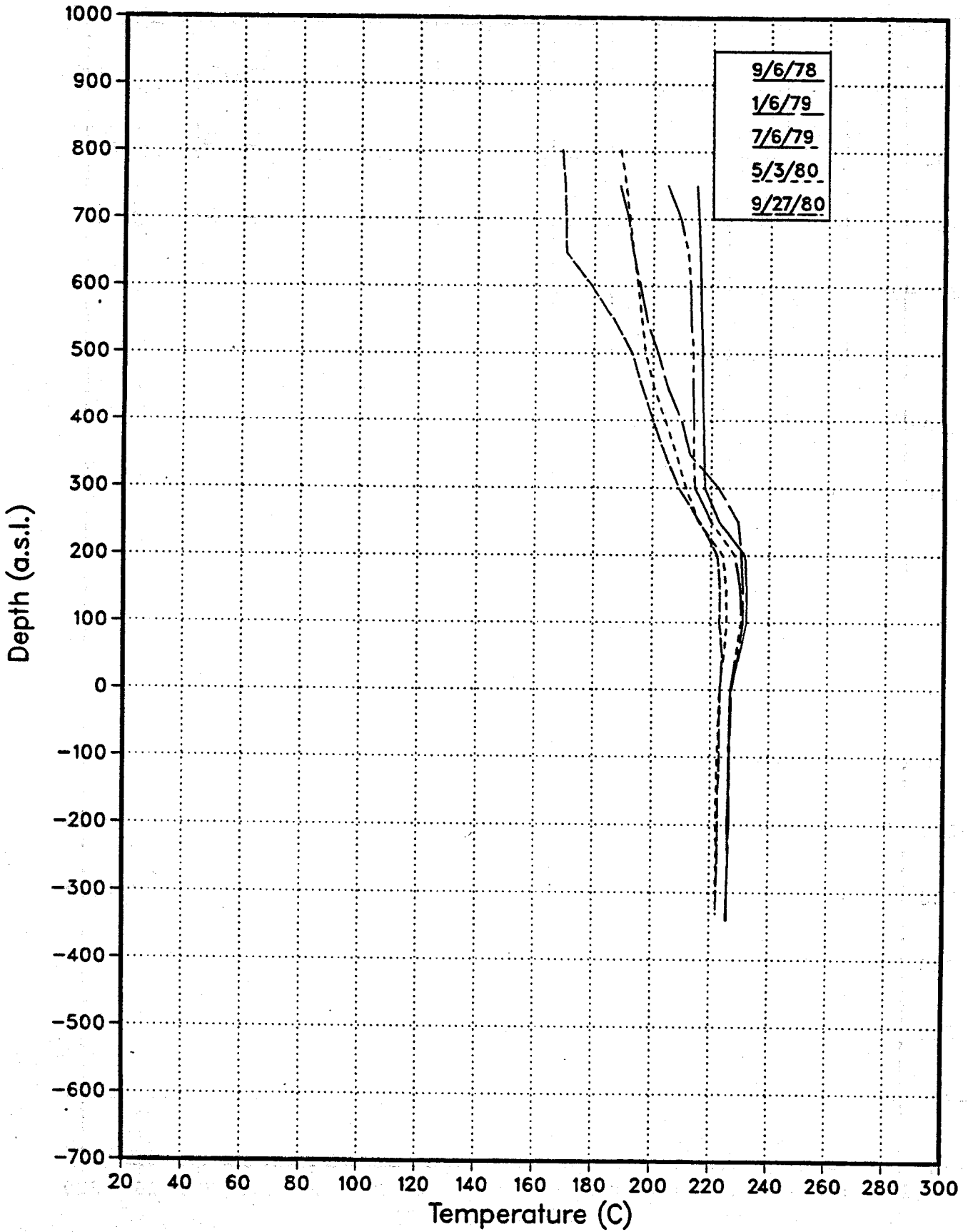
(Temperature Logs)



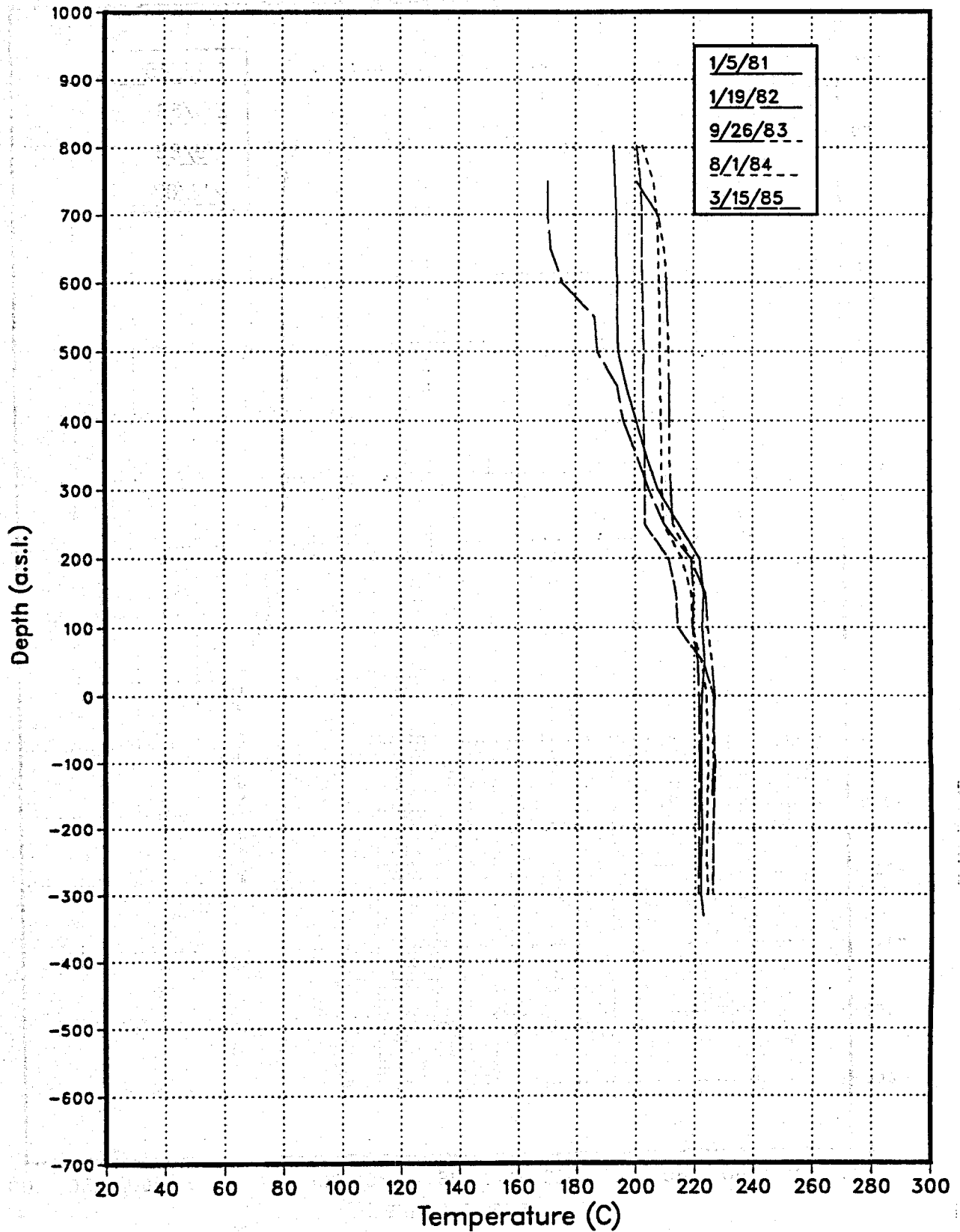
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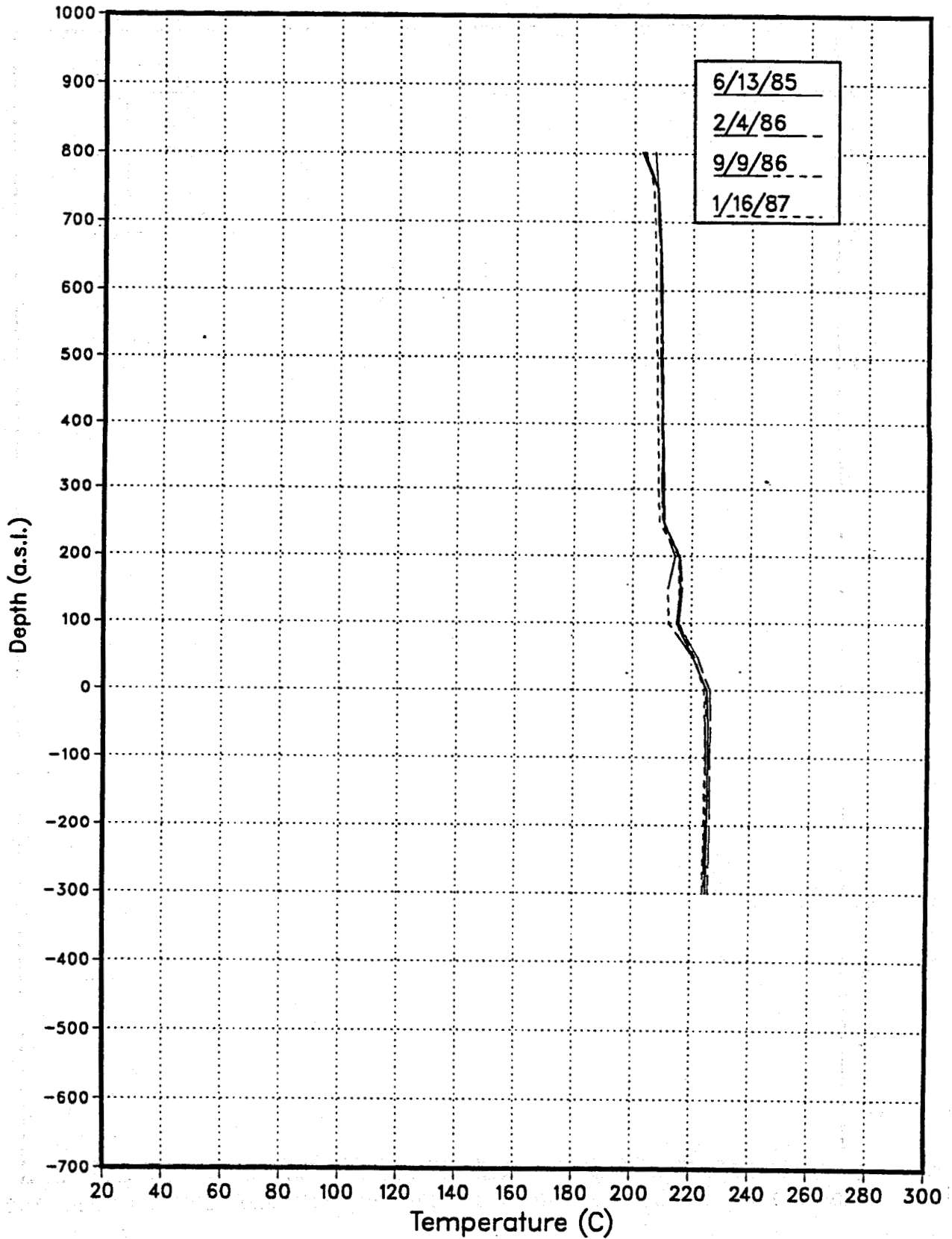
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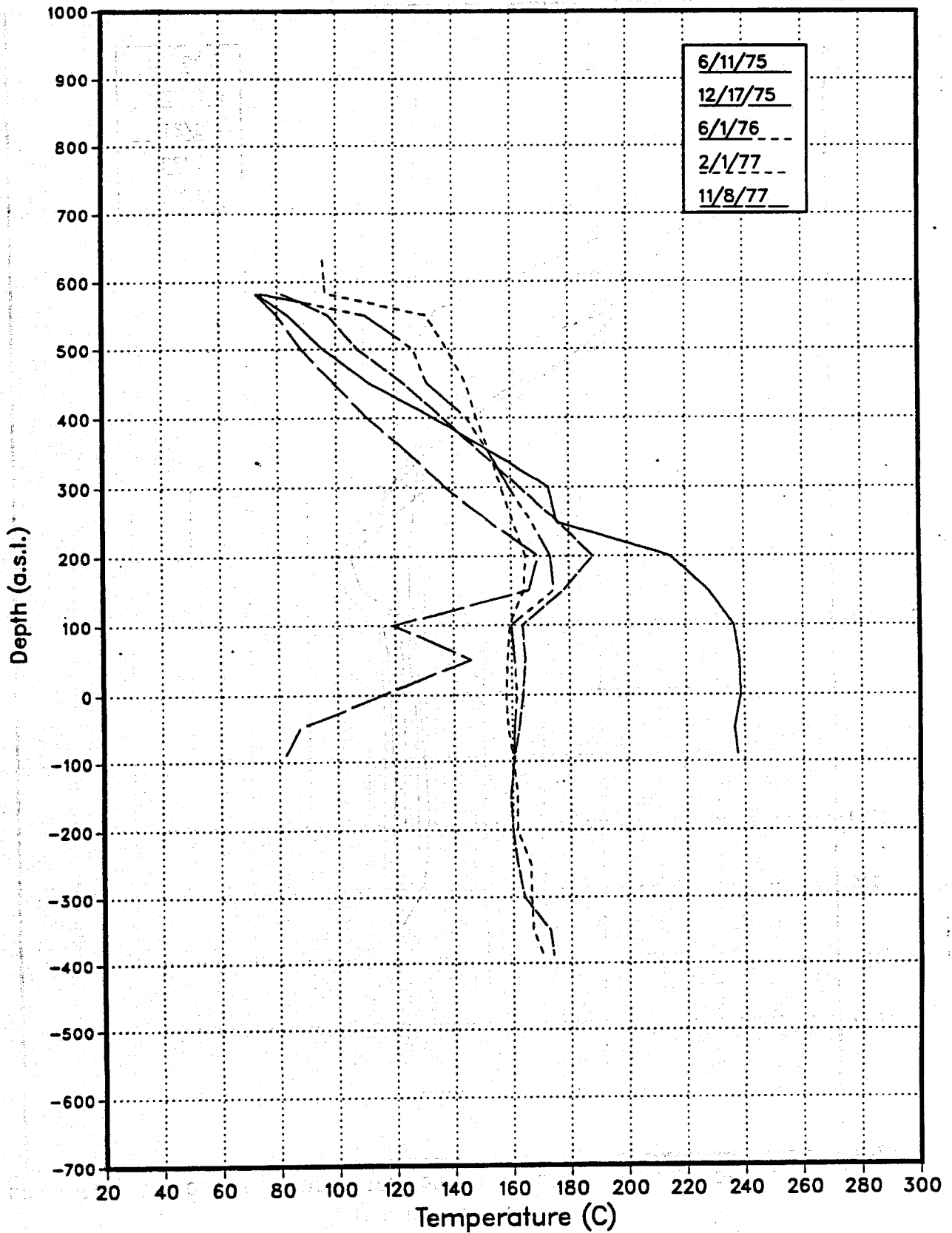
AH1 Temperature Surveys



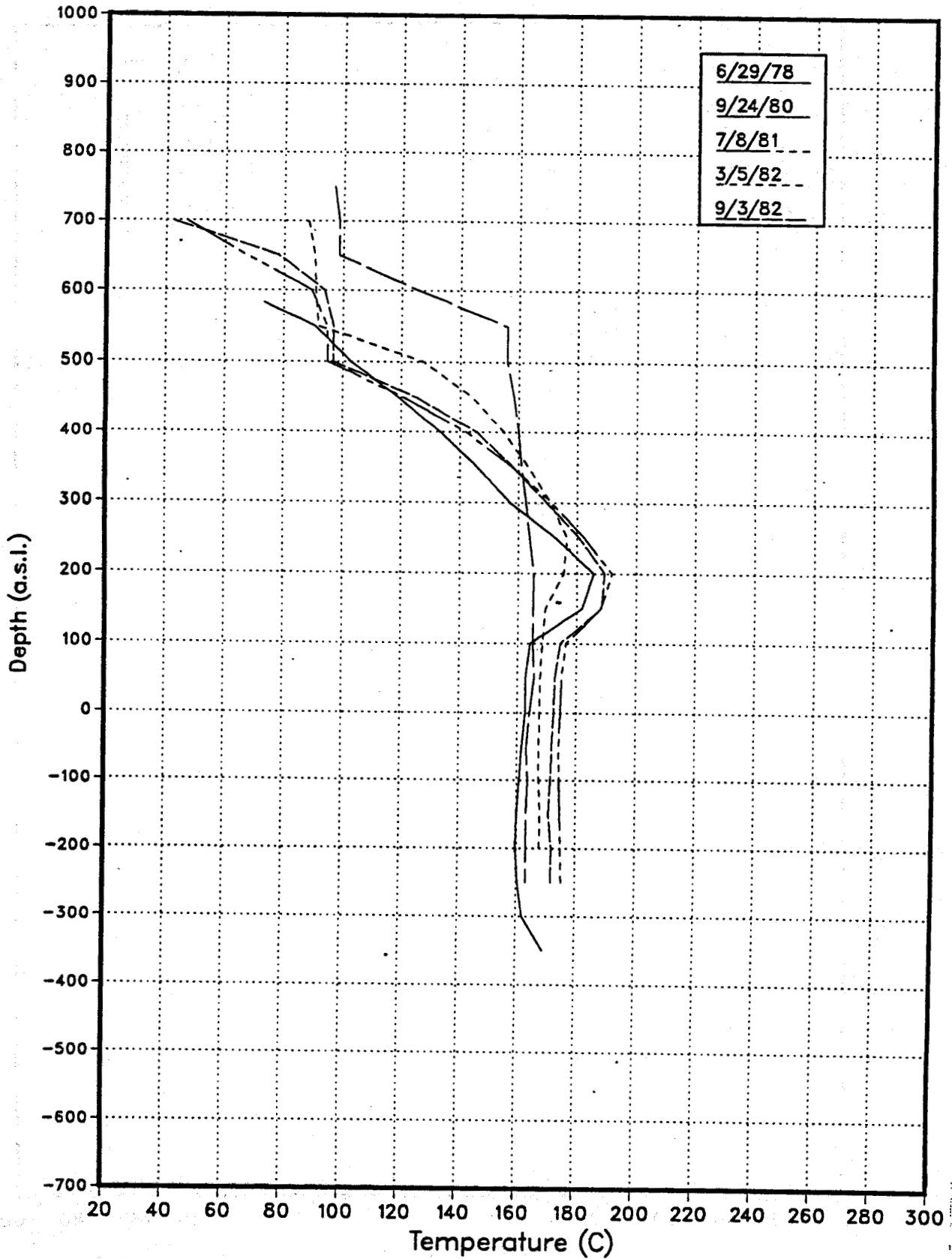
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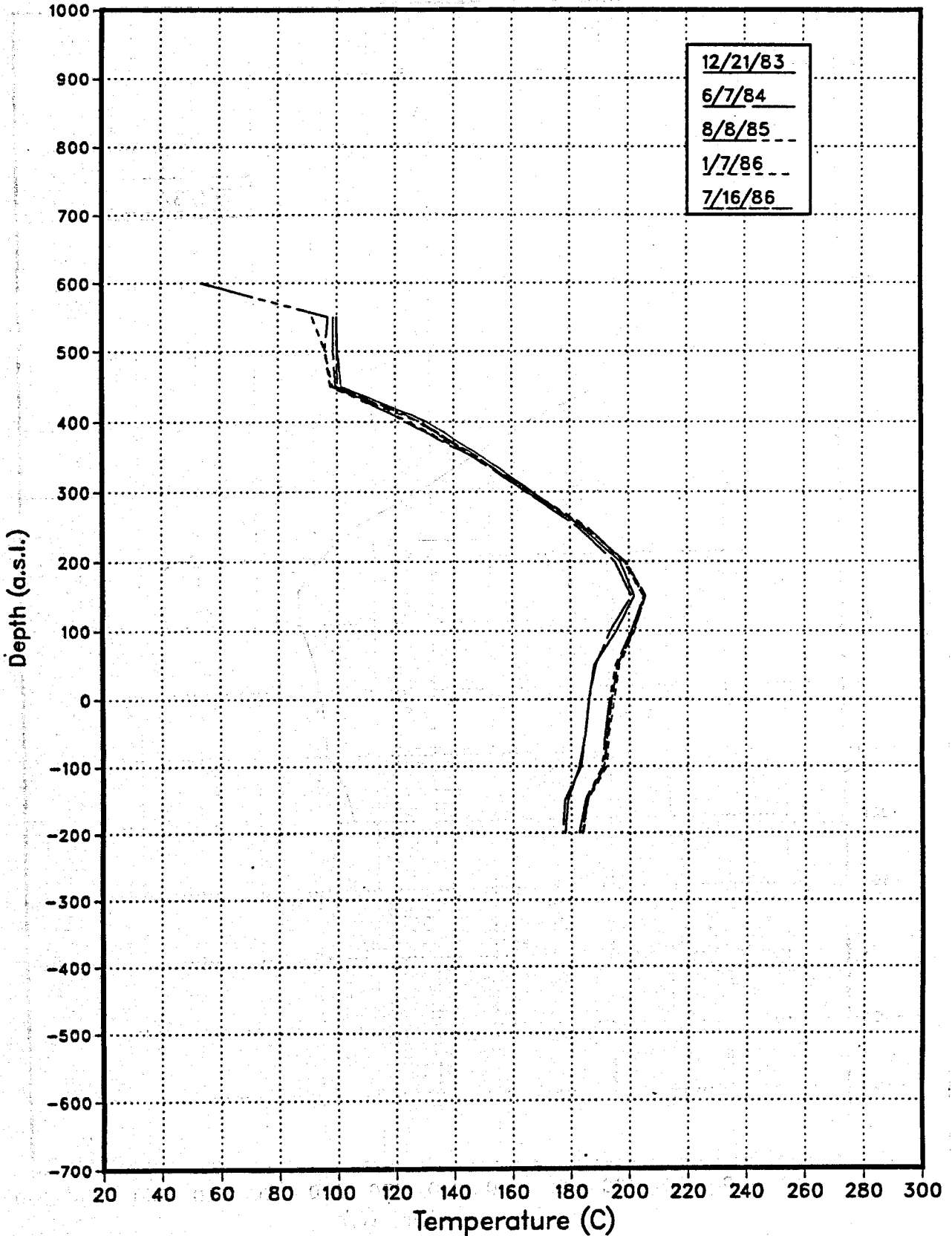
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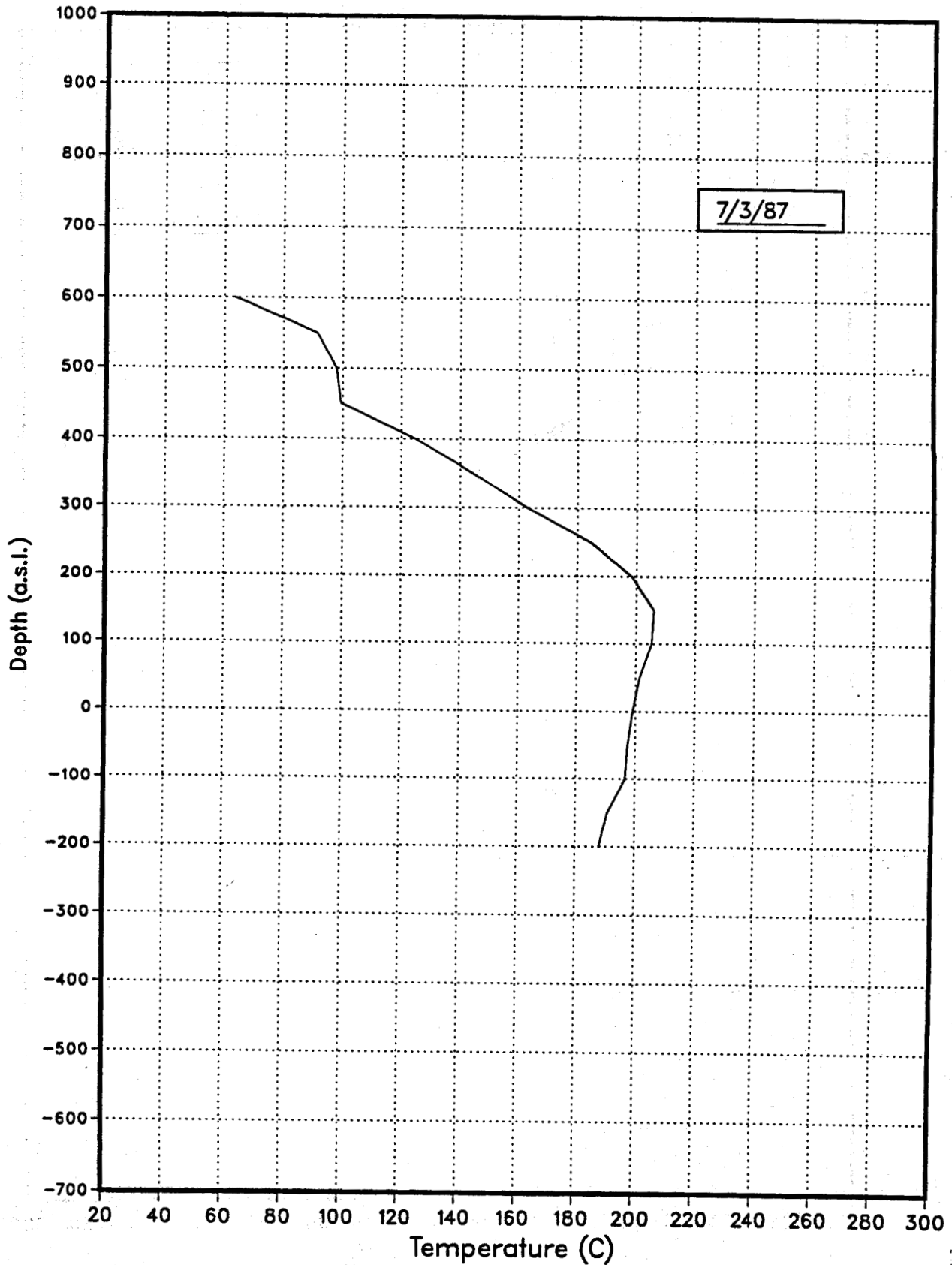
AH2 Temperature Surveys



AH2 Temperature Surveys

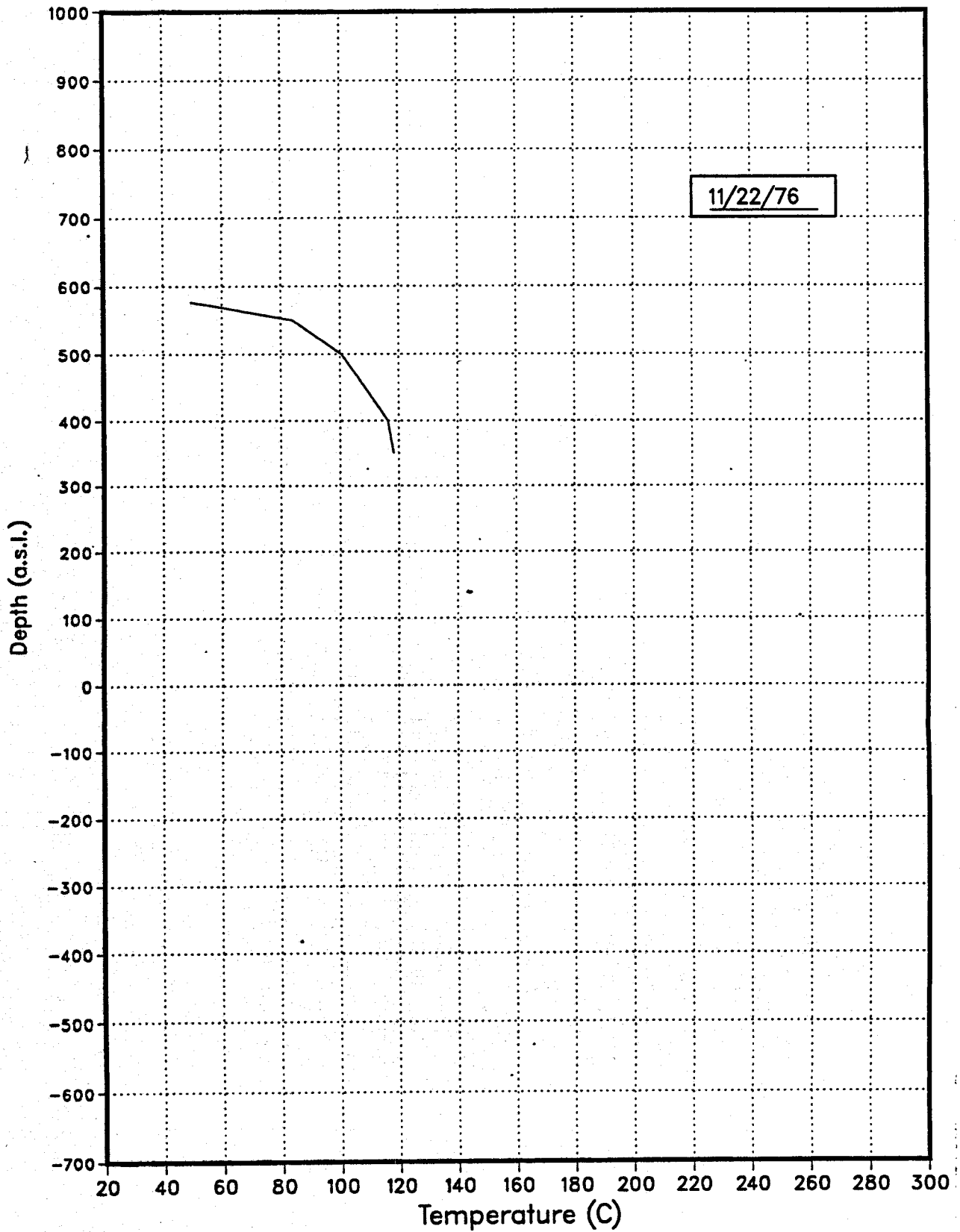


AH2 Temperature Surveys



-D11-1012

AH3 Temperature Surveys

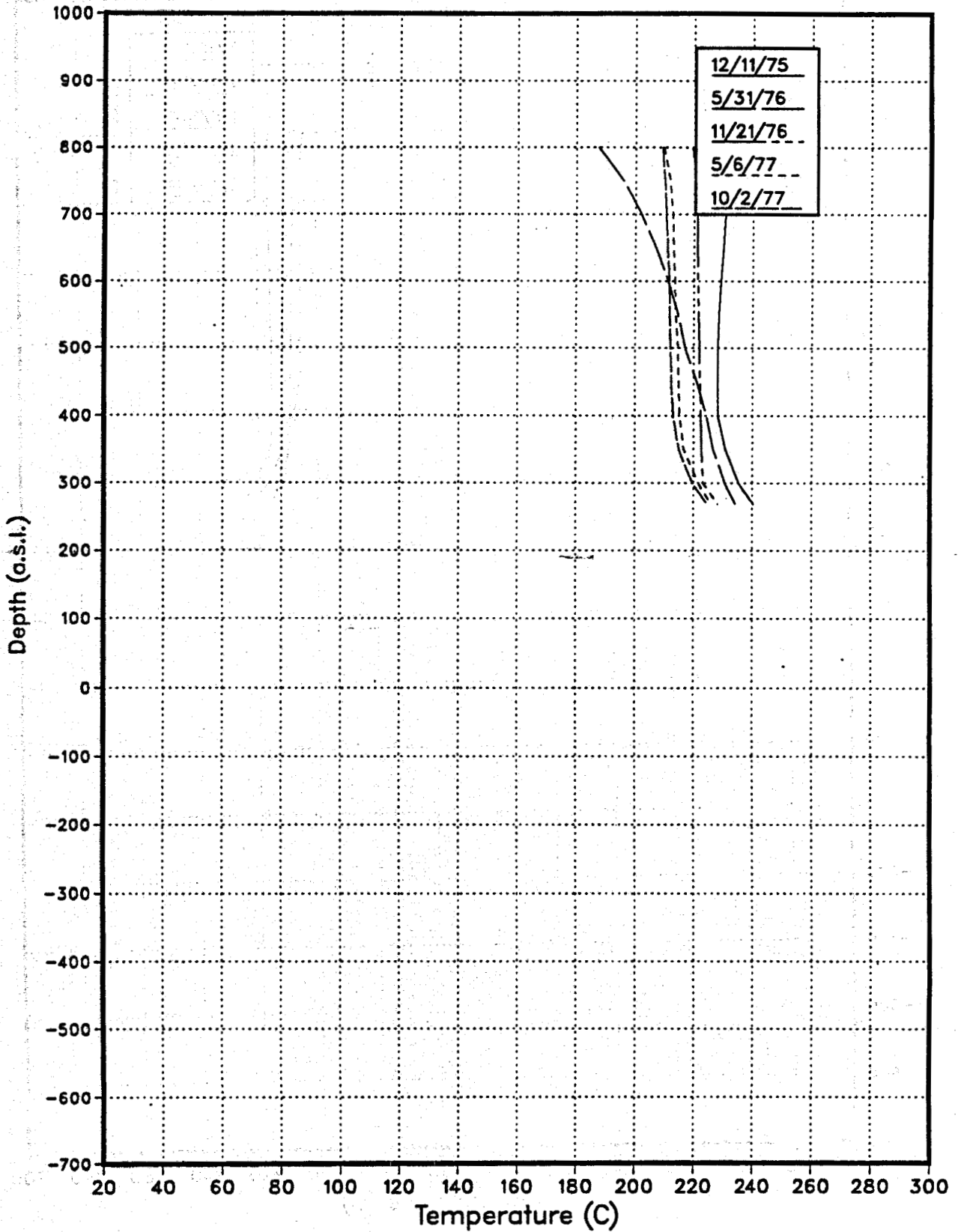


THE HISTORY OF THE UNITED STATES

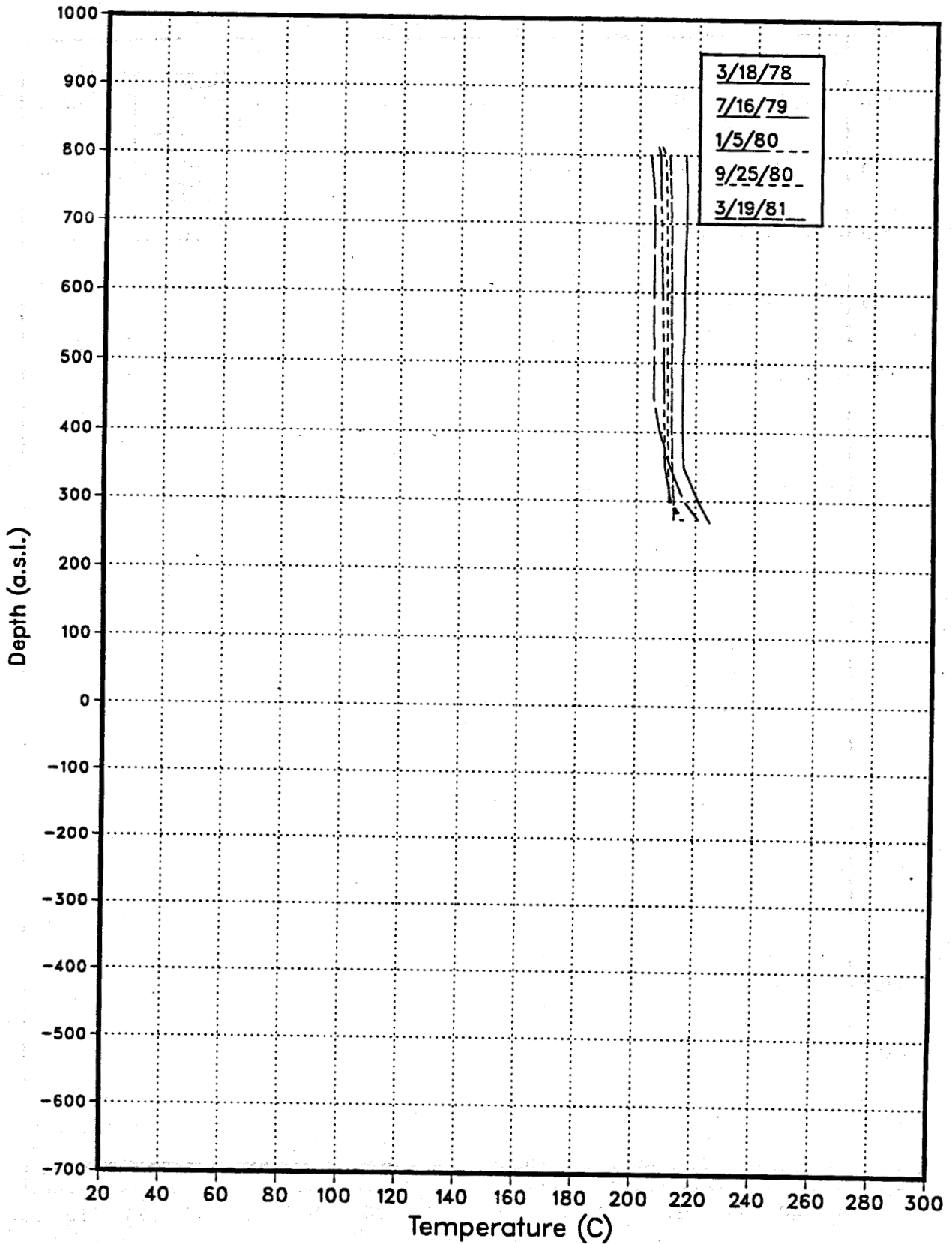
The history of the United States is a story of growth, struggle, and achievement. From the first European settlers to the present day, the nation has faced numerous challenges and triumphs. The early years were marked by the search for a better life and the establishment of a new society. The American Revolution was a pivotal moment in the nation's history, leading to the birth of a new republic. The years following the Revolution were a time of rapid expansion and development. The nation grew in size and population, and its economy flourished. The American Civil War was a defining moment in the nation's history, leading to the abolition of slavery and the preservation of the Union. The years following the Civil War were a time of reconstruction and progress. The nation continued to grow and develop, and its influence on the world increased. The American Revolution was a pivotal moment in the nation's history, leading to the birth of a new republic. The years following the Revolution were a time of rapid expansion and development. The nation grew in size and population, and its economy flourished. The American Civil War was a defining moment in the nation's history, leading to the abolition of slavery and the preservation of the Union. The years following the Civil War were a time of reconstruction and progress. The nation continued to grow and develop, and its influence on the world increased.



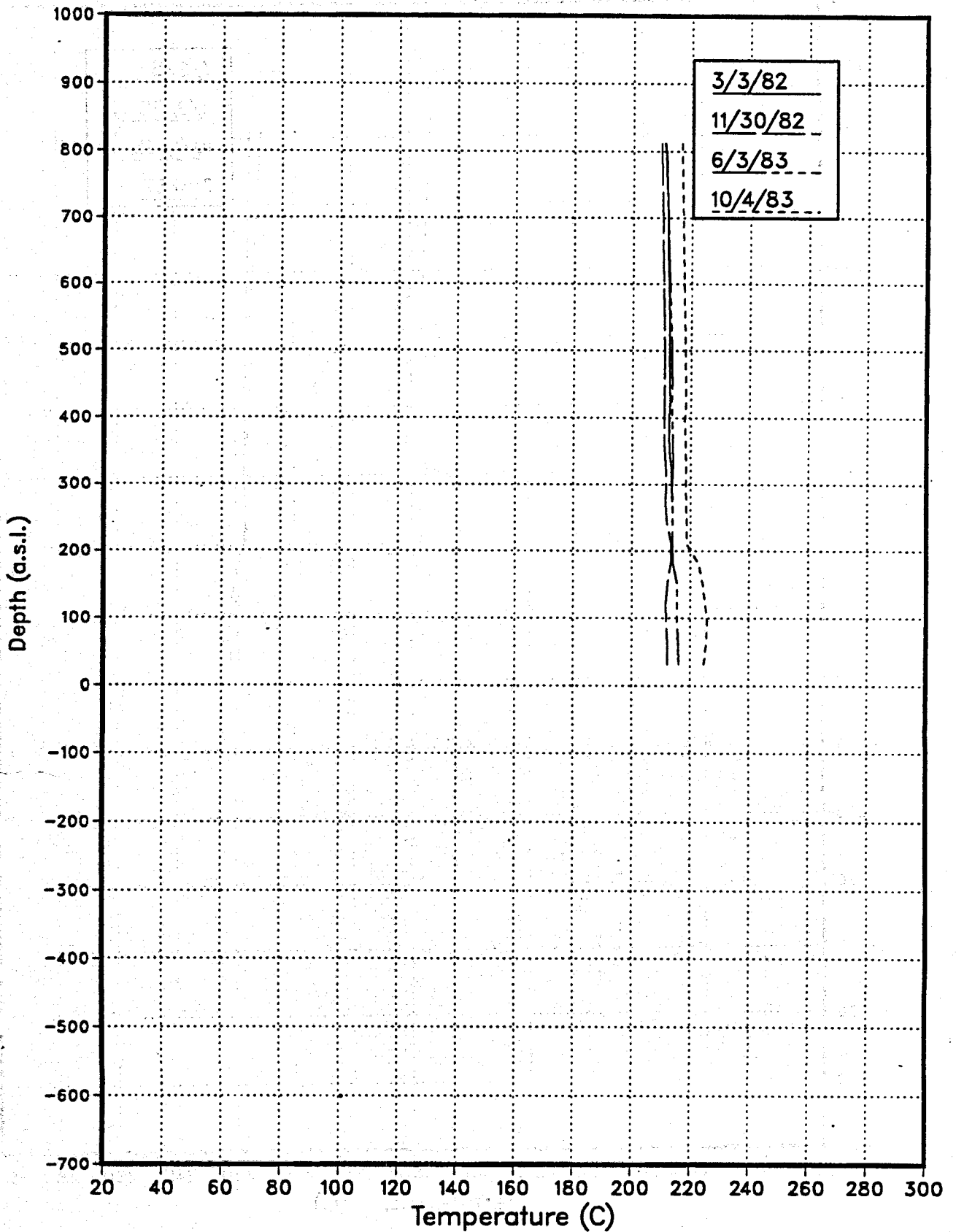
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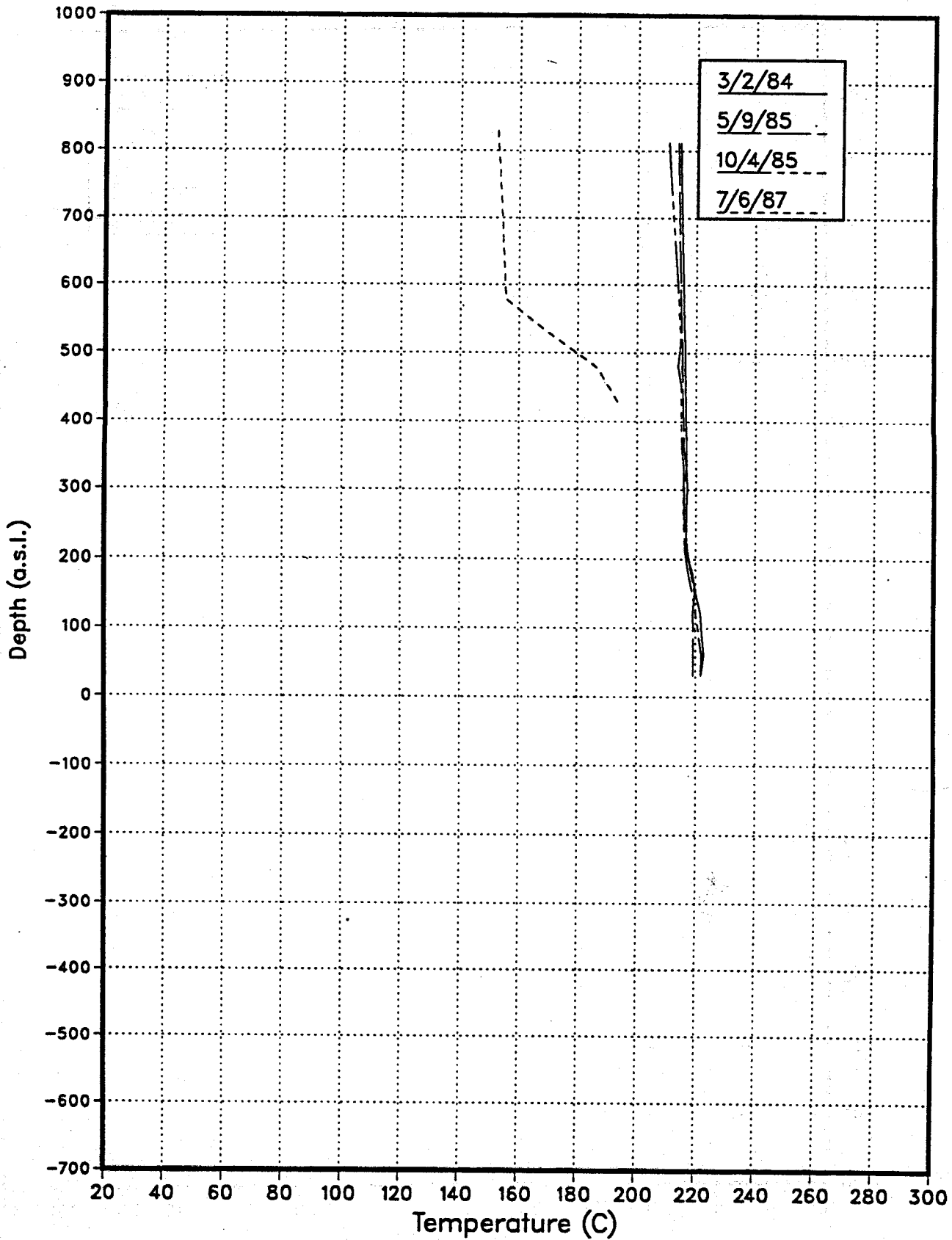
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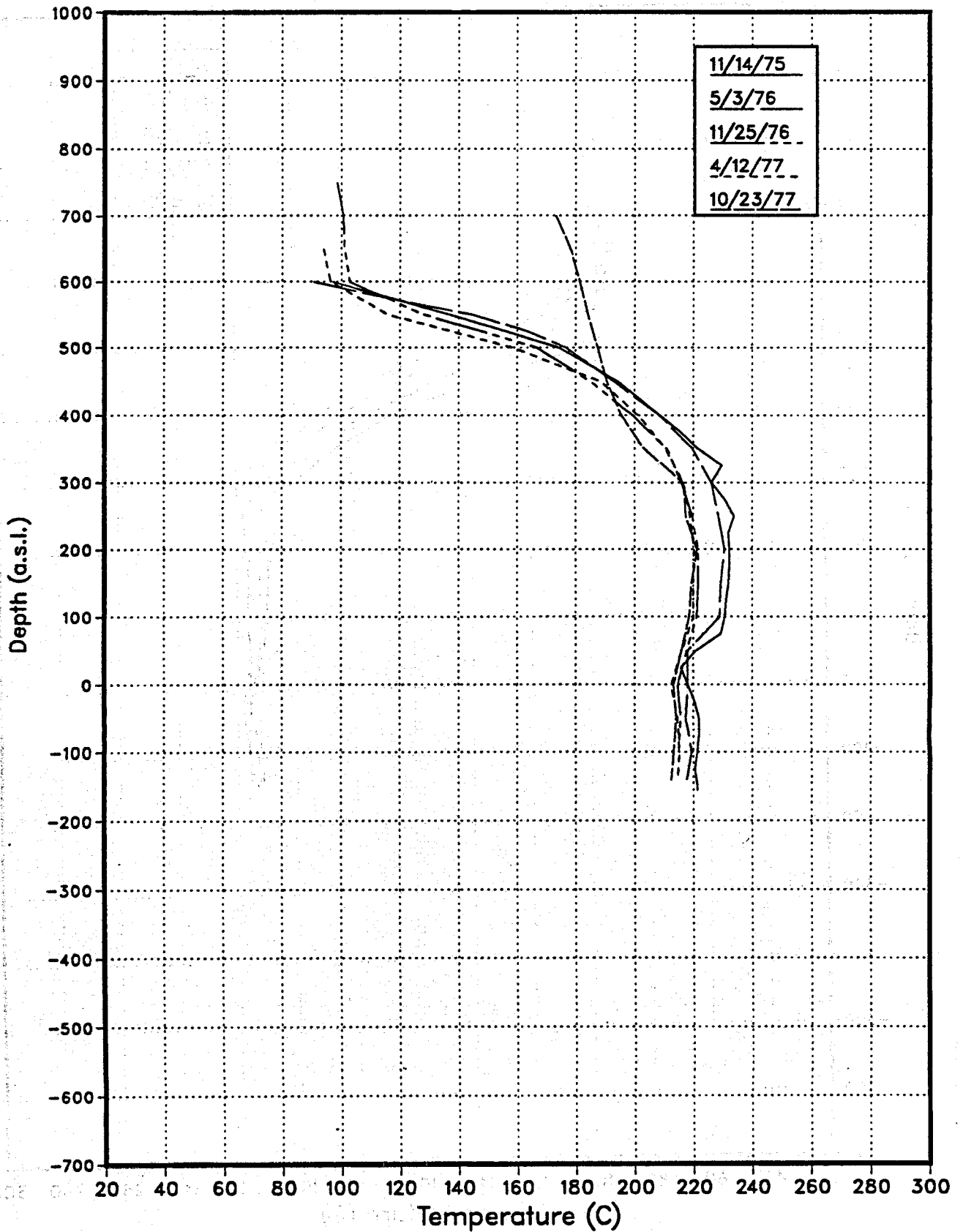
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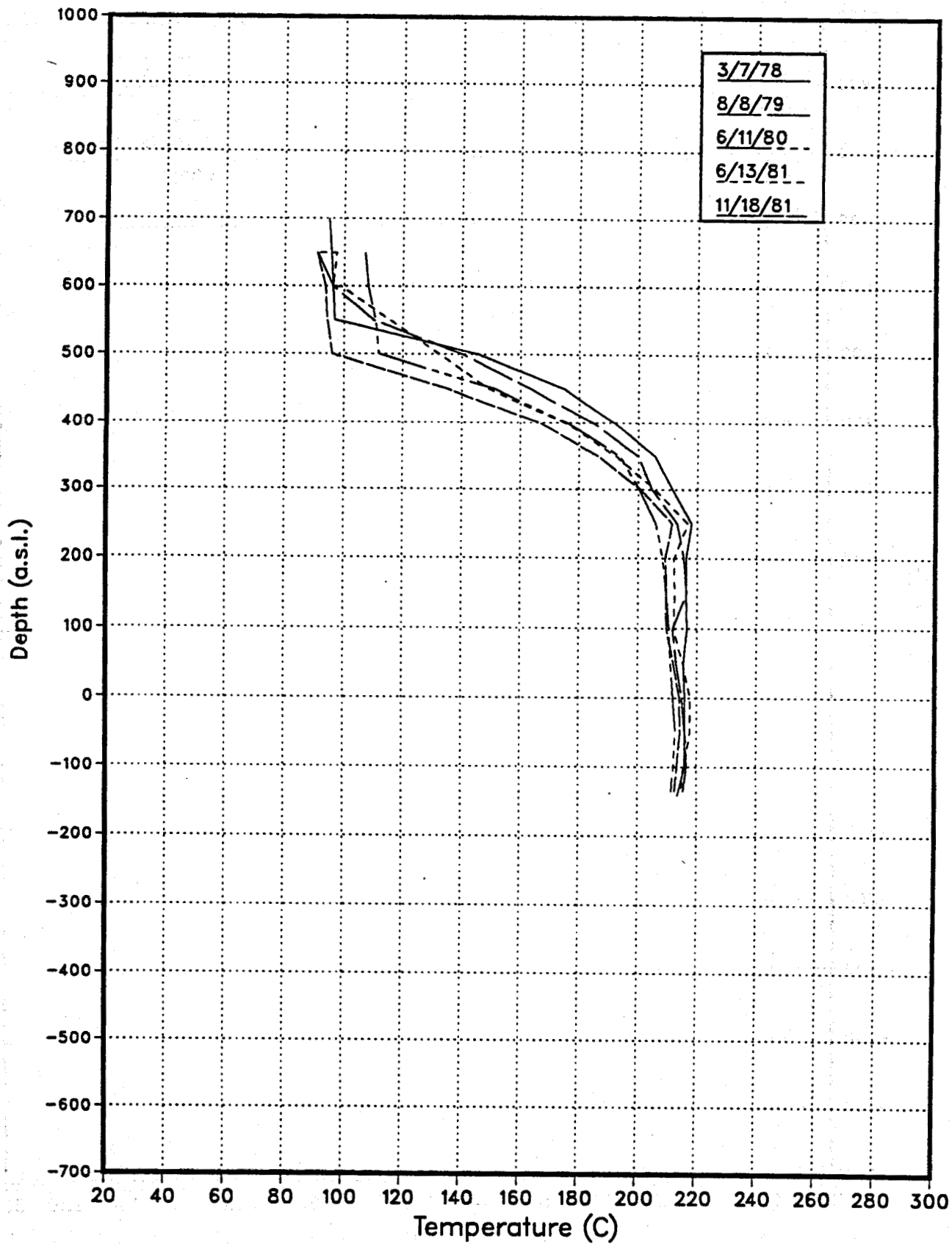
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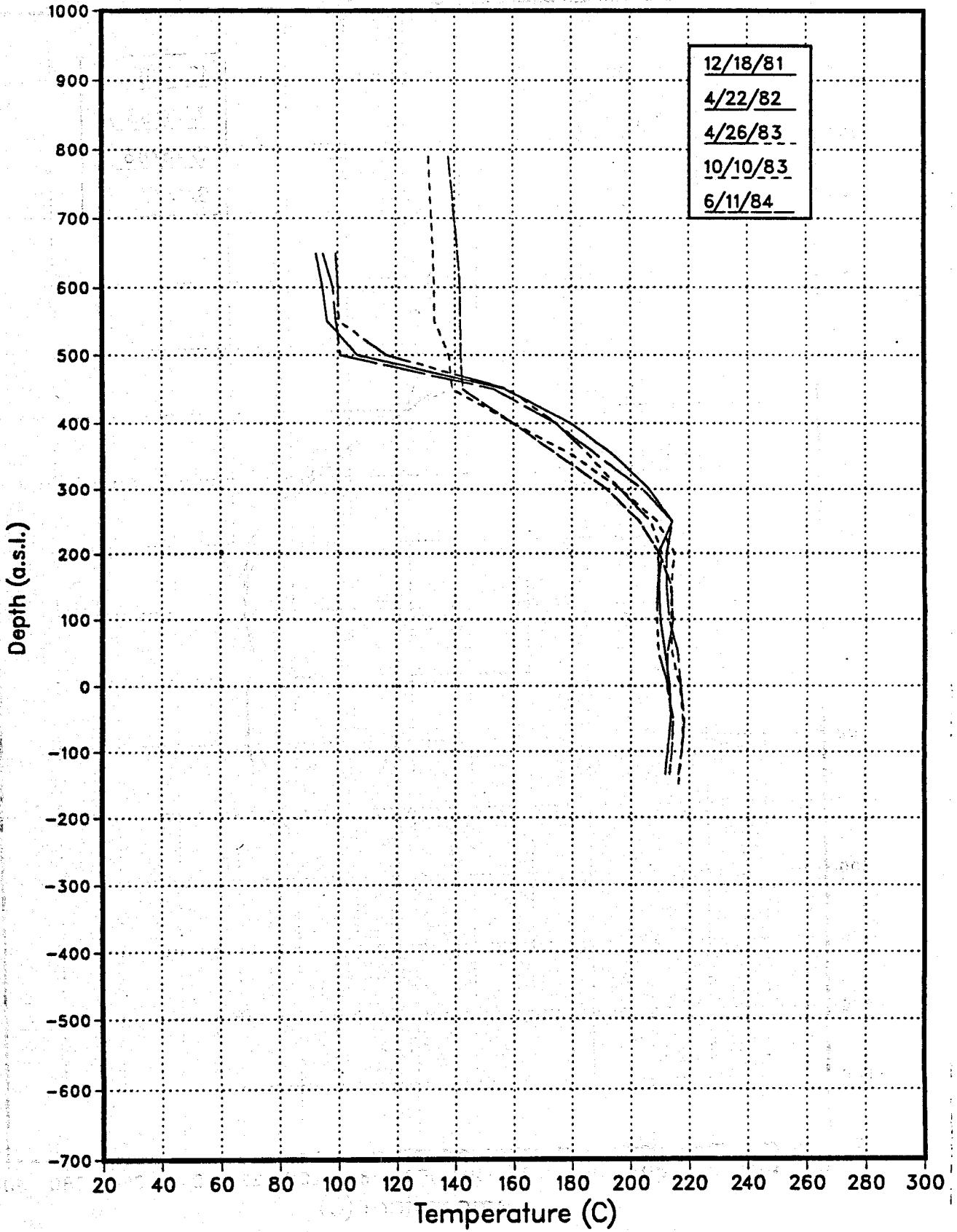
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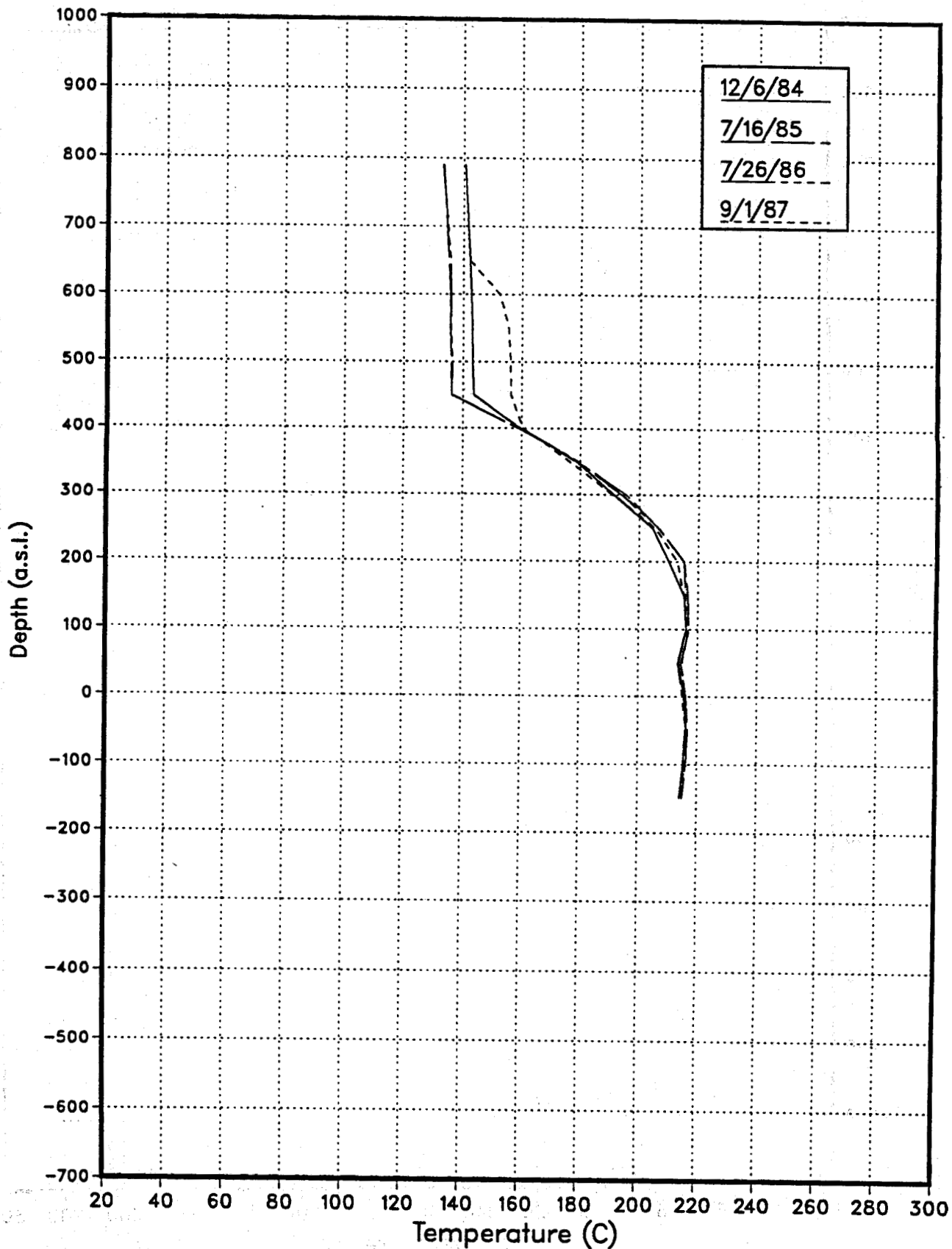
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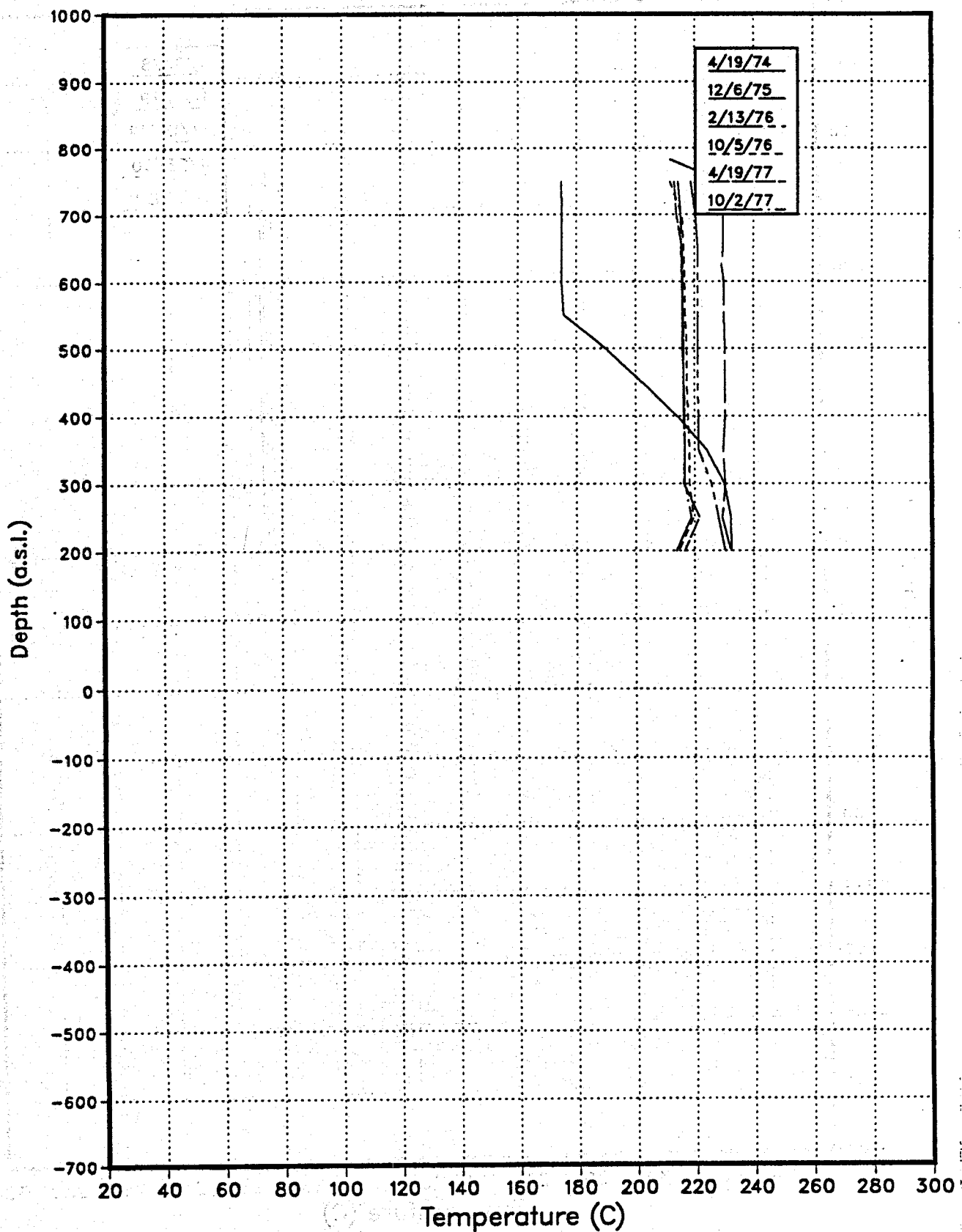
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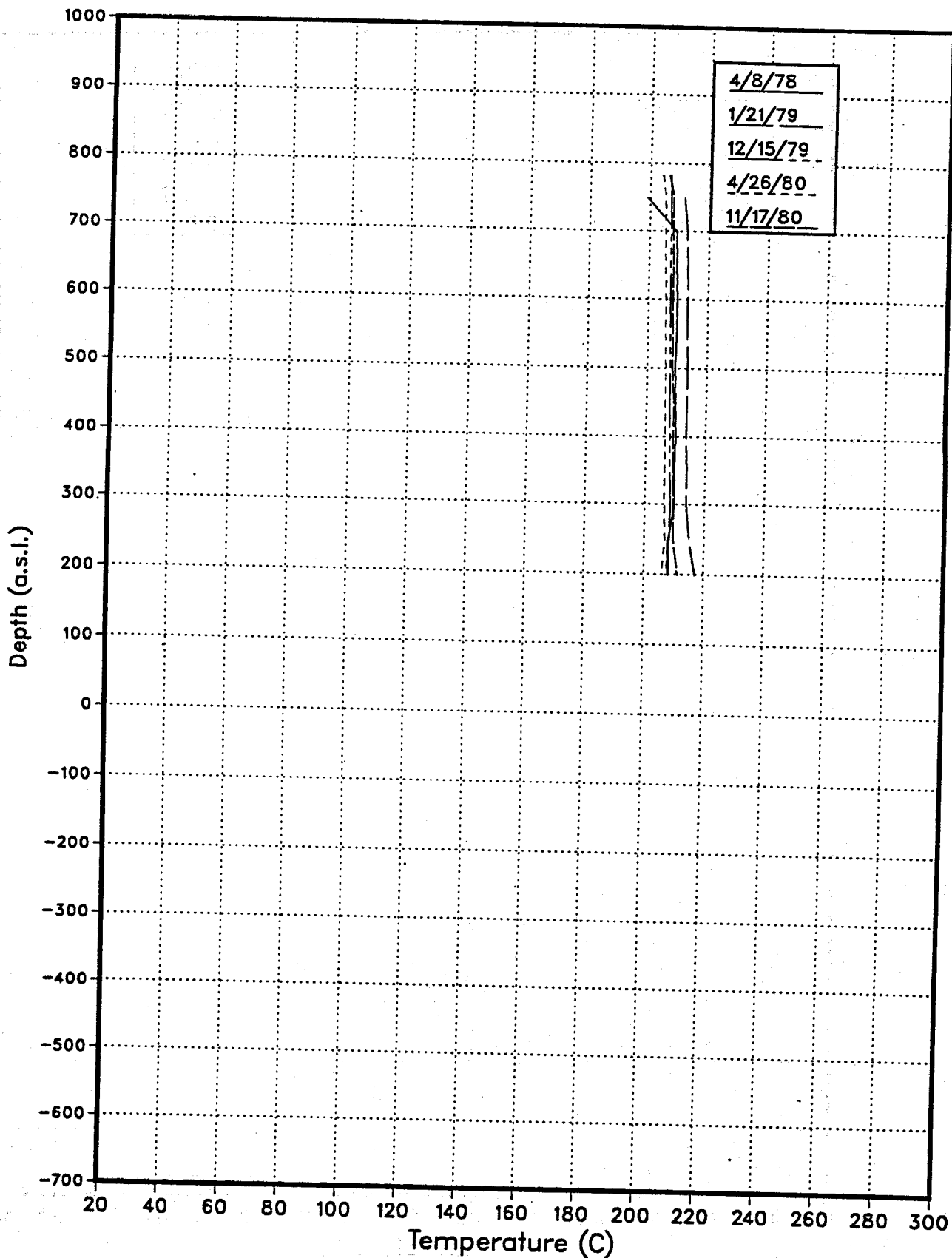
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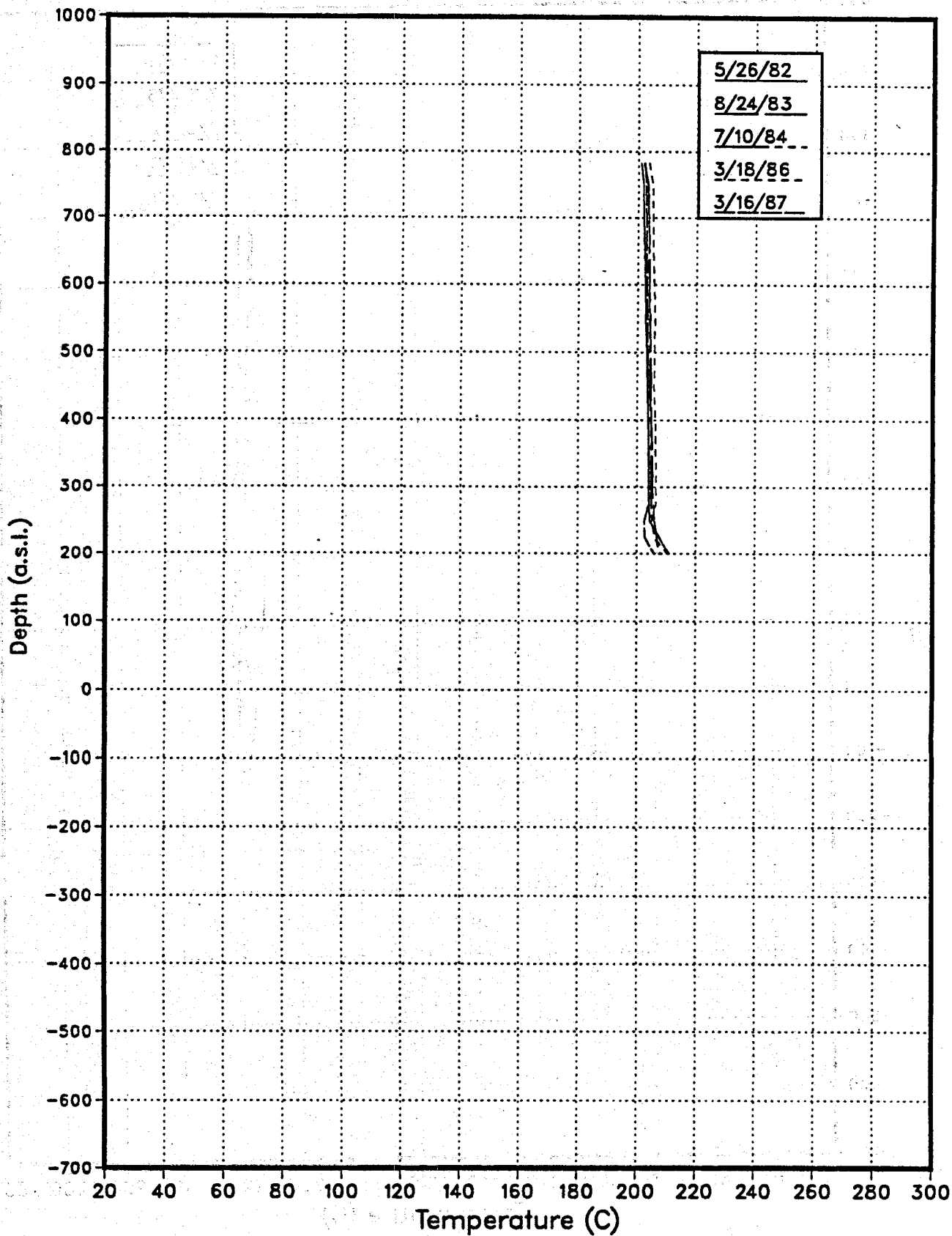
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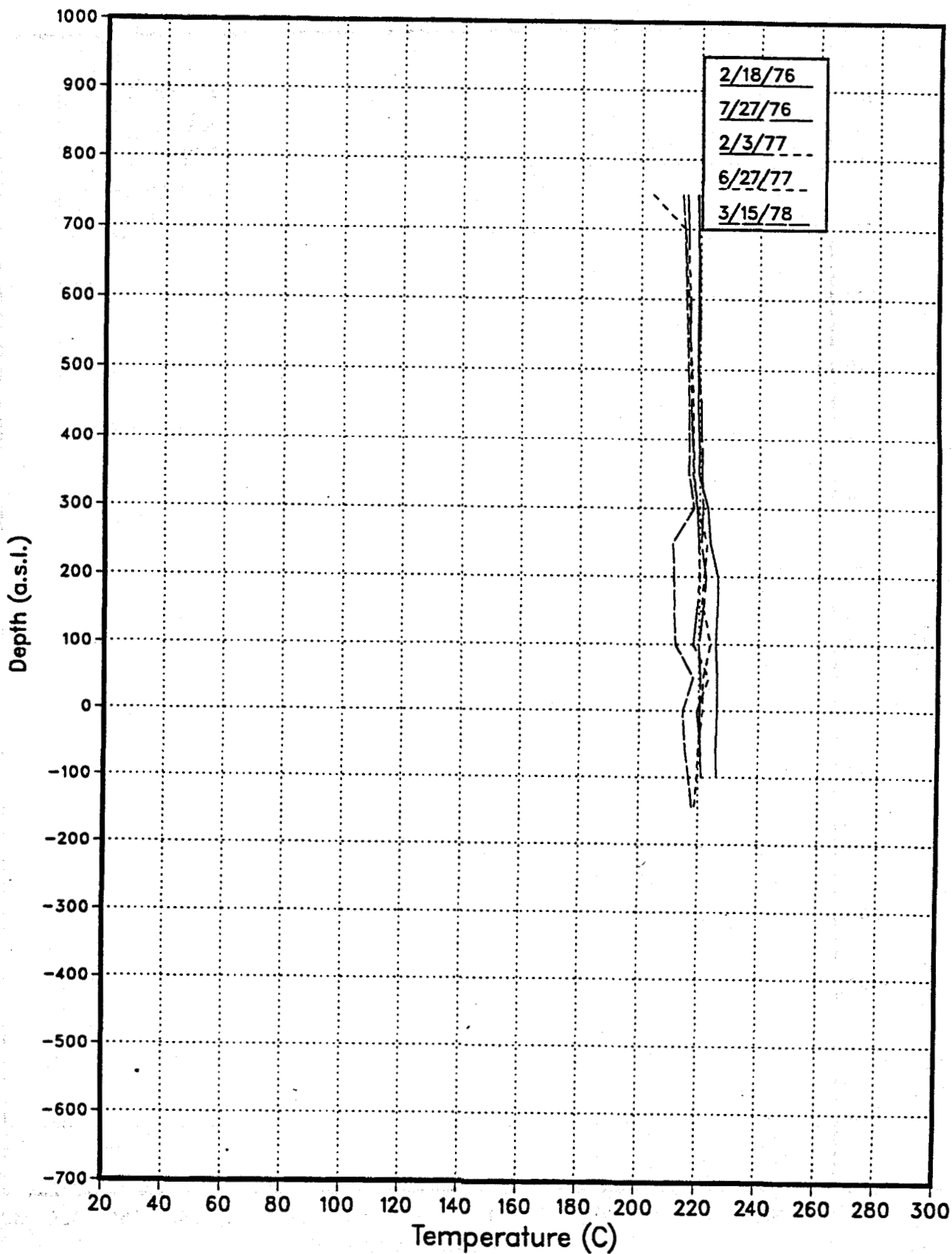
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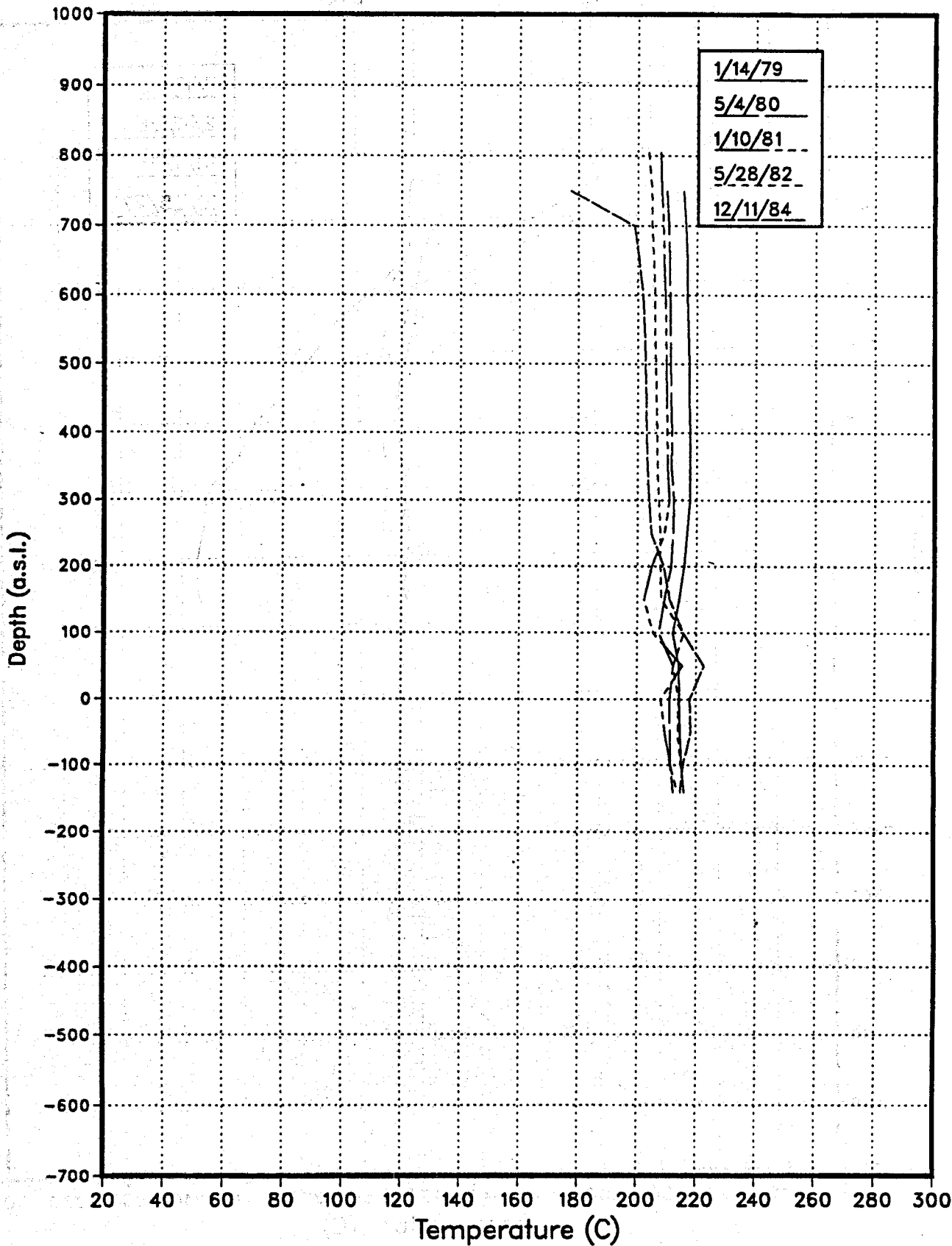
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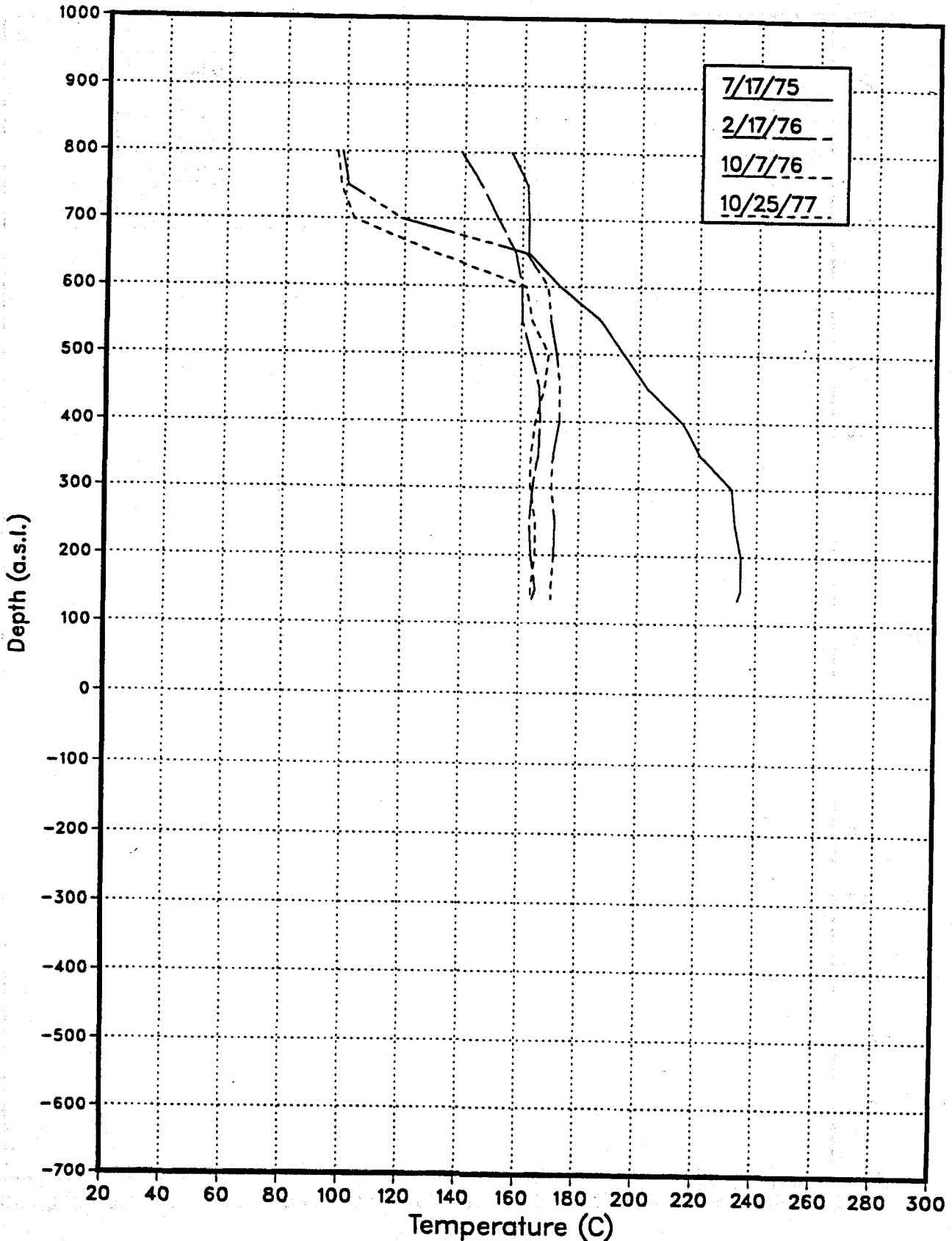
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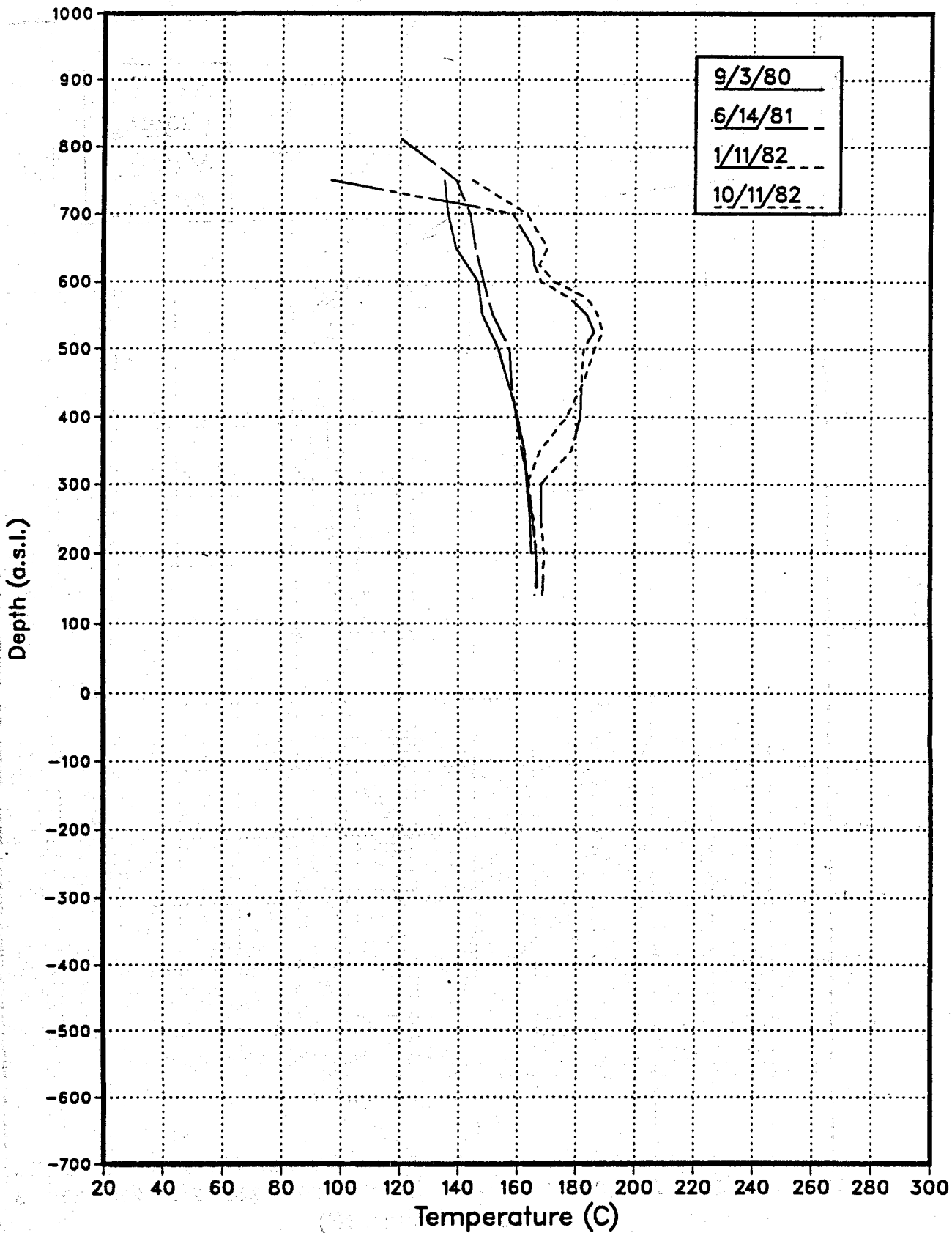
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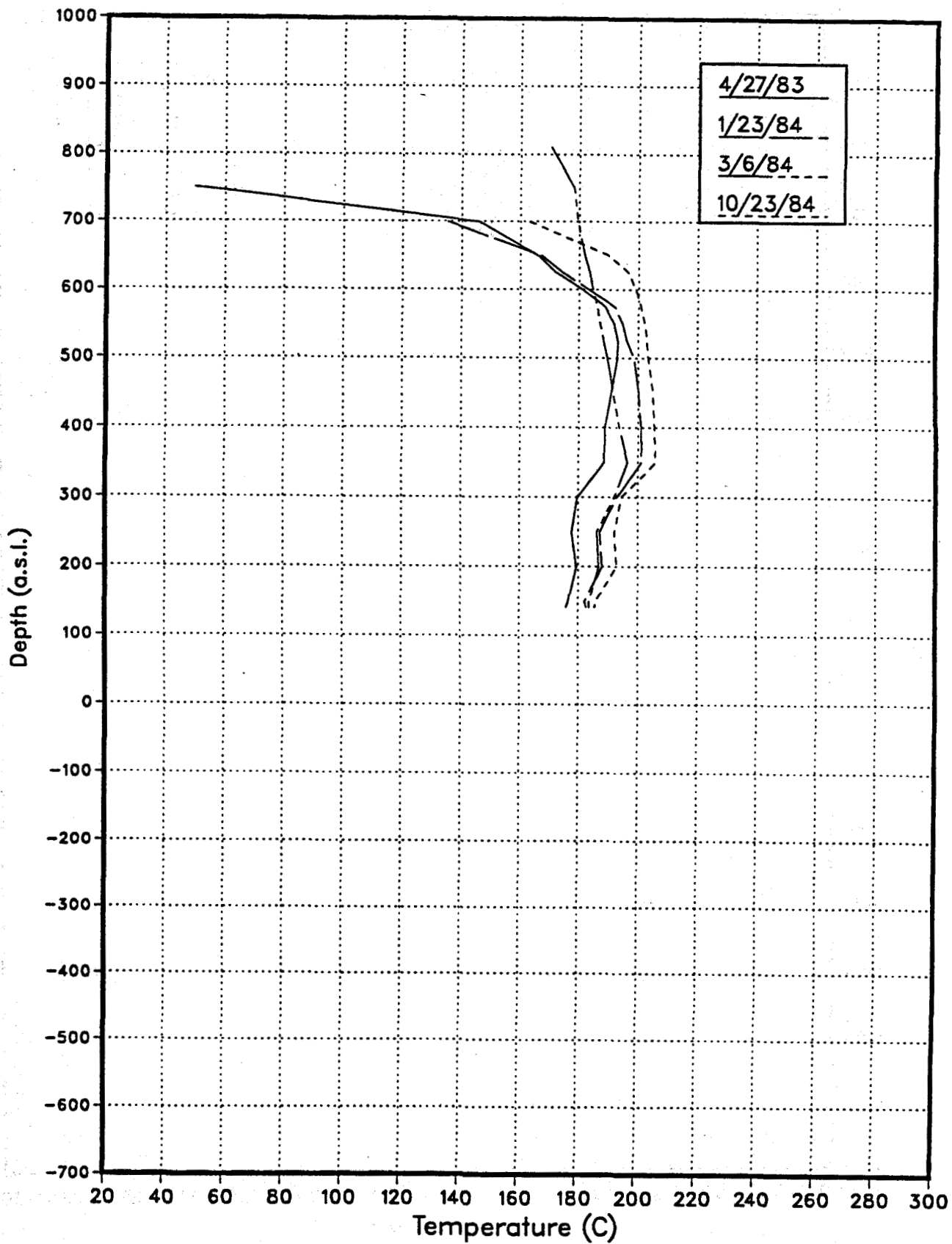
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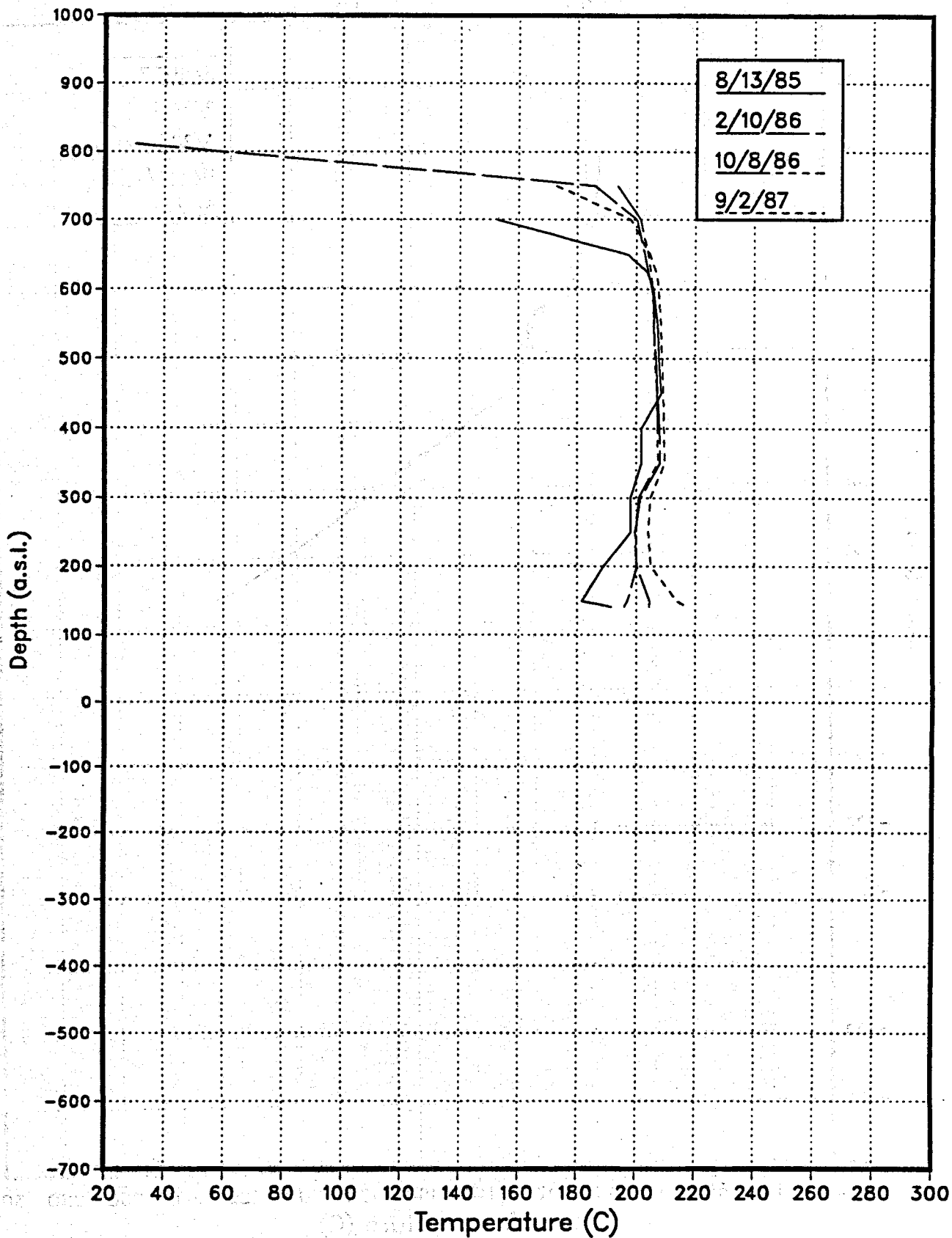
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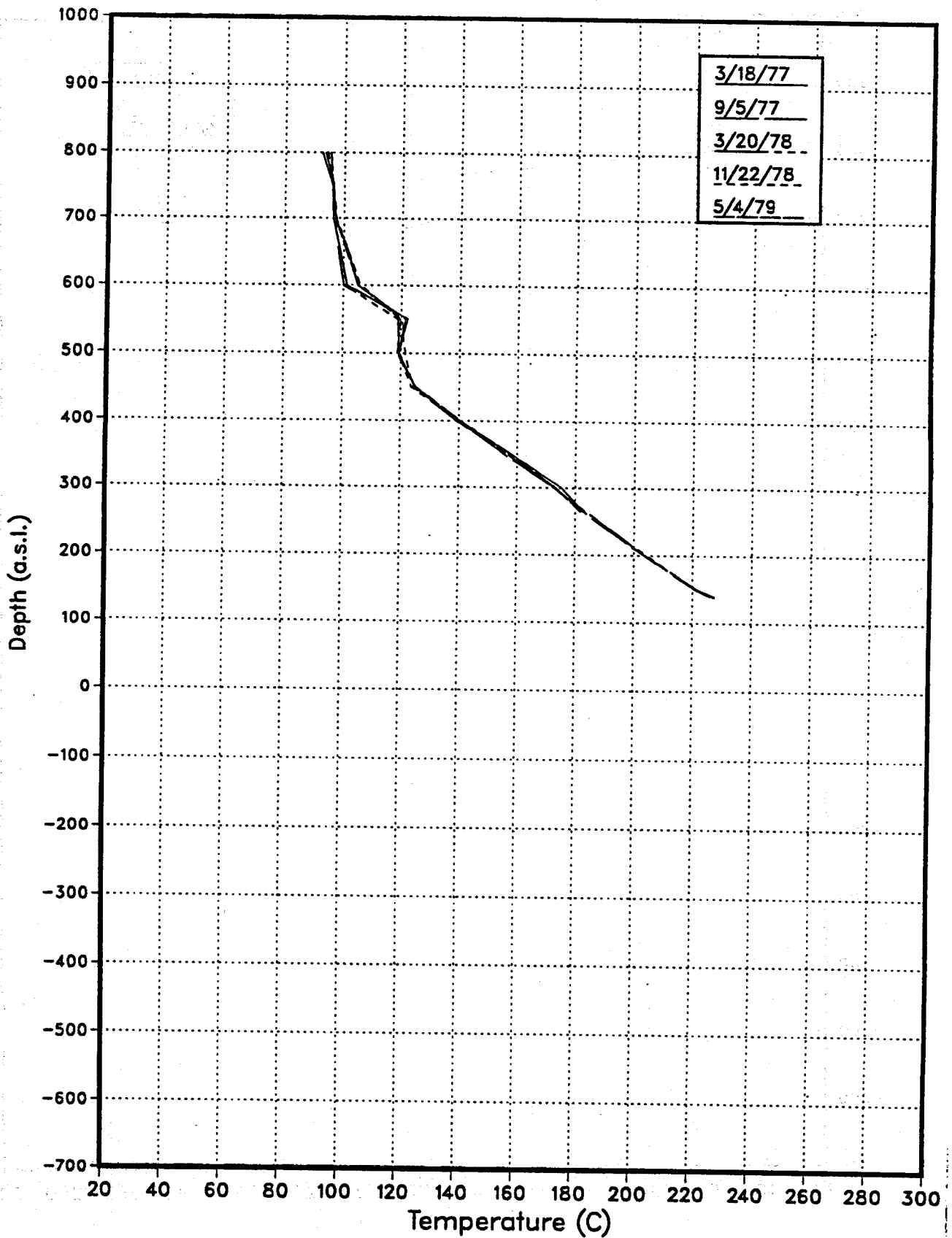
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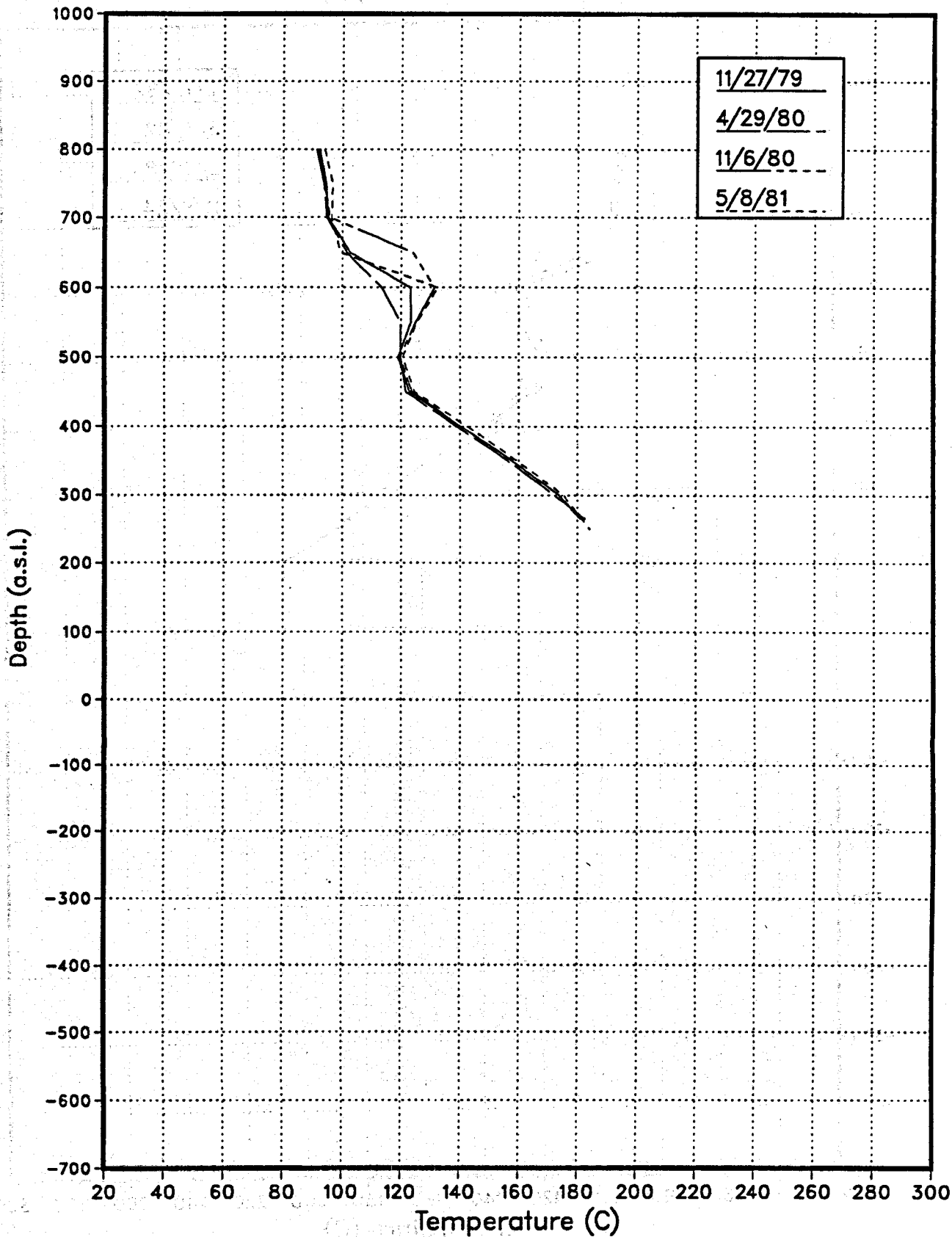
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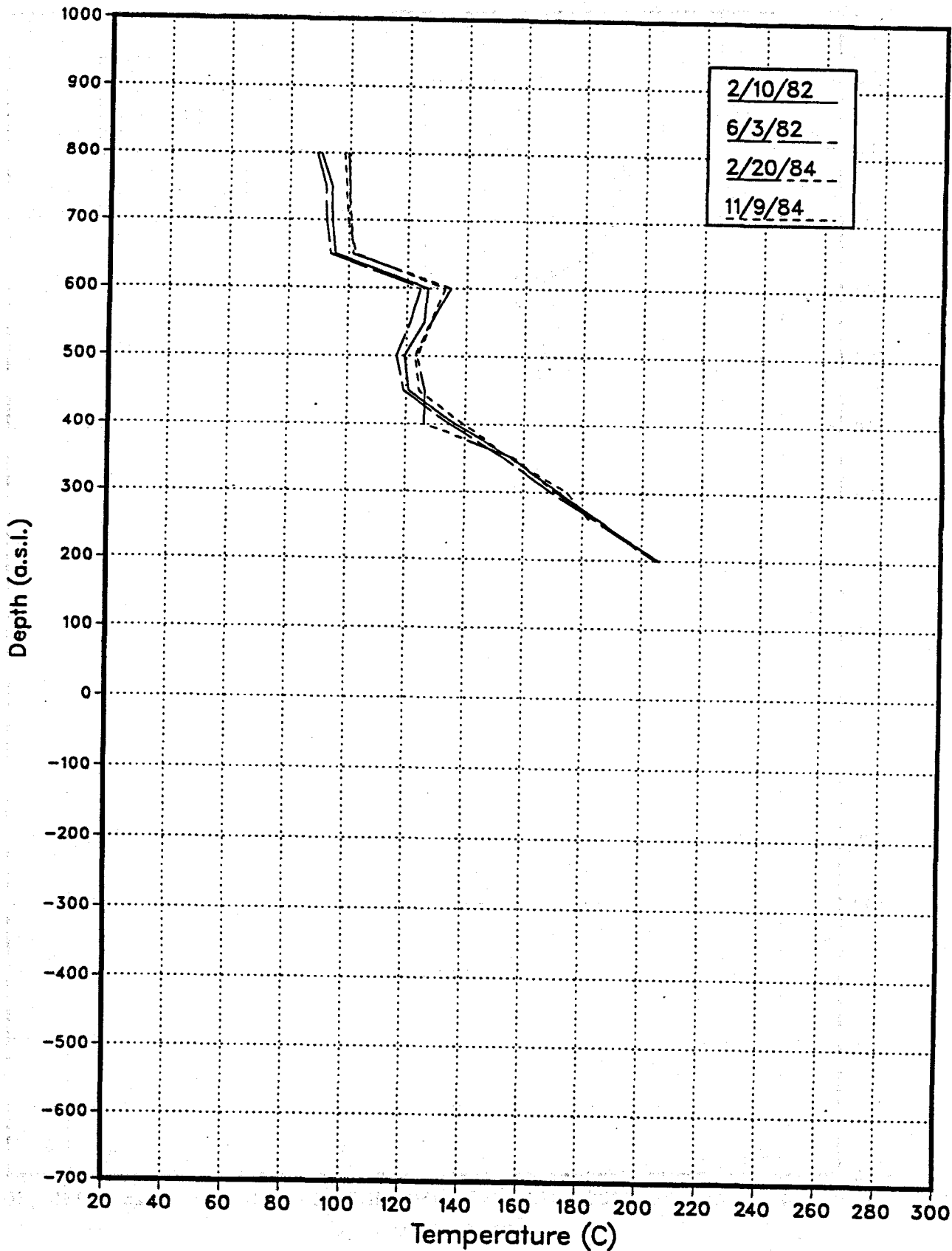
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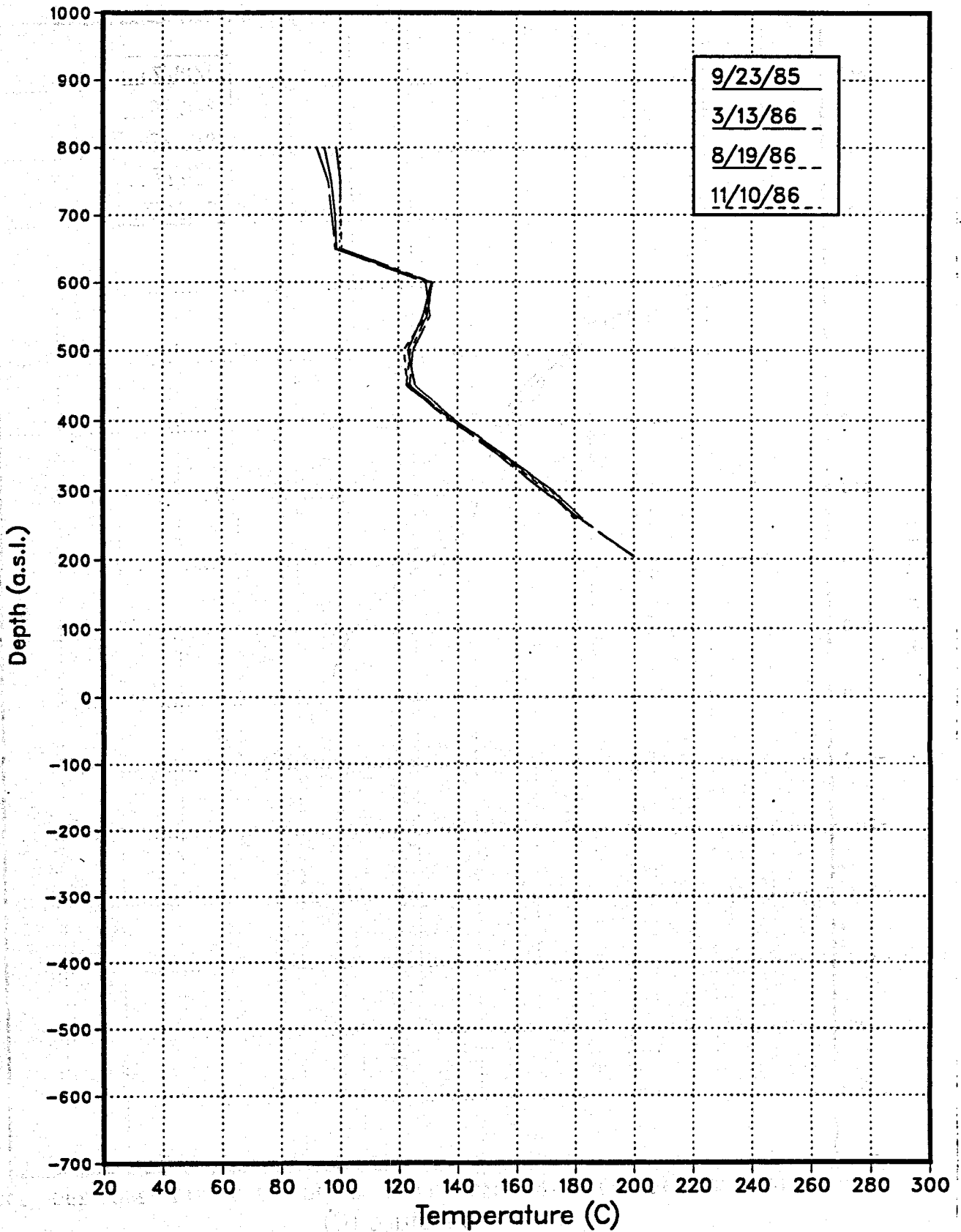
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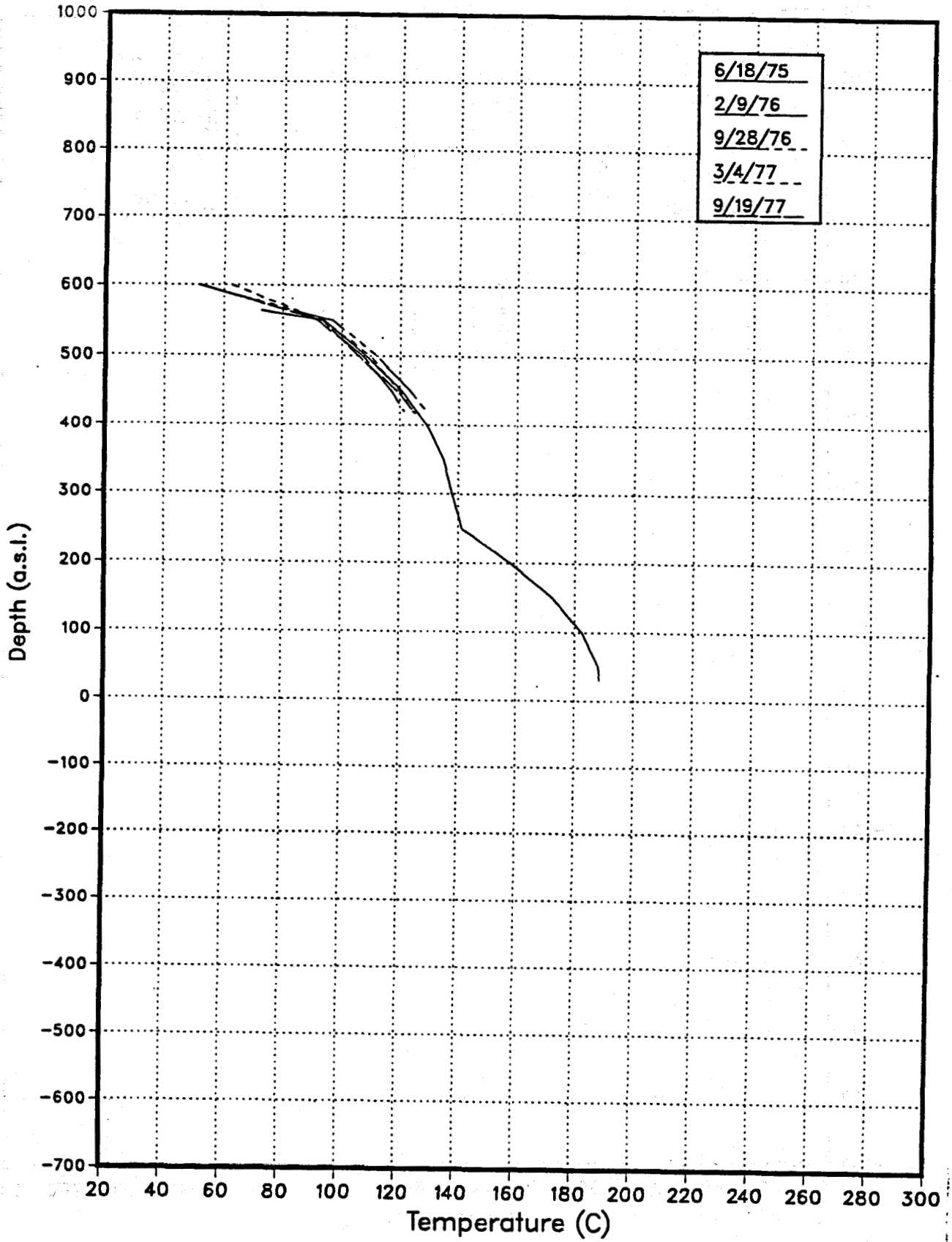
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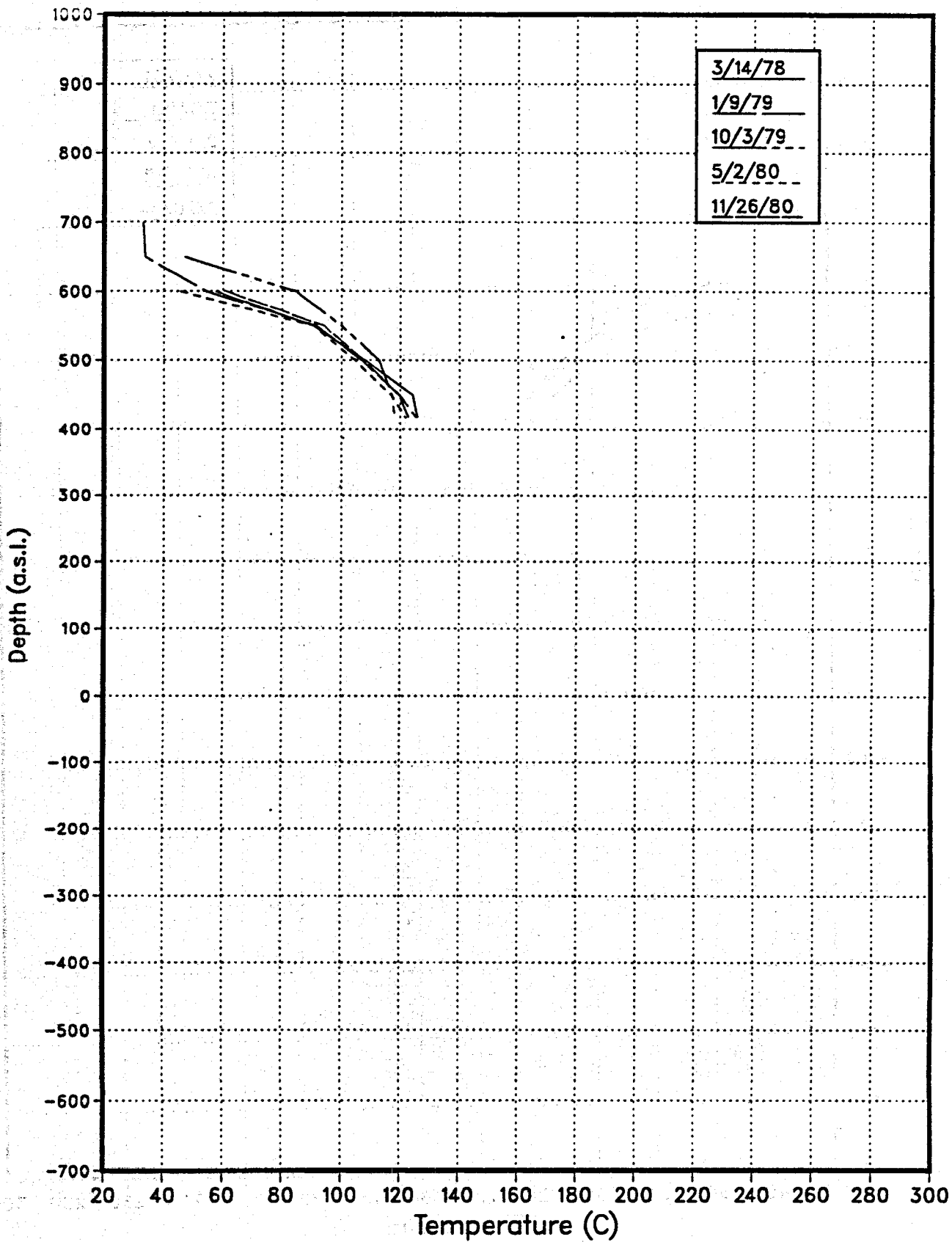
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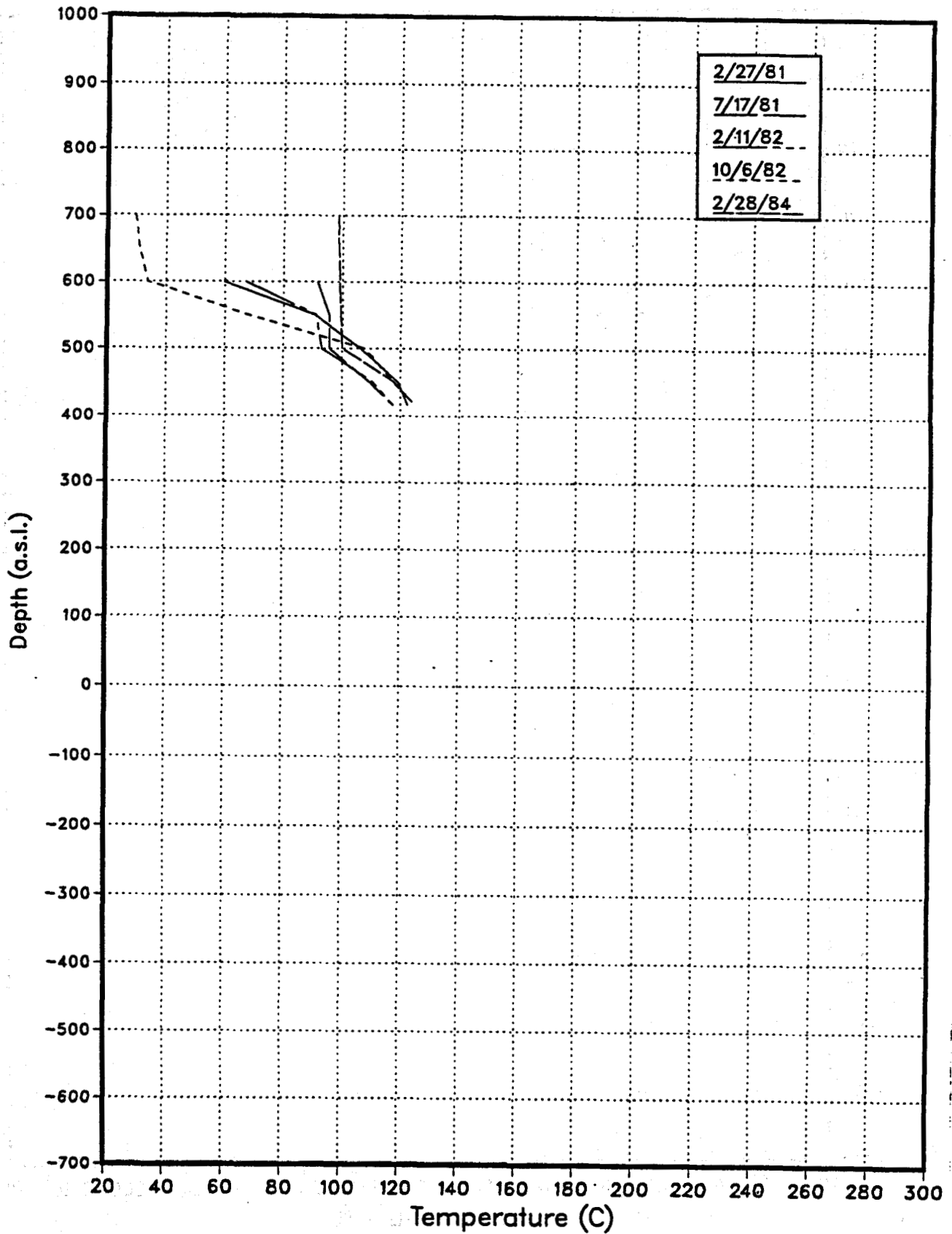
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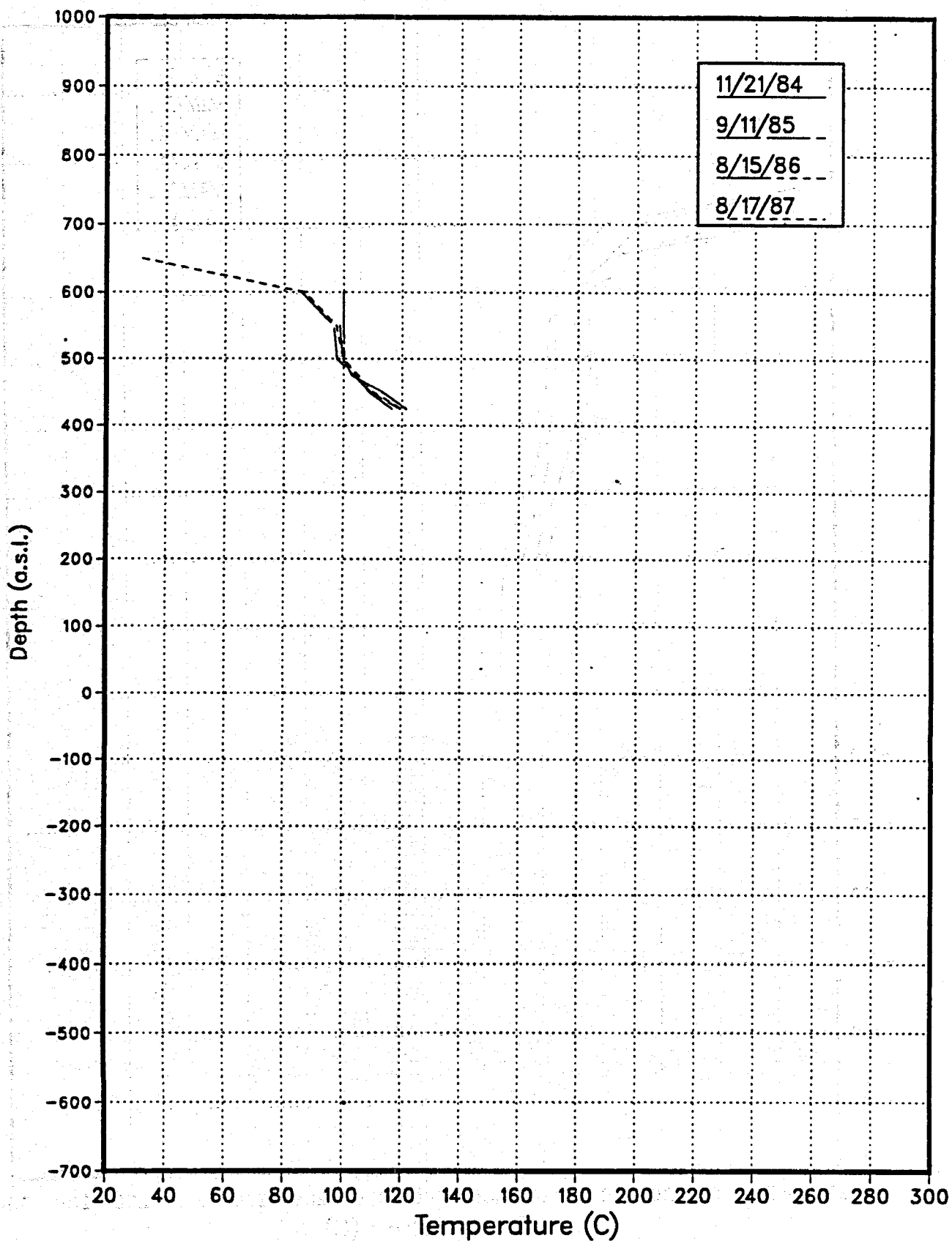
AH11 Temperature Surveys



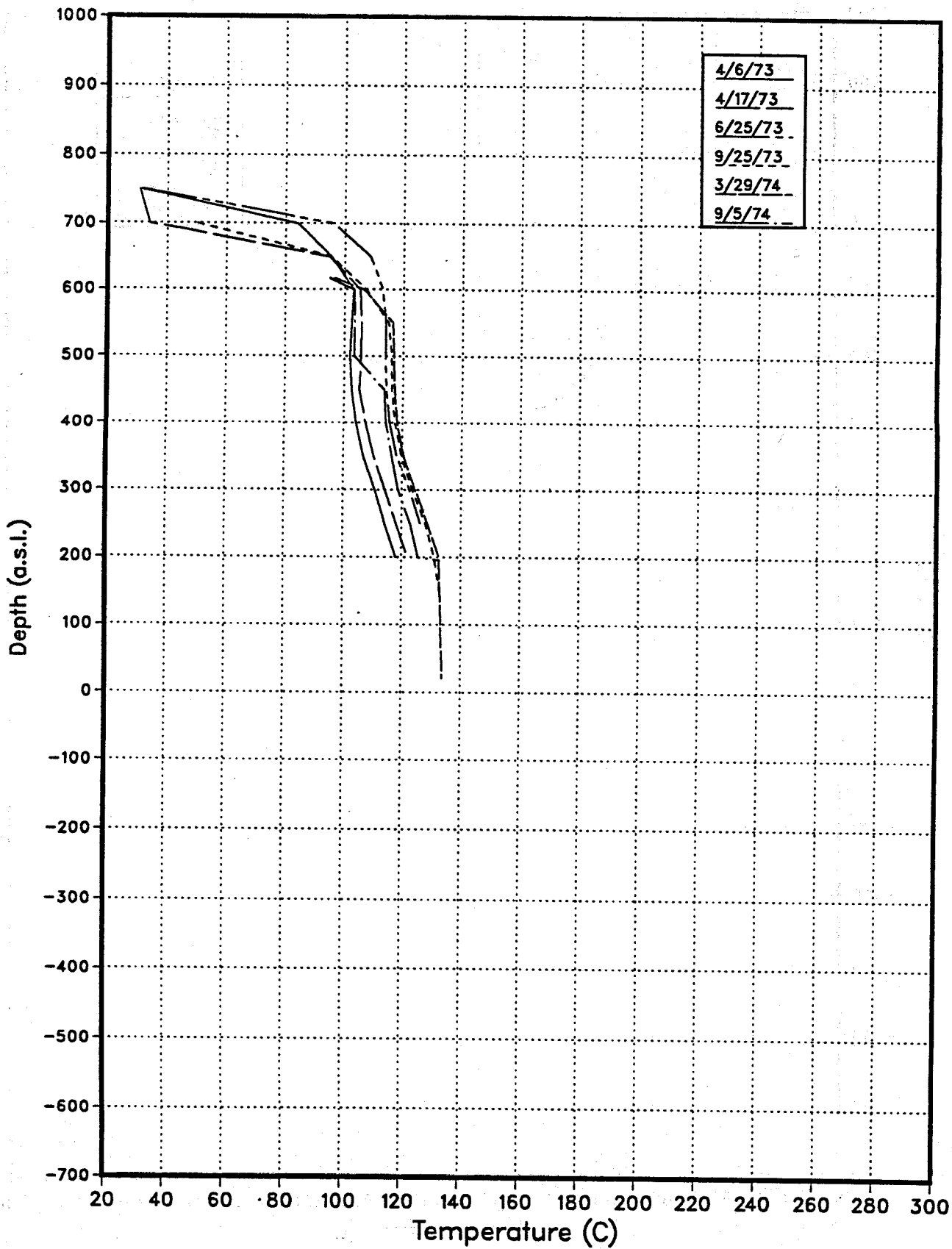
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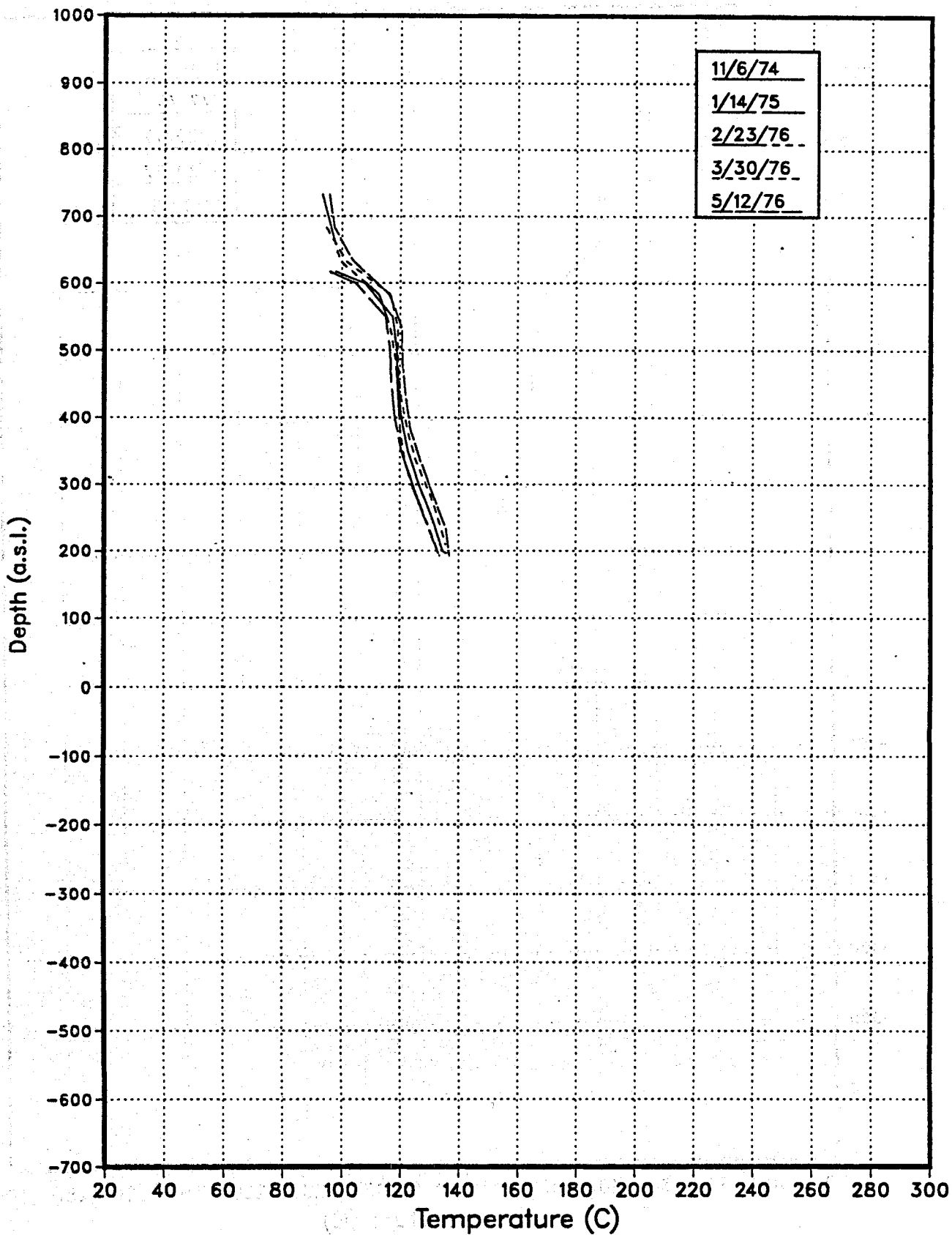
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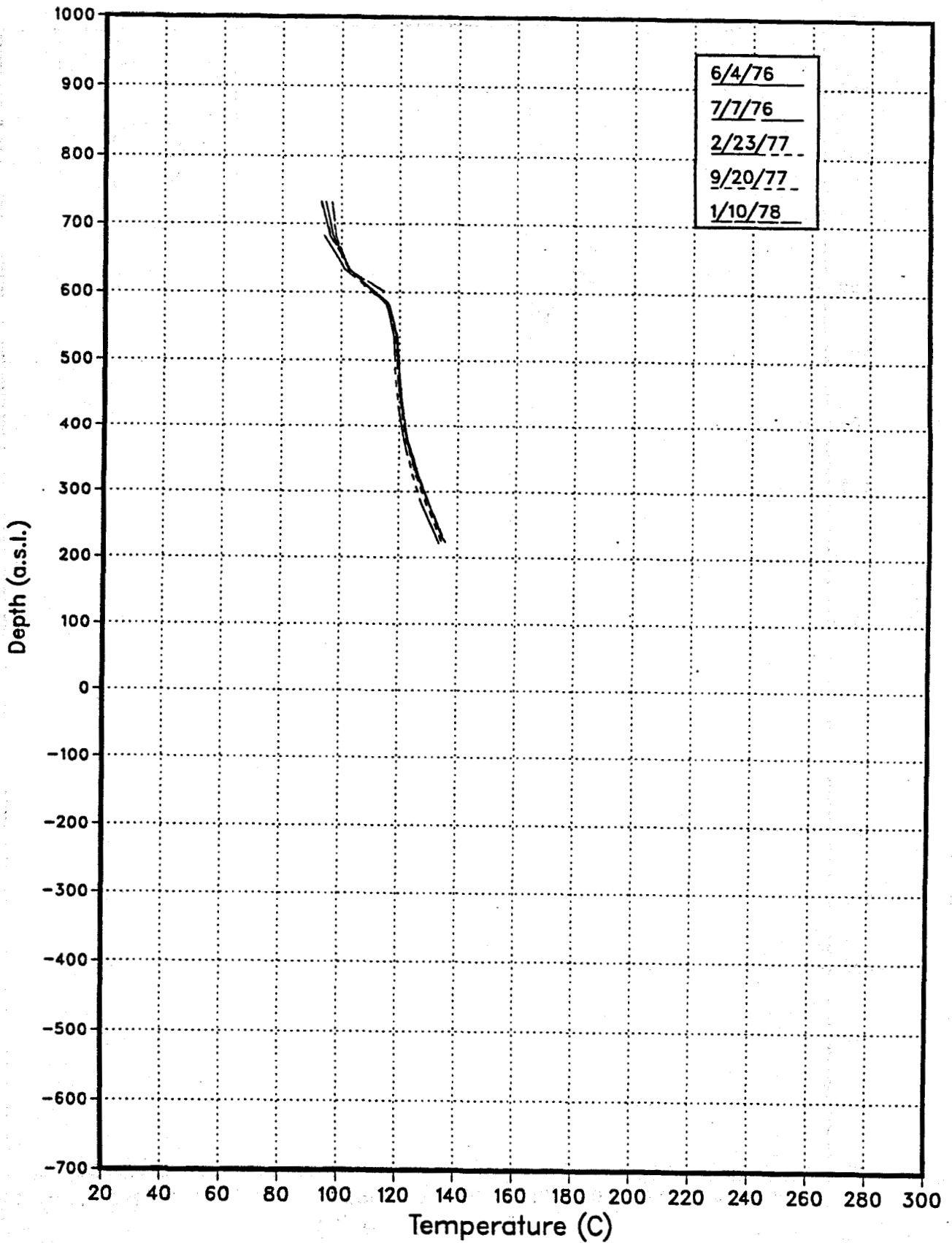
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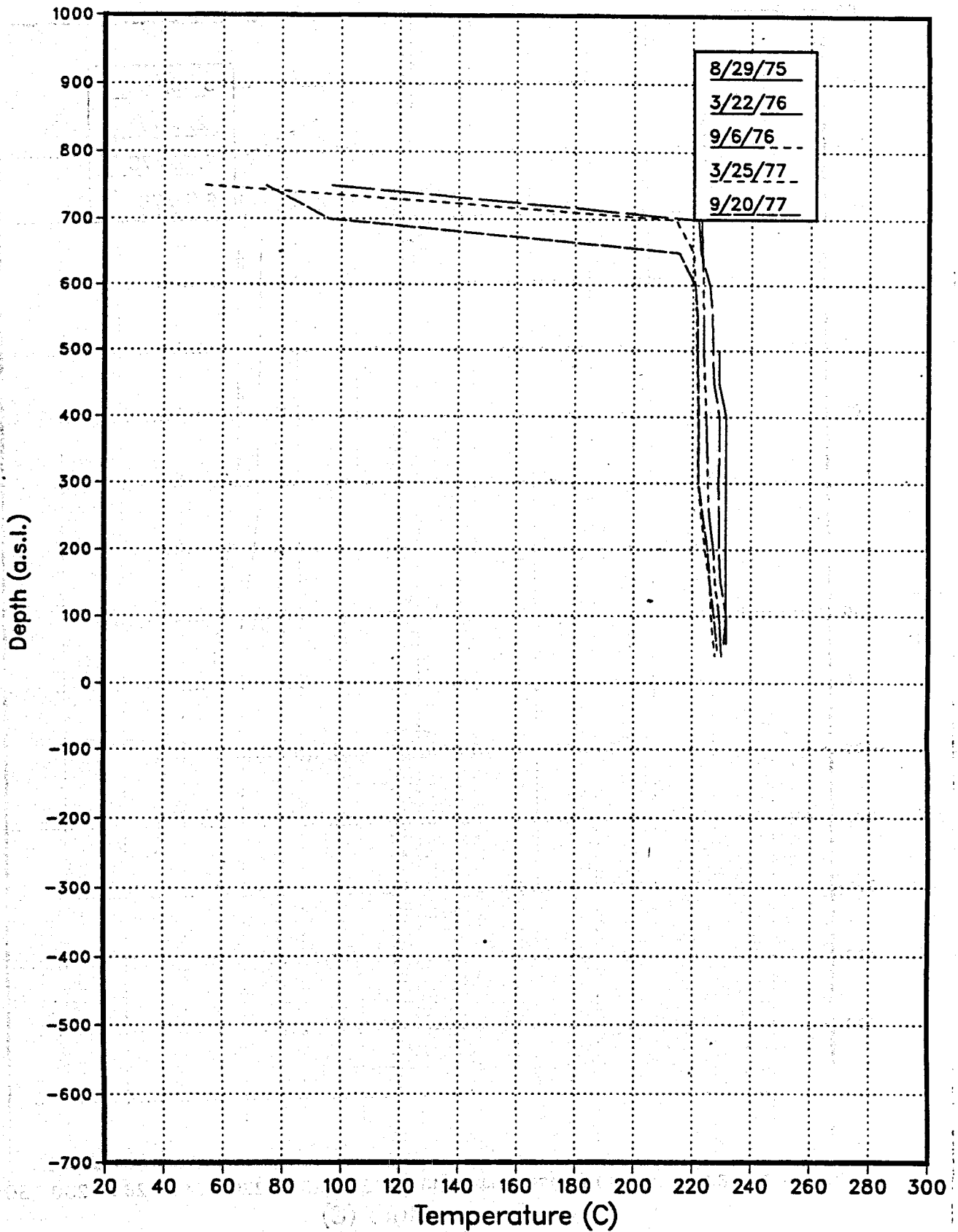
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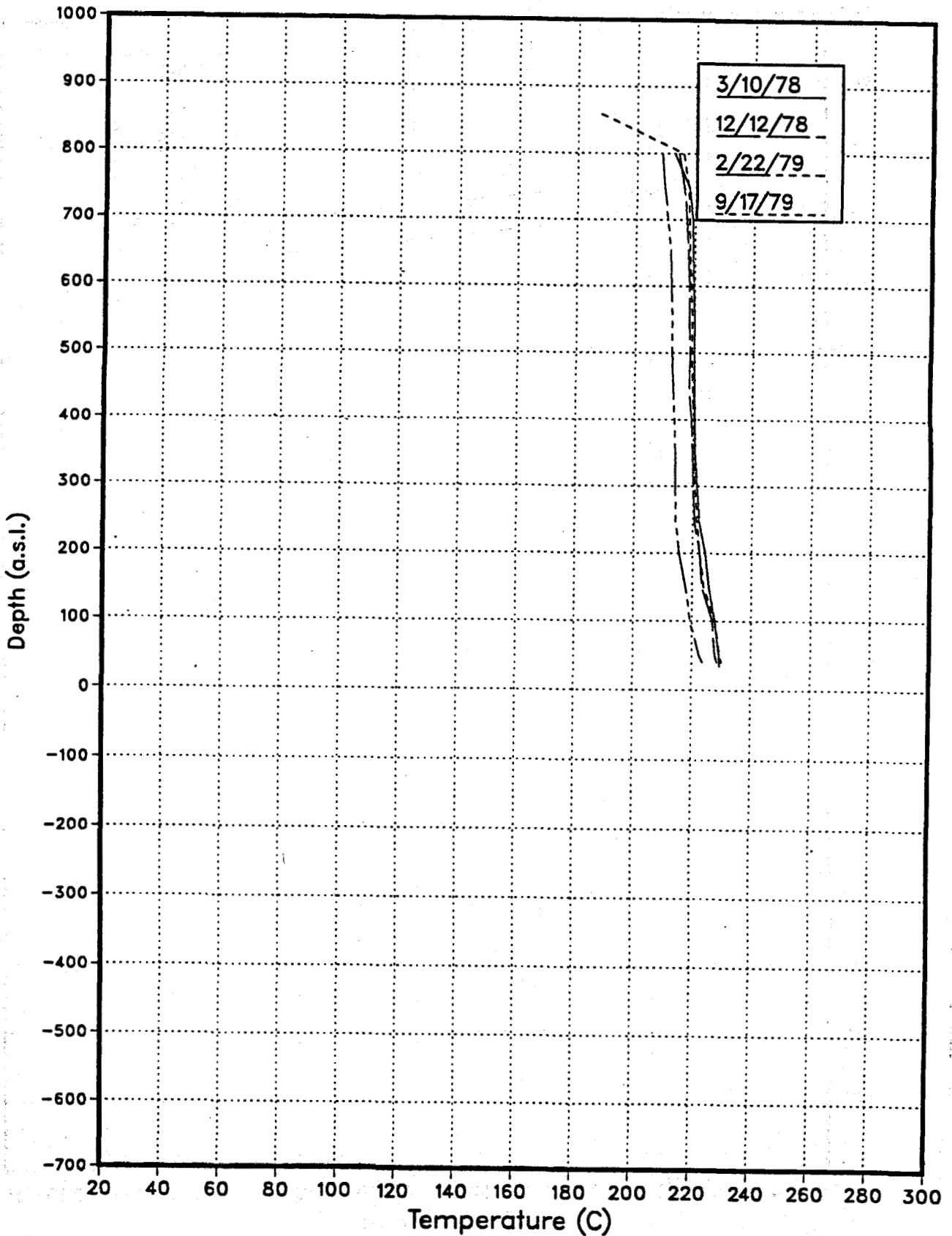
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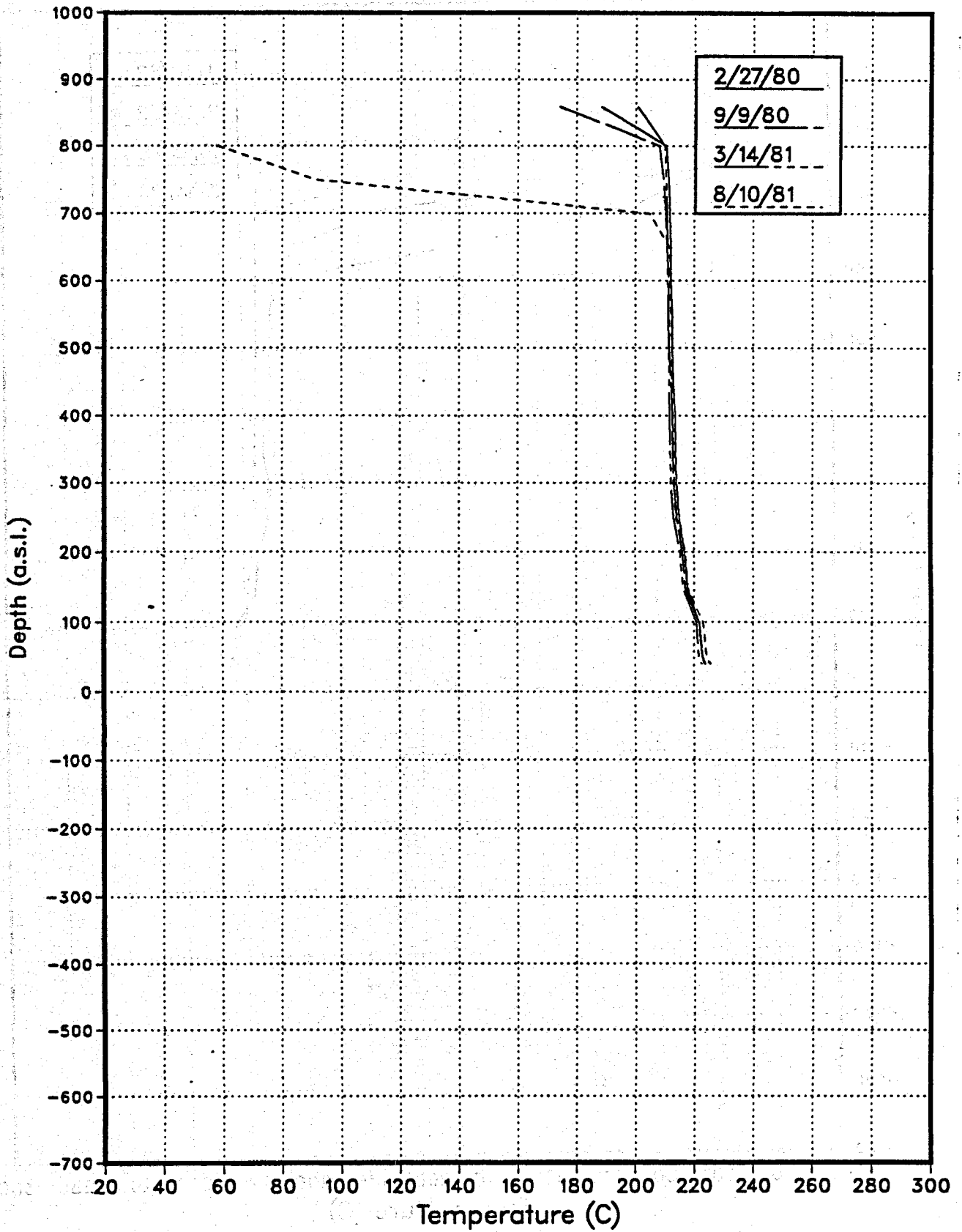
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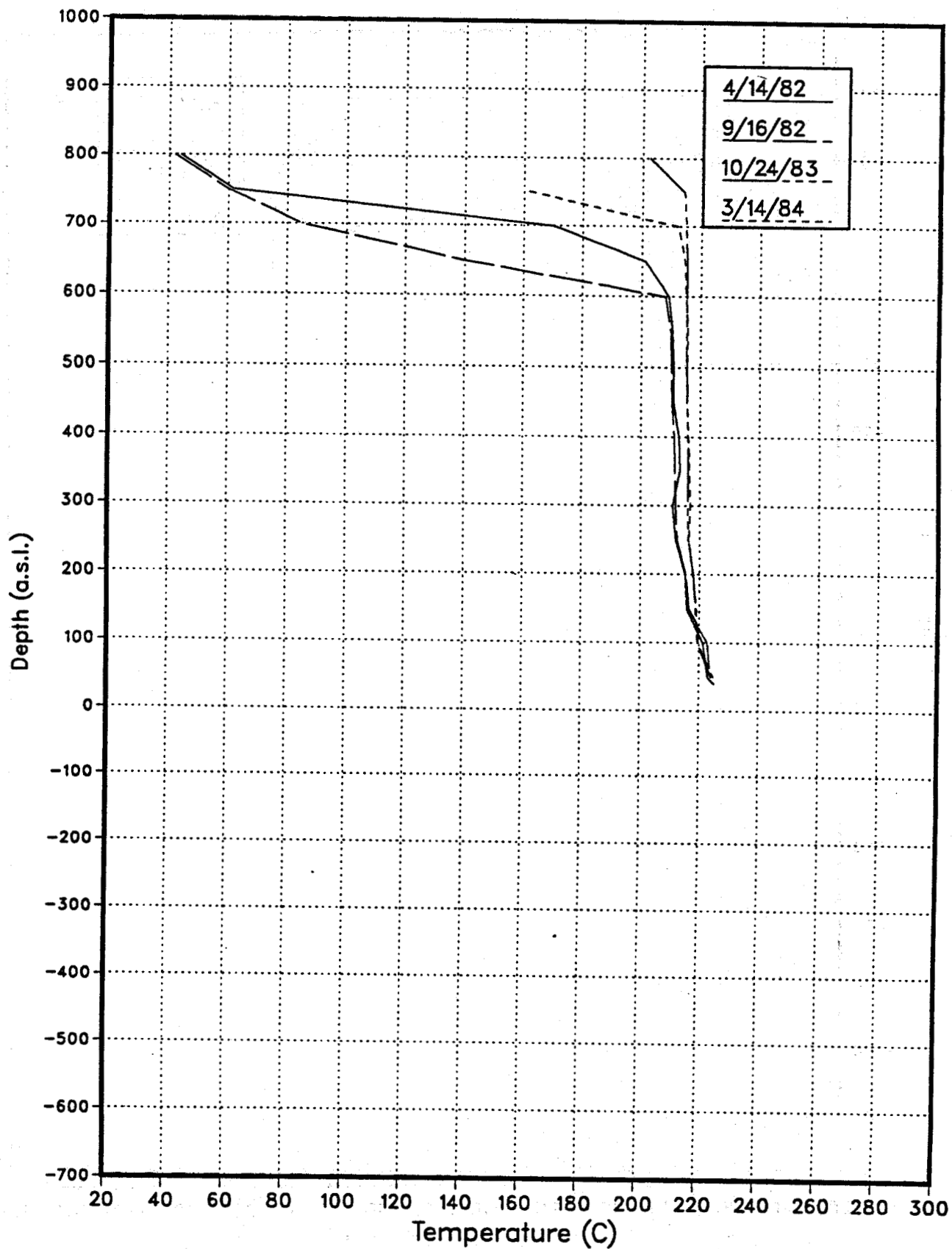
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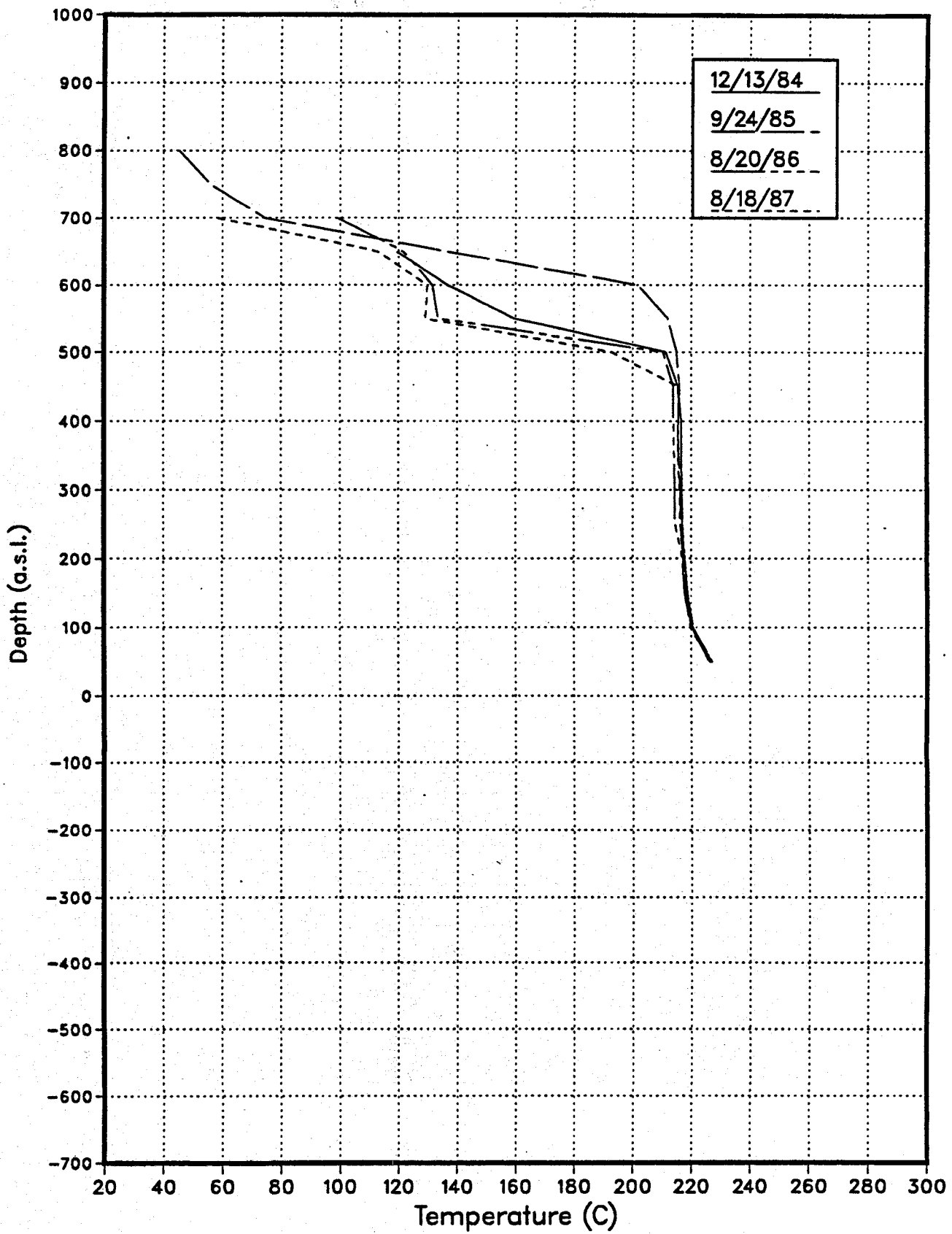
AH13 Temperature Surveys



AH13 Temperature Surveys



AH13 Temperature Surveys



THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first people who lived on this continent, and continues through the years of exploration, settlement, and the struggle for independence. The story is one of a people who have built a great nation, and who are still building it today.

The first people who lived on this continent were the Indians. They were here long before the first Europeans came. They lived in small groups, and they were very skilled at hunting and gathering. They were also very brave and brave.

The first Europeans who came to this continent were the explorers. They were looking for new lands to settle, and they found a great many. They were also looking for gold and silver, and they found a great many of those things, too.

The first settlers who came to this continent were the Pilgrims. They were looking for a place where they could practice their religion in peace, and they found it in the state of Massachusetts. They were very brave and brave.

The first war that the United States fought was the Revolutionary War. It was a war for independence, and it was fought between the British and the Americans. The Americans won, and they became a free and independent nation.

The first president of the United States was George Washington. He was a great leader, and he was very brave and brave.

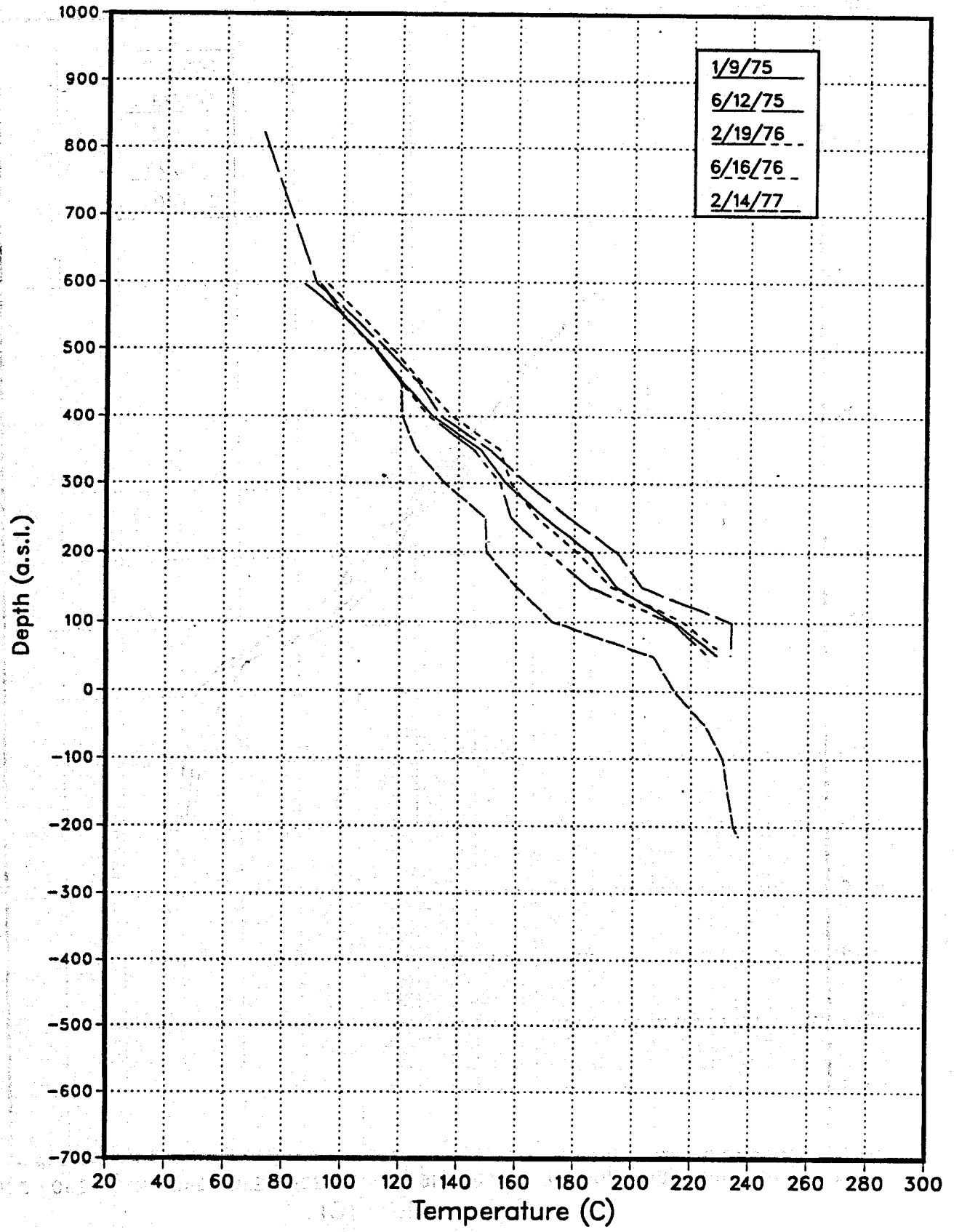
The first great war that the United States fought was the Civil War. It was a war between the North and the South, and it was fought for the right to keep slavery. The North won, and slavery was abolished.

The first great war that the United States fought was the World War. It was a war between the United States and Germany, and it was fought for the right to keep peace. The United States won, and the world is a better place because of it.

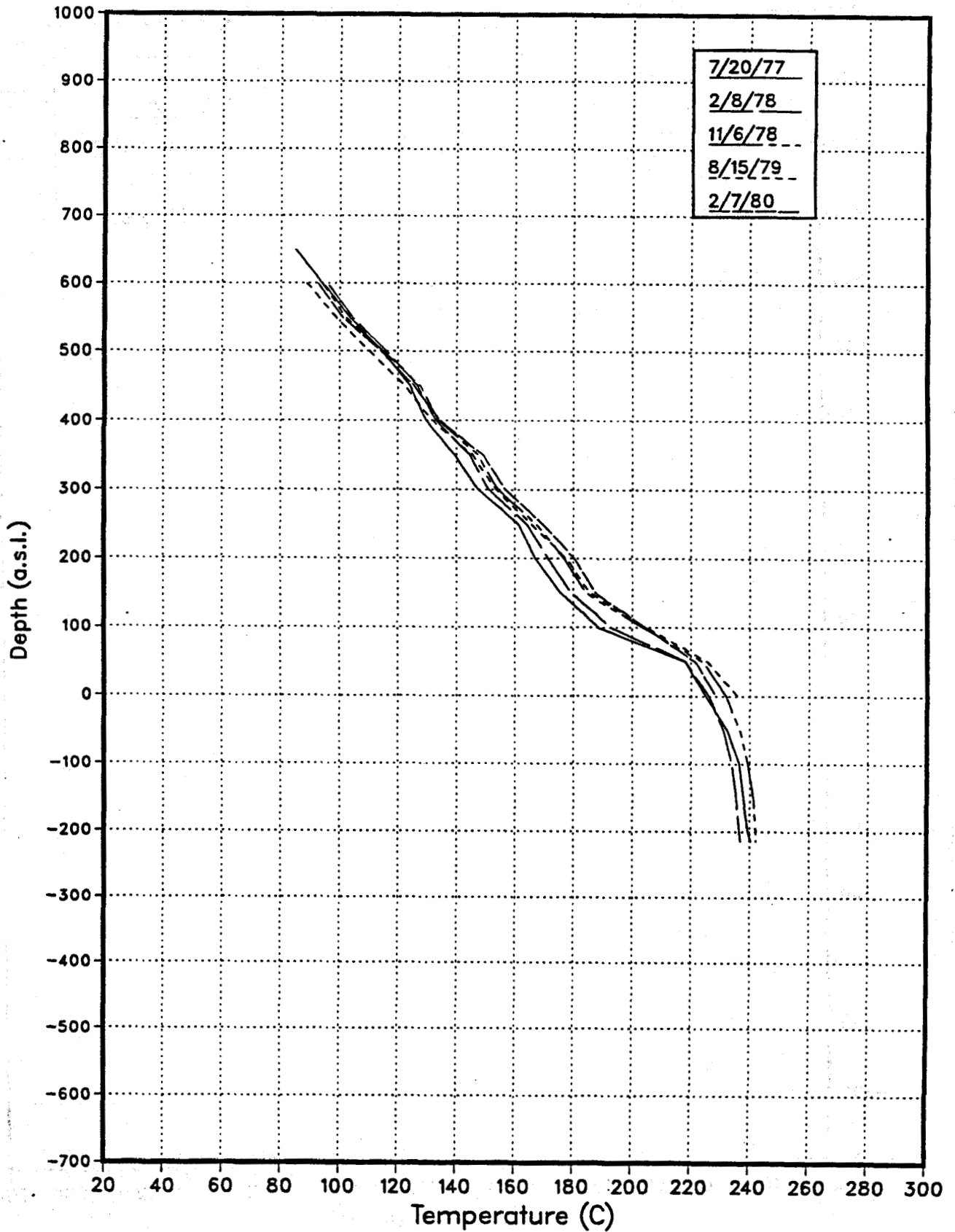
The first great war that the United States fought was the Vietnam War. It was a war between the United States and North Vietnam, and it was fought for the right to keep peace. The United States won, and the world is a better place because of it.

The first great war that the United States fought was the War on Terror. It was a war between the United States and al-Qaeda, and it was fought for the right to keep peace. The United States won, and the world is a better place because of it.

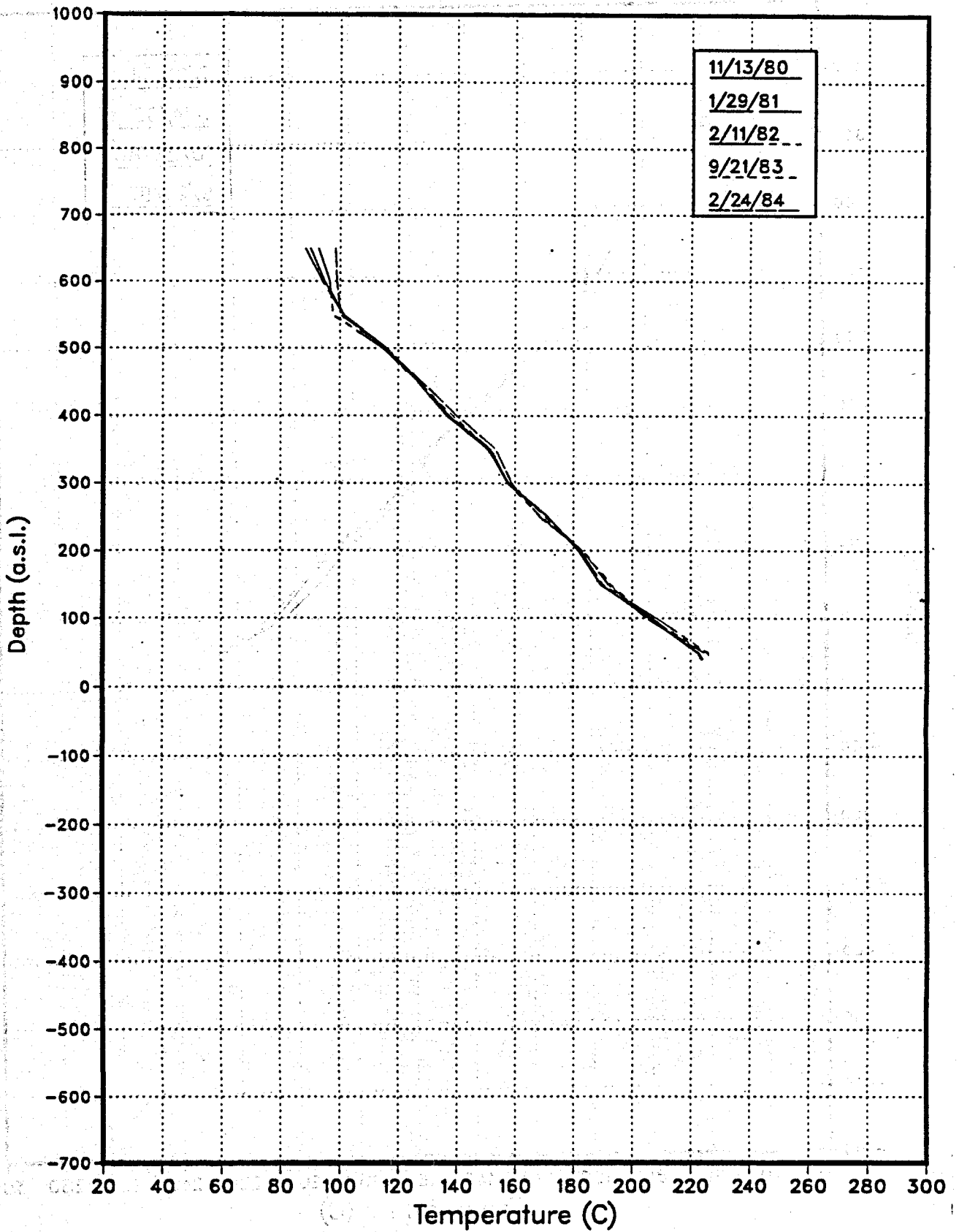
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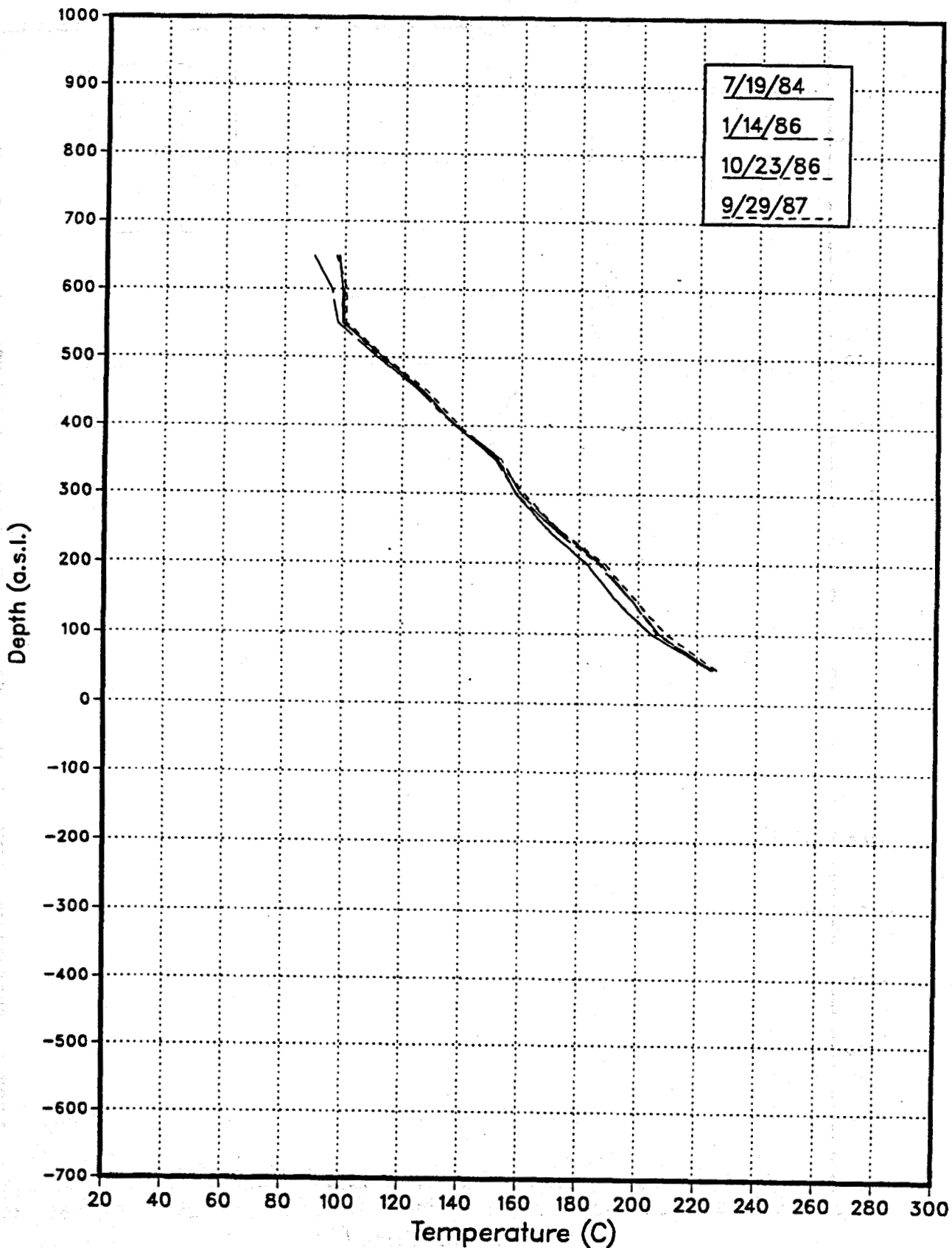
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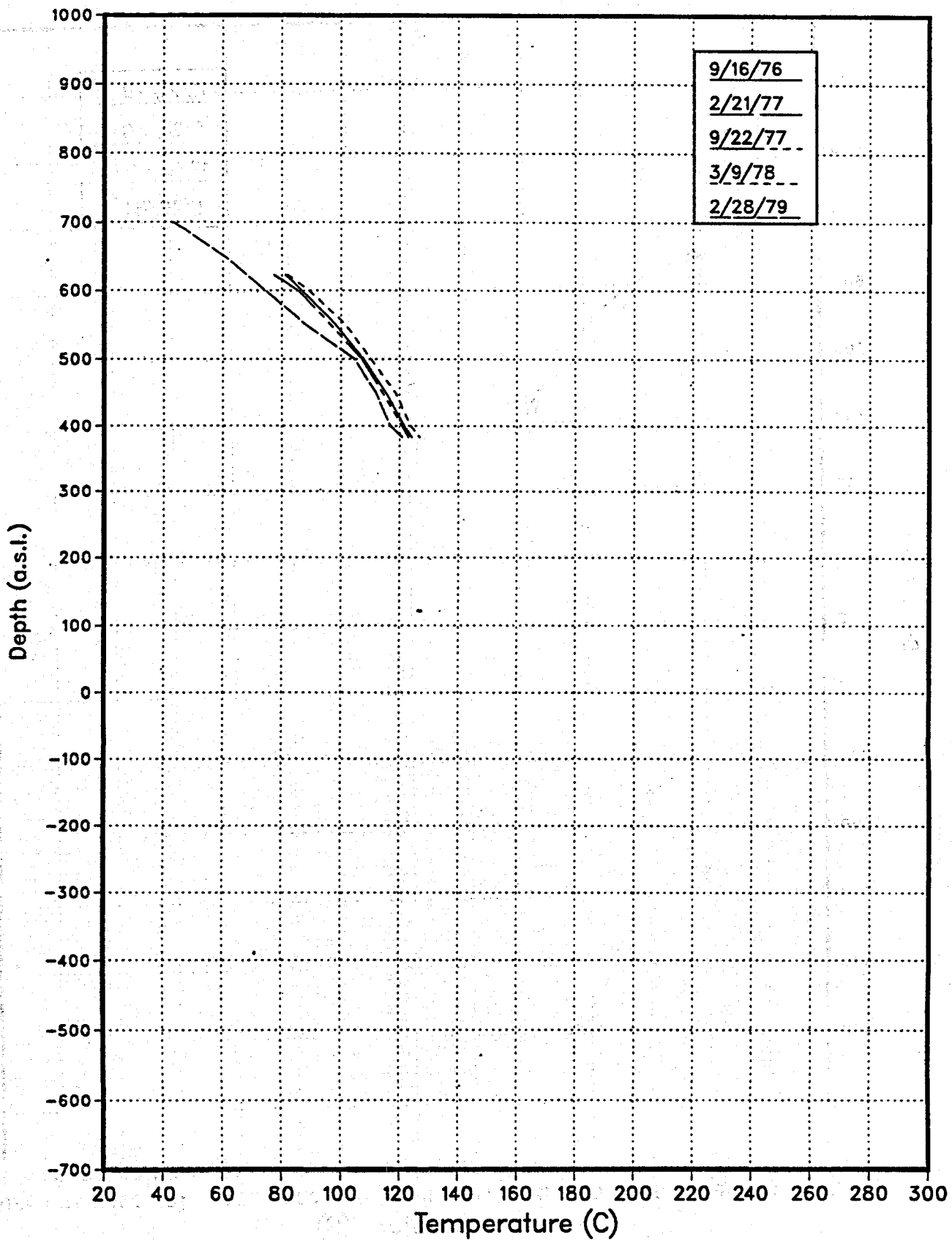
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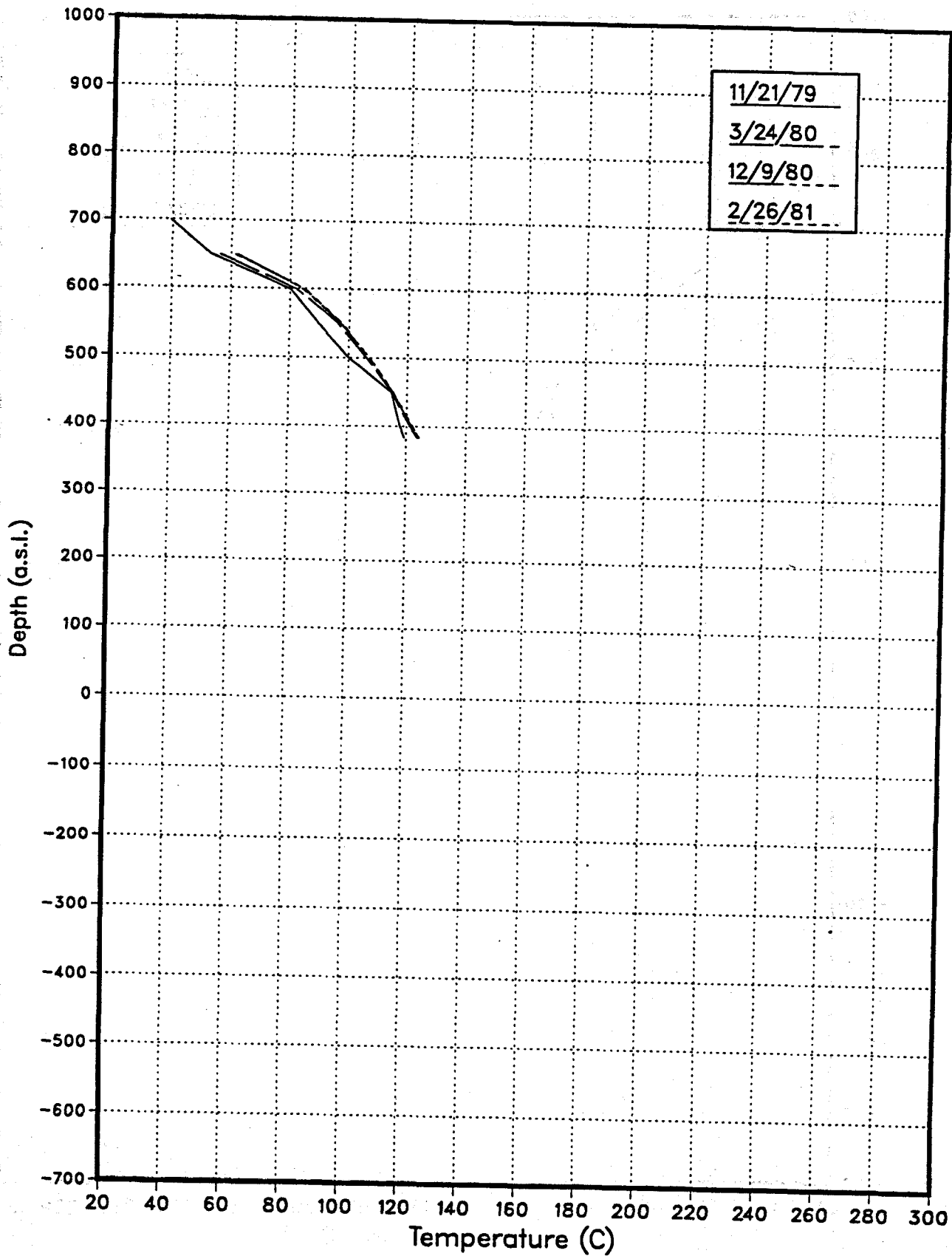
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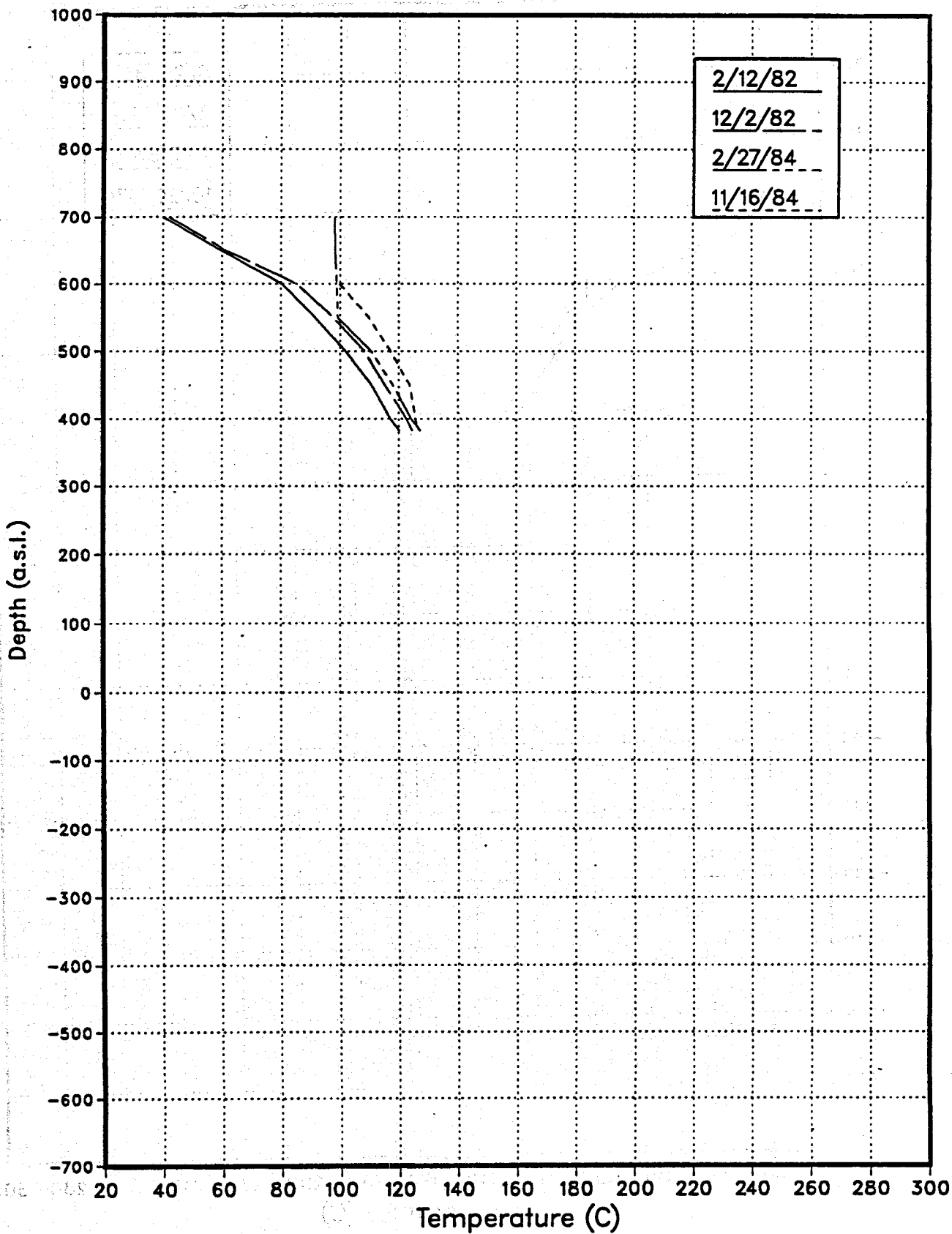
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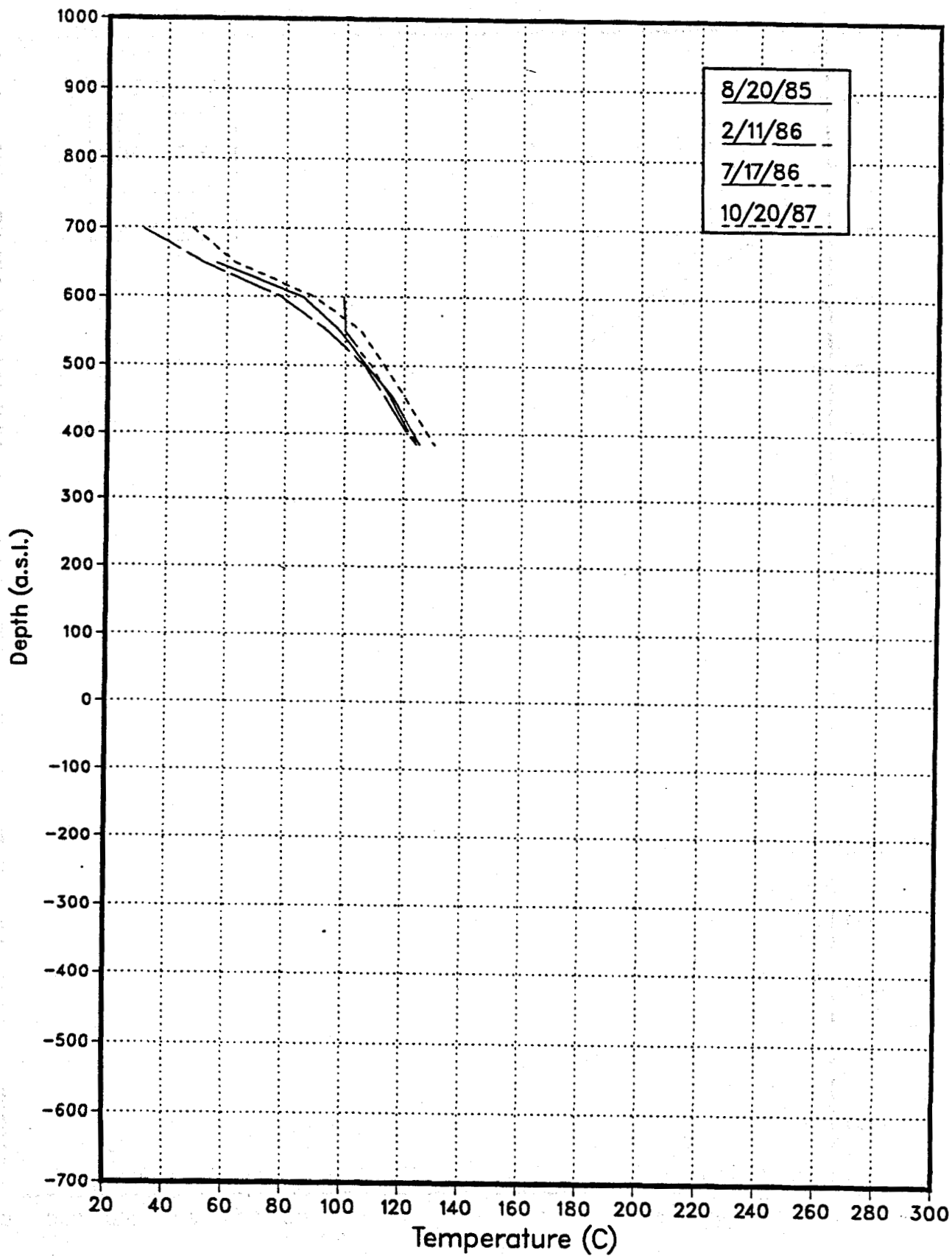
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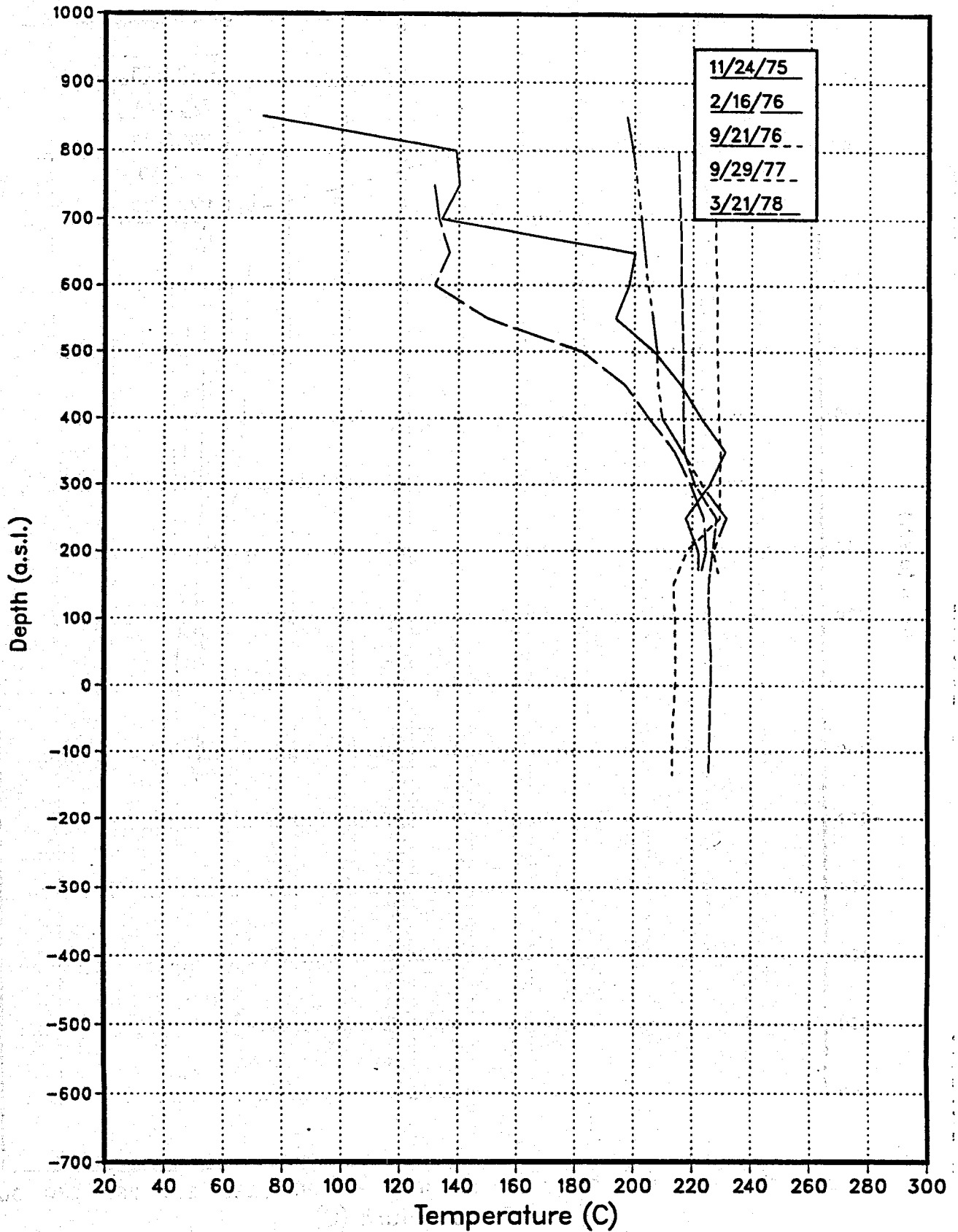
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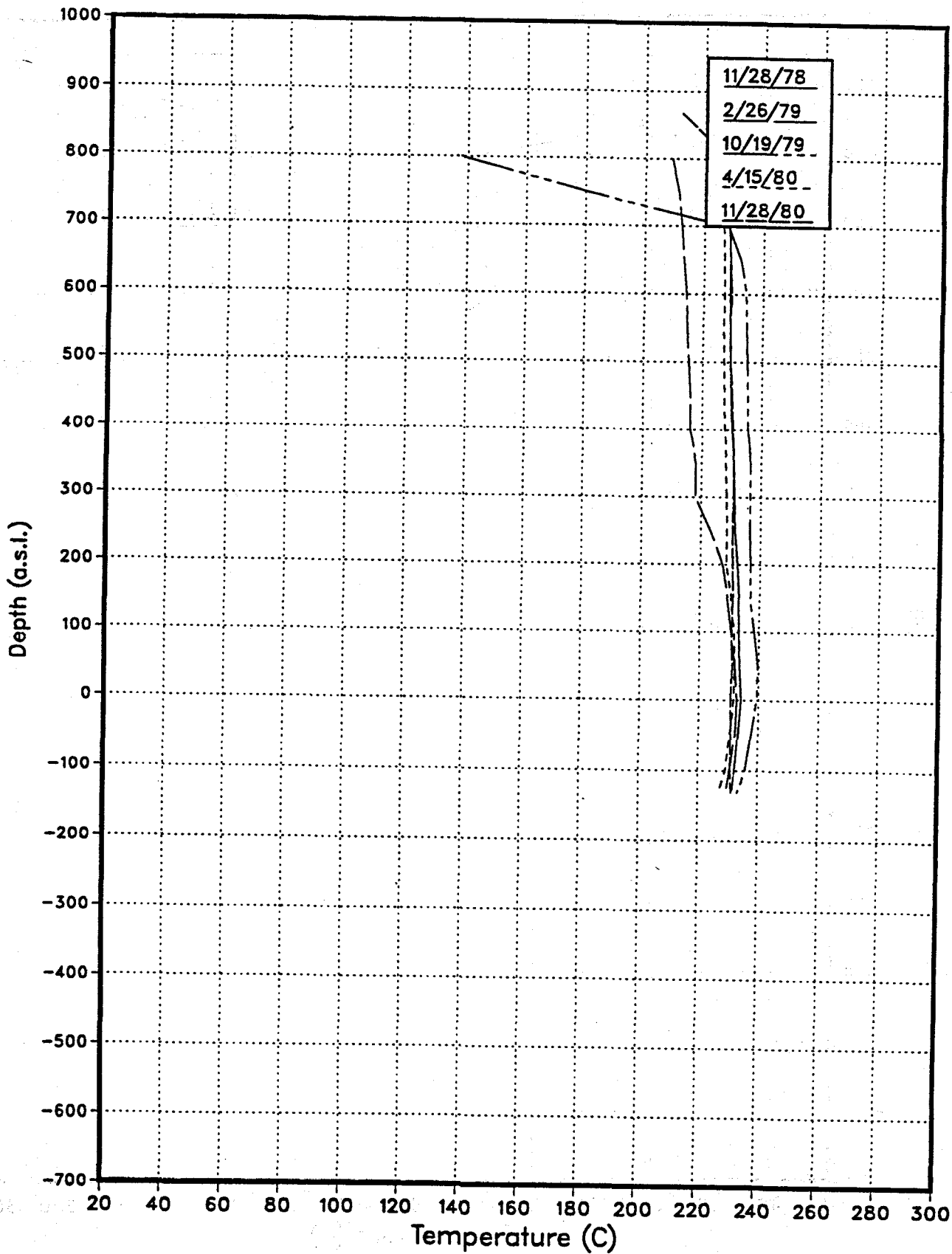
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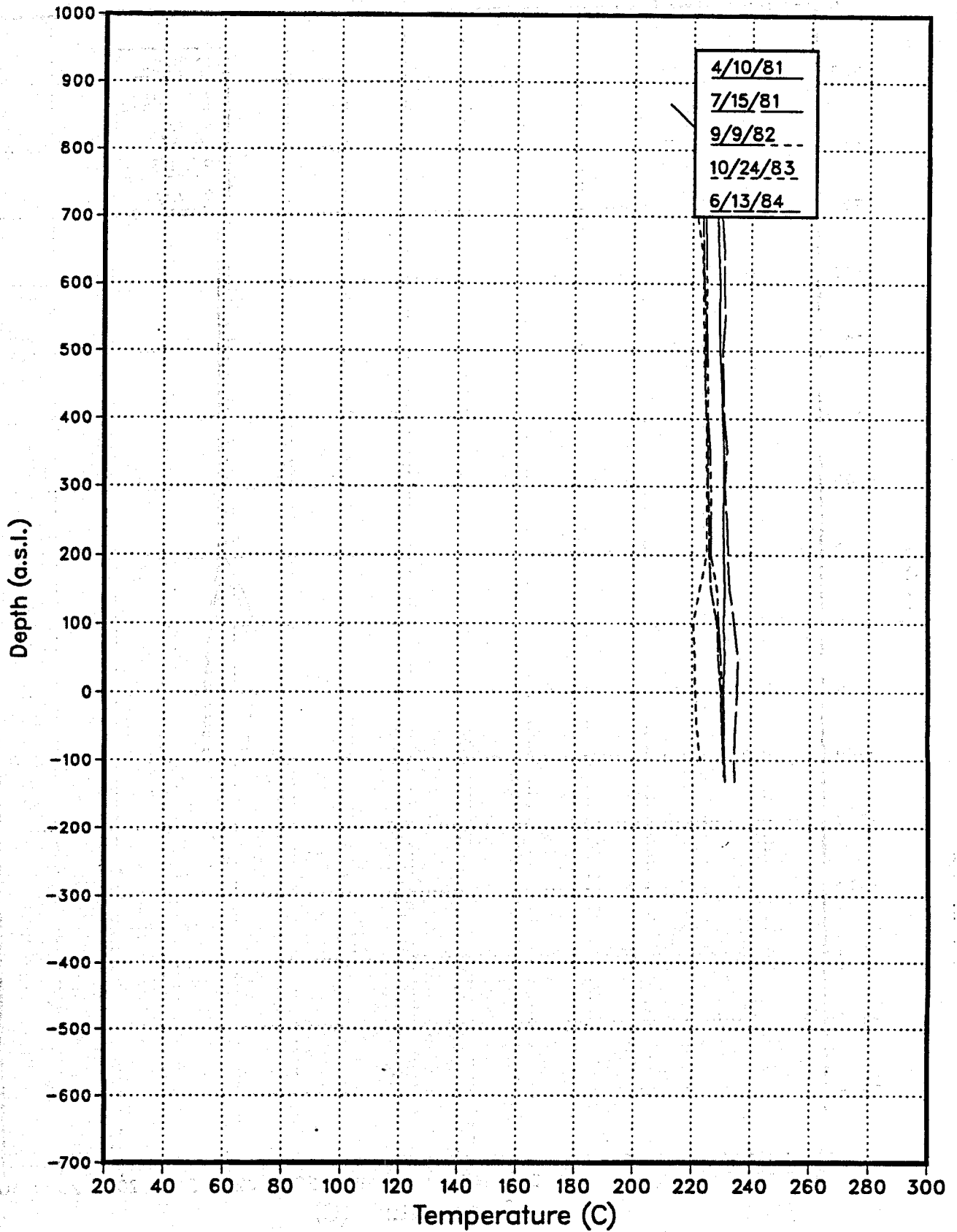
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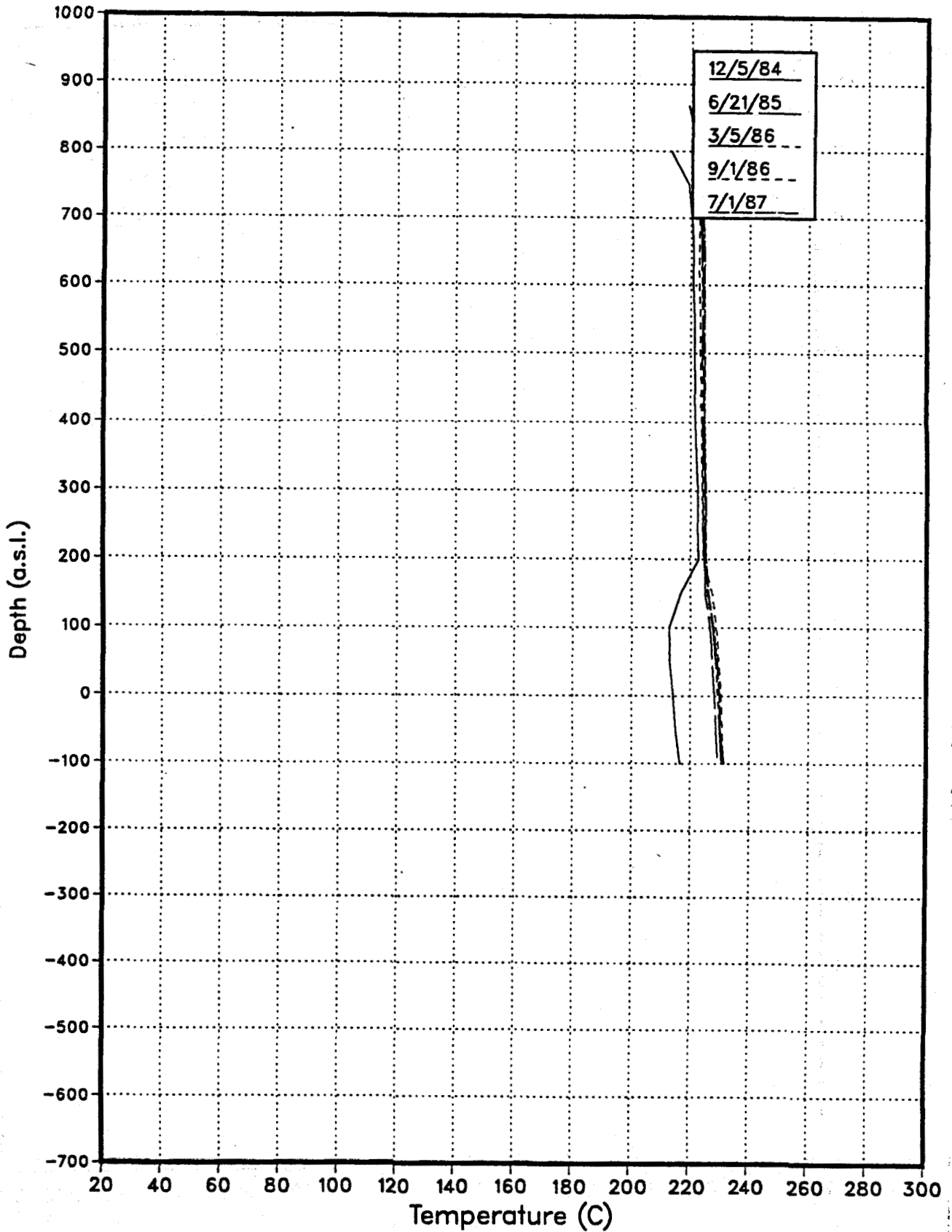
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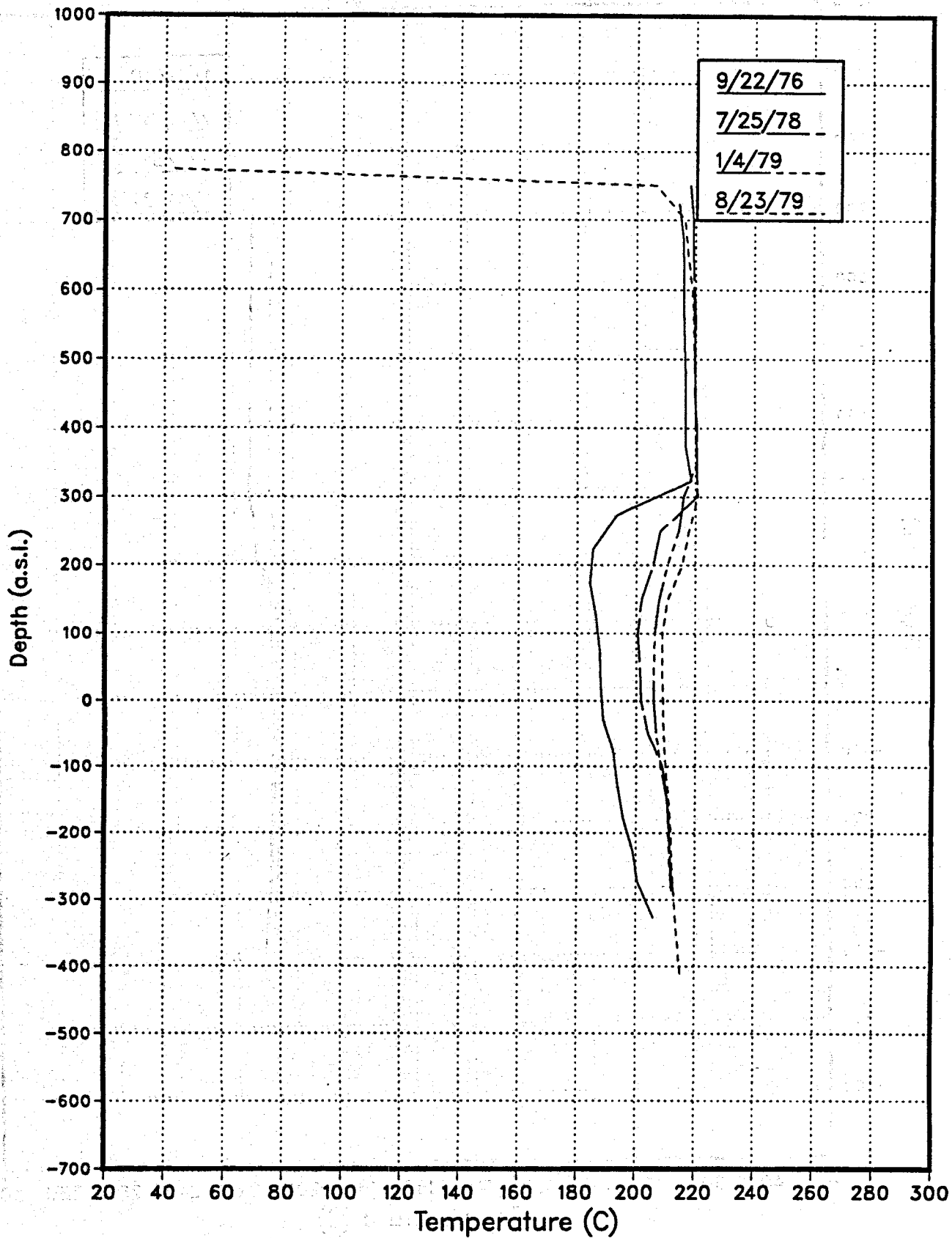
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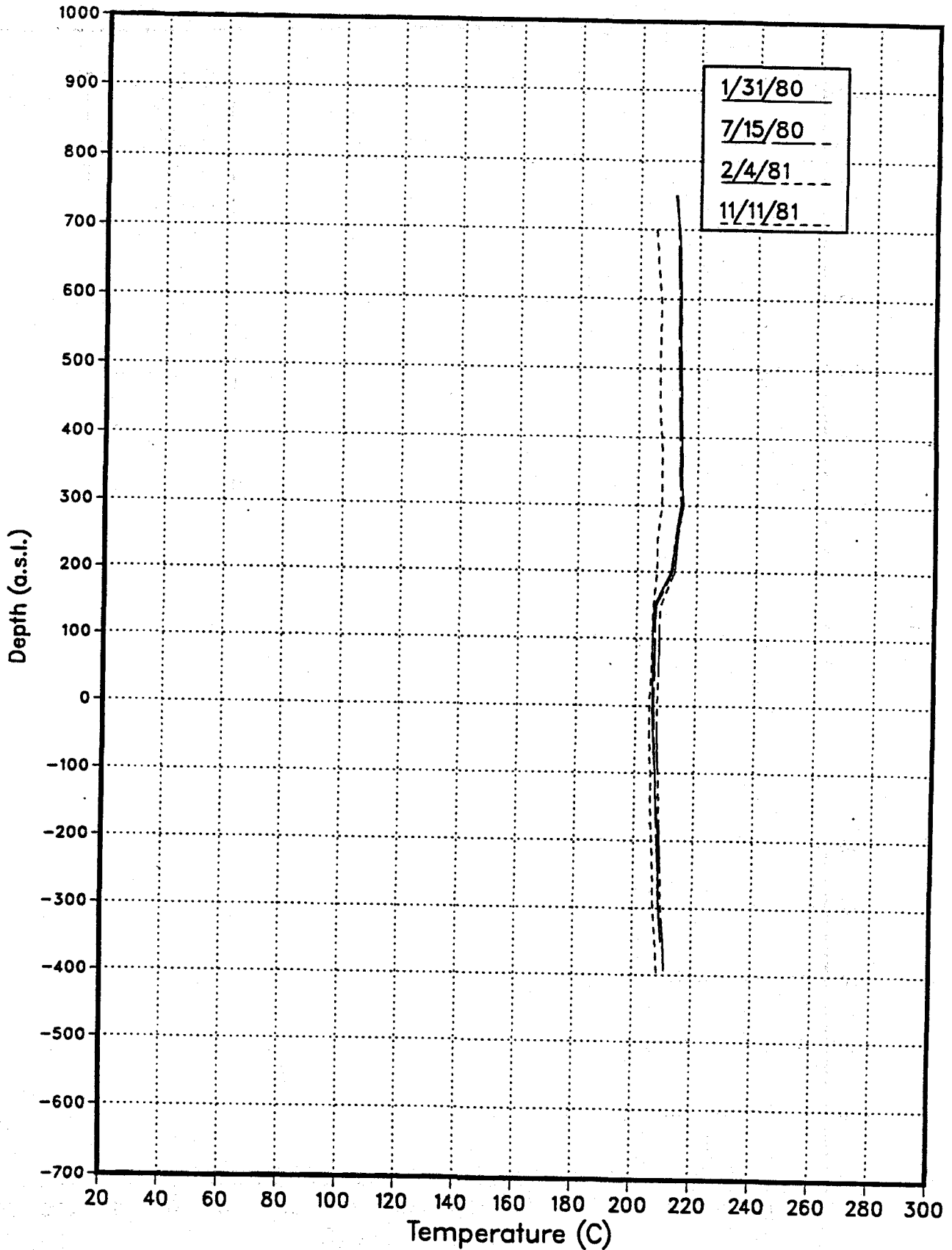
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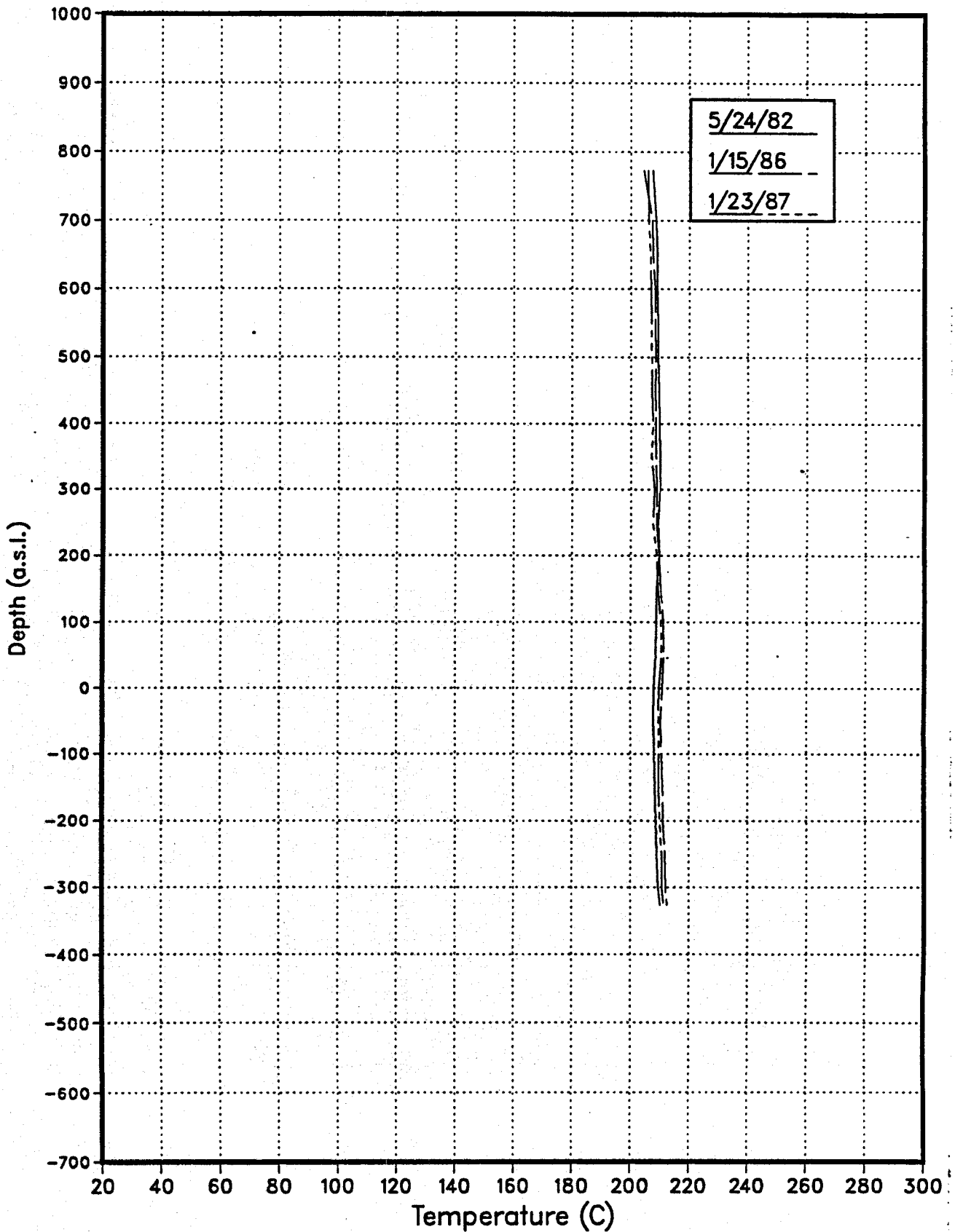
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AH17 Temperature Surveys



AH17 Temperature Surveys

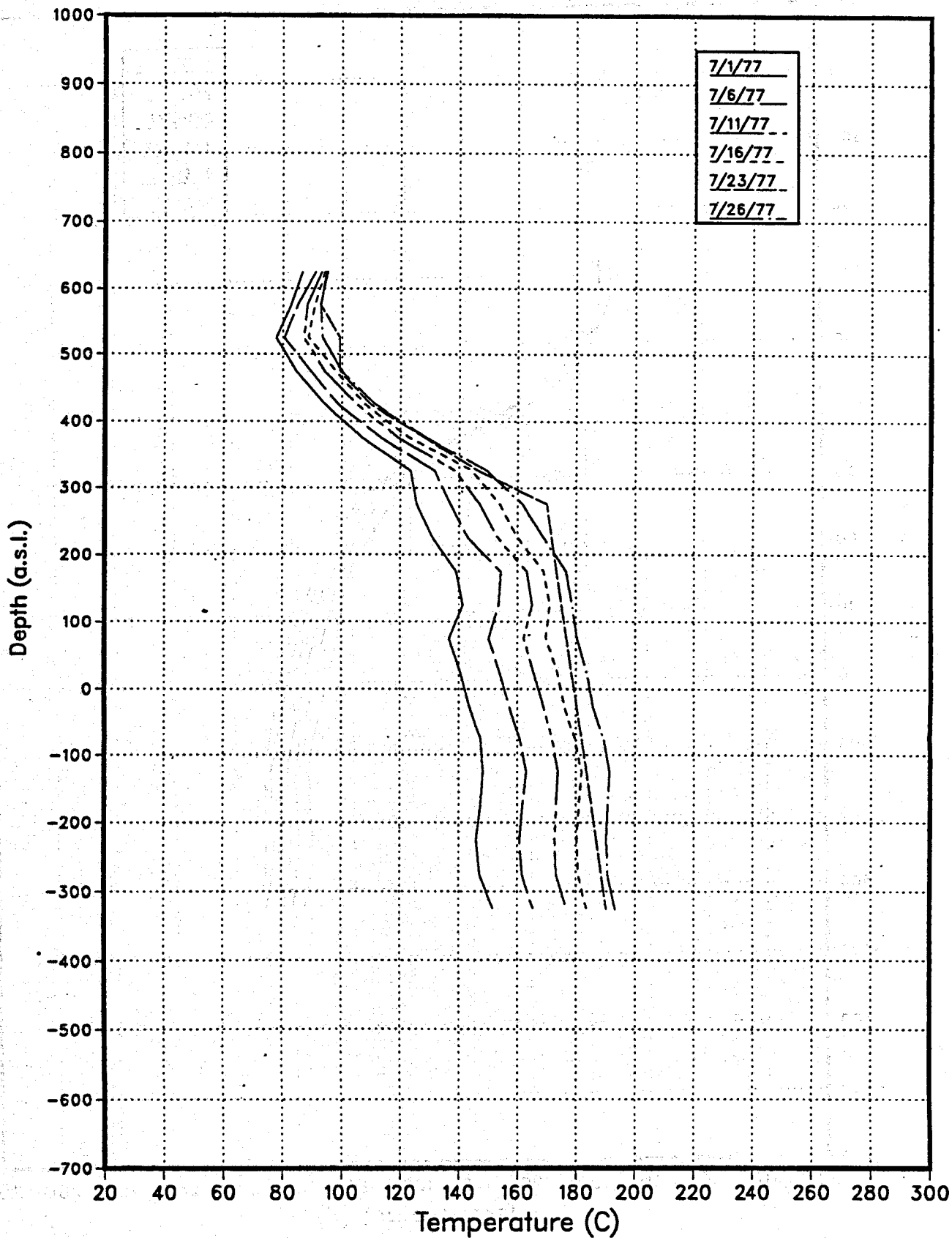


THE UNIVERSITY OF CHICAGO

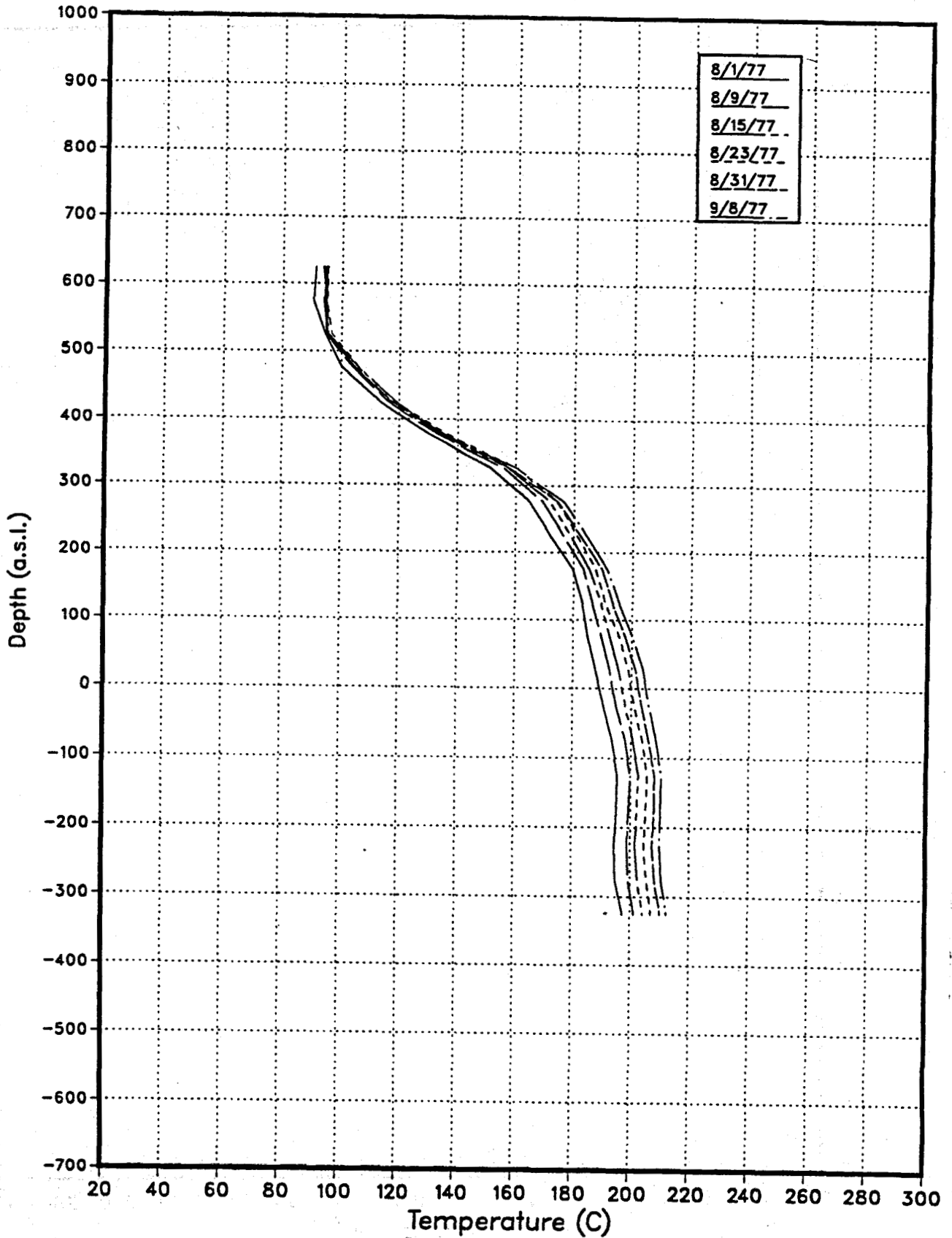
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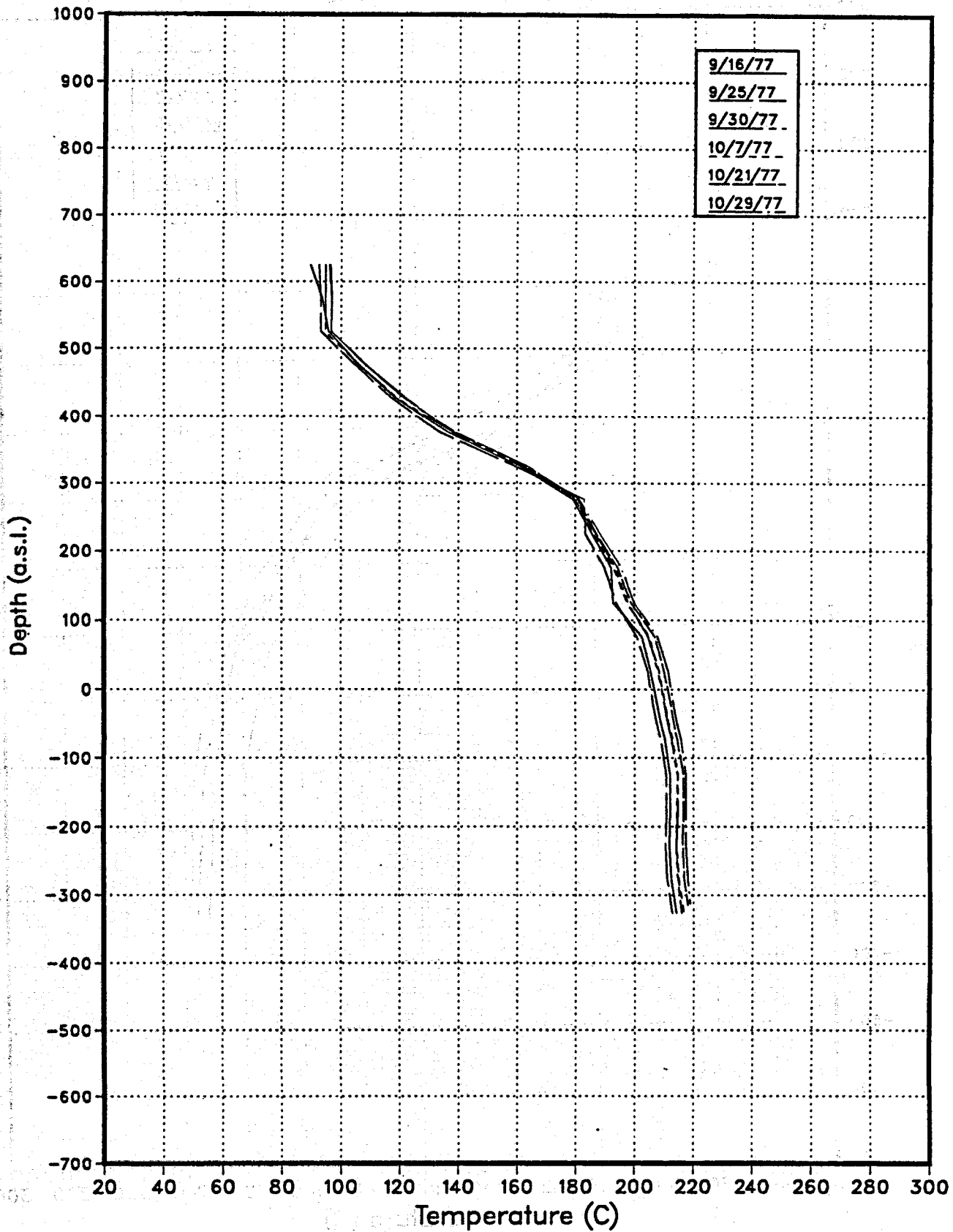
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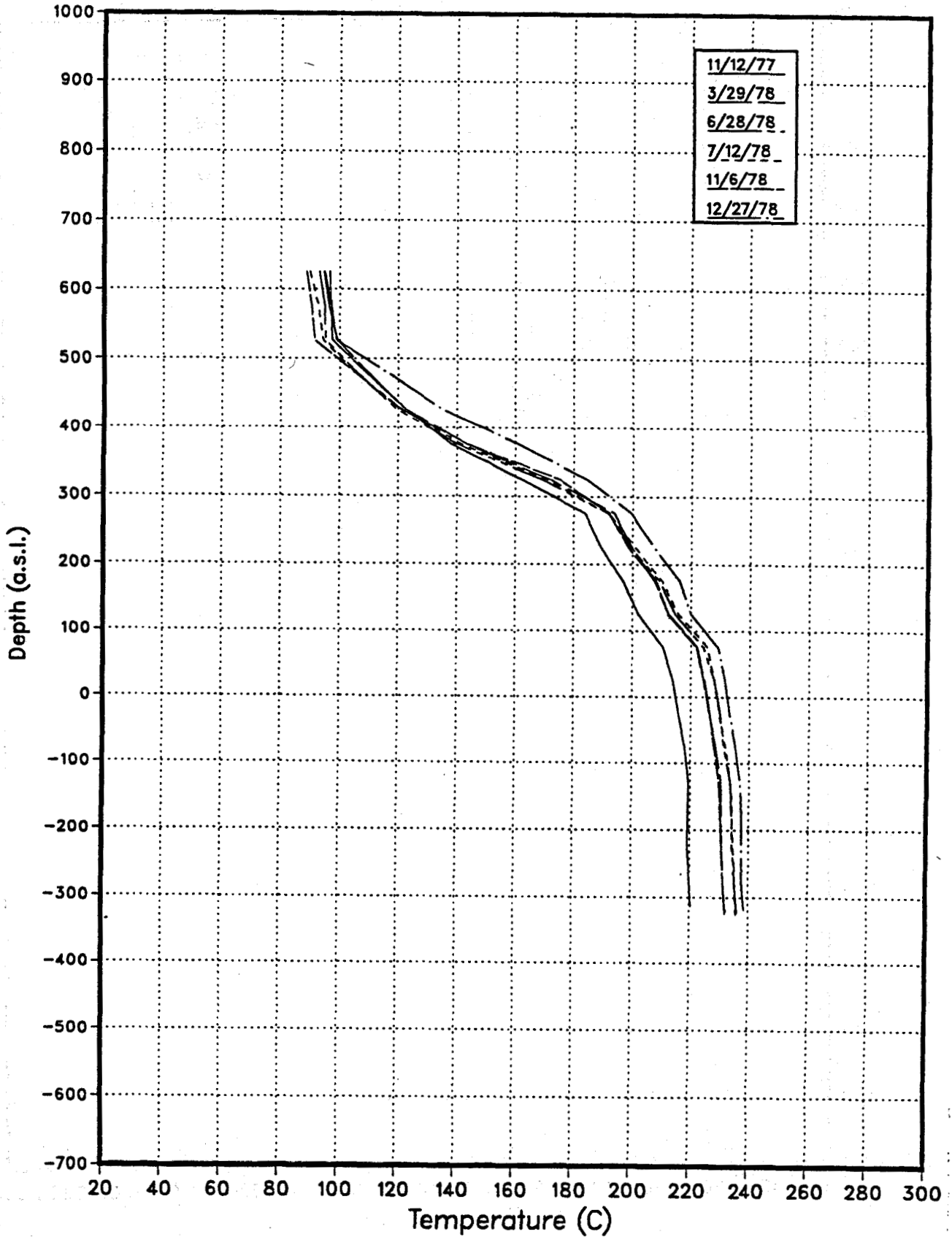
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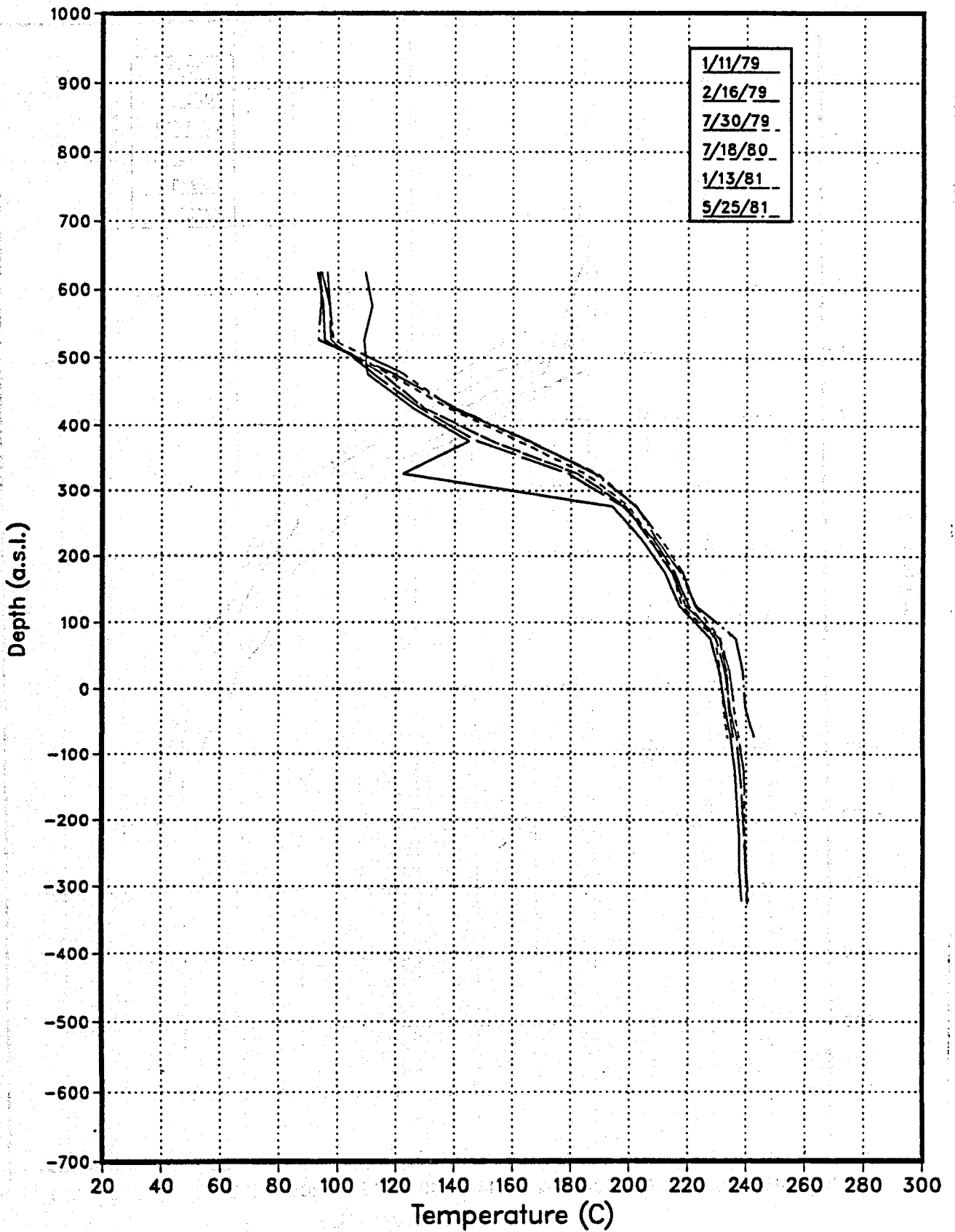
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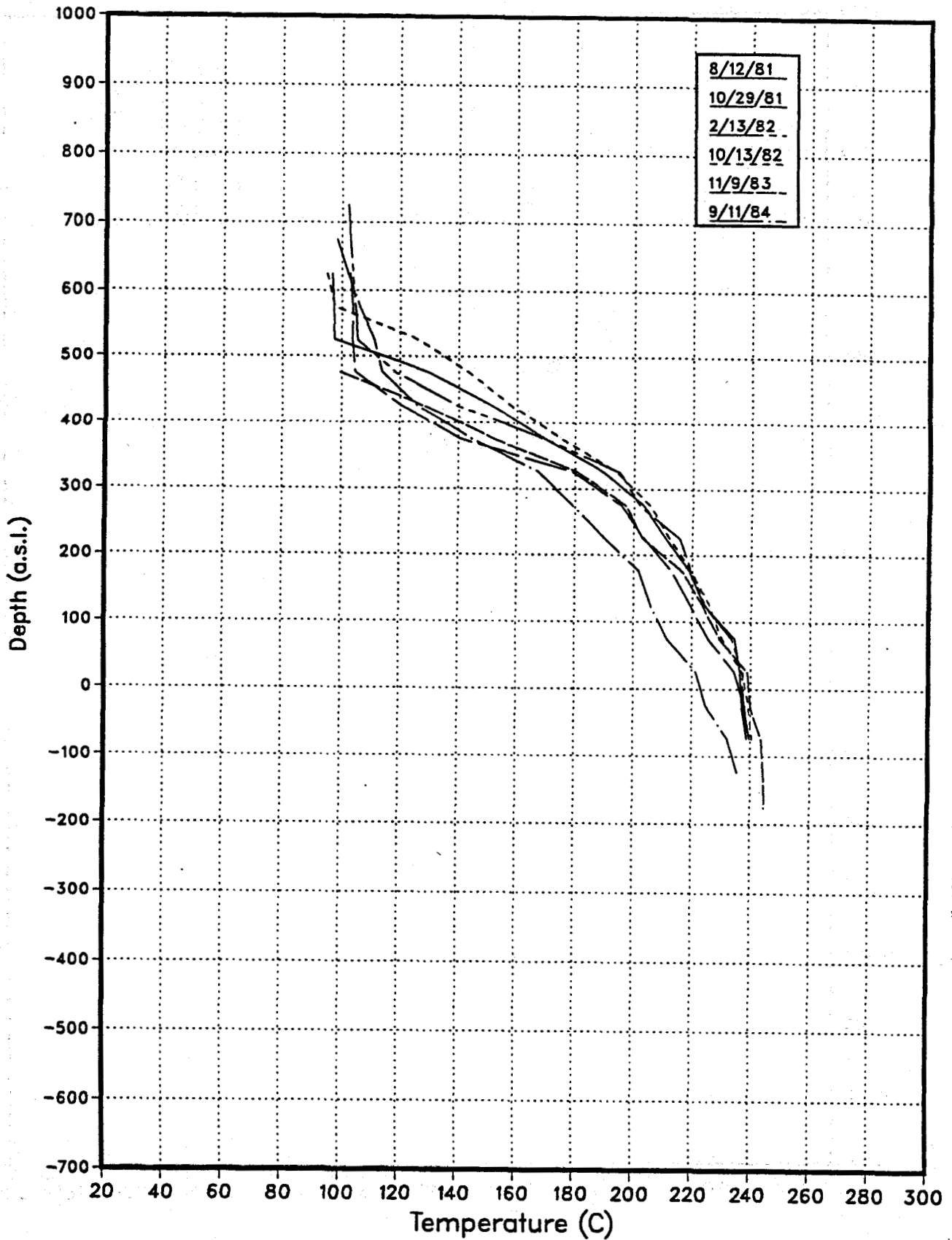
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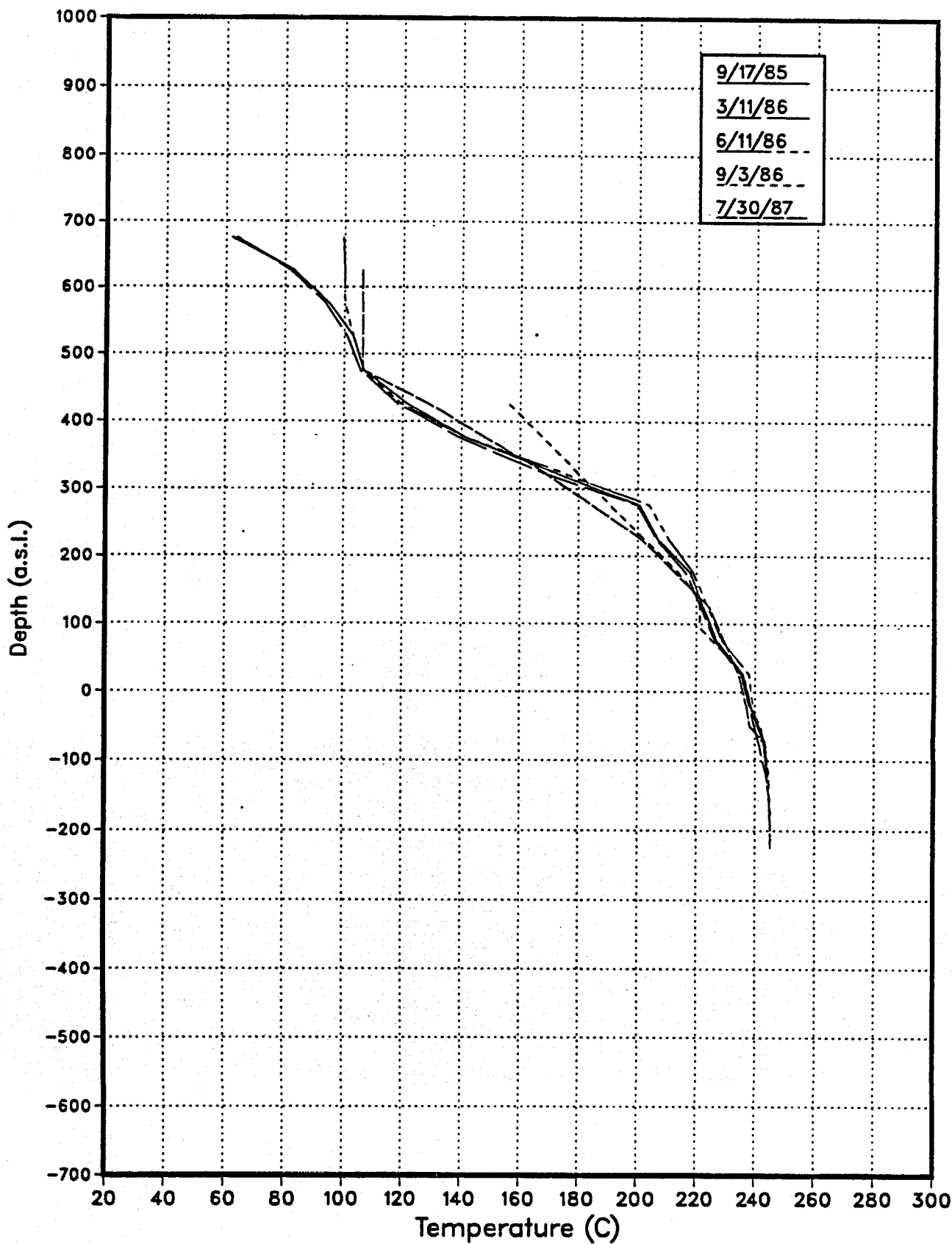
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AH18 Temperature Surveys



AH18 Temperature Surveys

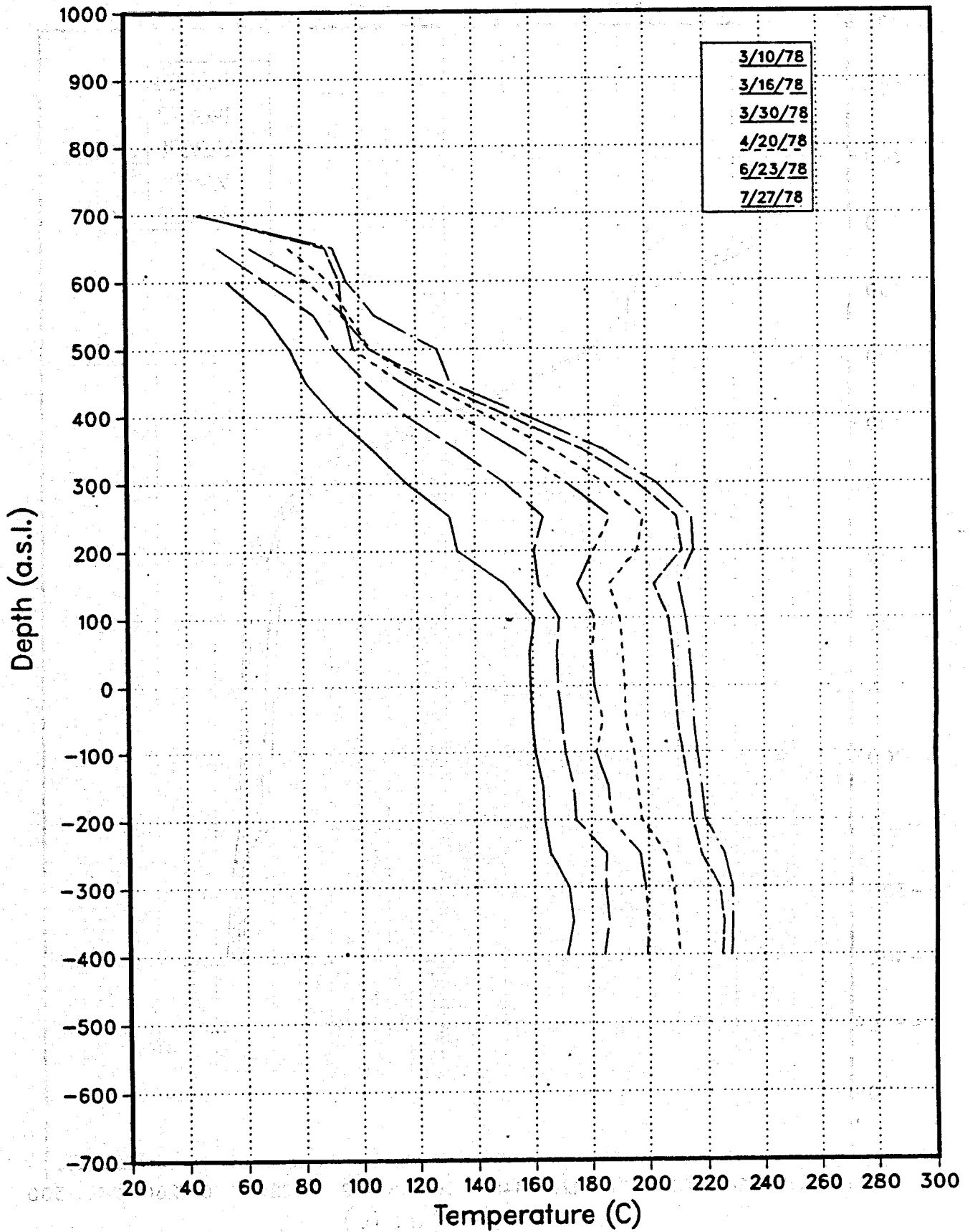


THE HISTORY OF THE UNITED STATES

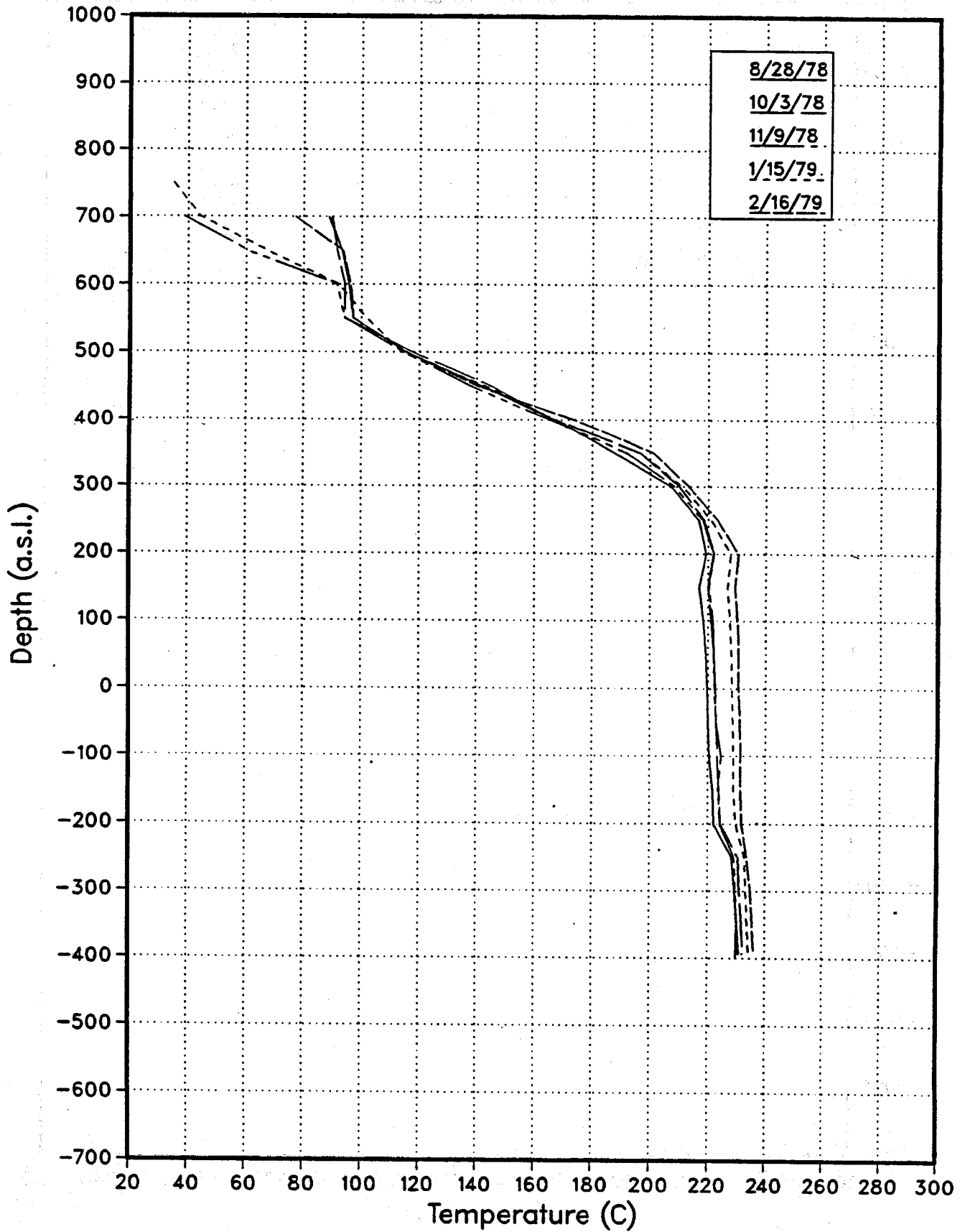
The history of the United States is a story of growth and change. From the first settlers to the present day, the nation has evolved through various stages of development. The early years were marked by exploration and the establishment of colonies. The American Revolution led to the birth of a new nation, and the subsequent years saw the expansion of territory and the growth of a diverse population. The Civil War was a pivotal moment in the nation's history, leading to the abolition of slavery and the strengthening of the federal government. The 20th century brought significant social and economic changes, including the rise of the industrial revolution and the emergence of the United States as a global superpower. Today, the United States continues to face new challenges and opportunities, and its history remains a source of inspiration and guidance for the future.

The early years of the United States were characterized by a spirit of adventure and discovery. Explorers like Christopher Columbus and John Cabot opened up new worlds, and settlers sought a better life in the New World. The Pilgrims and Puritans established colonies that would become the foundation of the United States. The American Revolution was a struggle for independence, and the resulting Constitution established a new form of government. The nation's territory expanded westward, and the population grew rapidly. The Civil War was a defining moment, as the nation grappled with the issue of slavery. The war ended with the Union's victory, and the Reconstruction period followed. The 20th century saw the United States emerge as a world leader, with its economy and military power reaching unprecedented levels. The Cold War era was marked by tensions with the Soviet Union, and the Vietnam War tested the nation's resolve. Today, the United States remains a global superpower, and its history continues to shape the world.

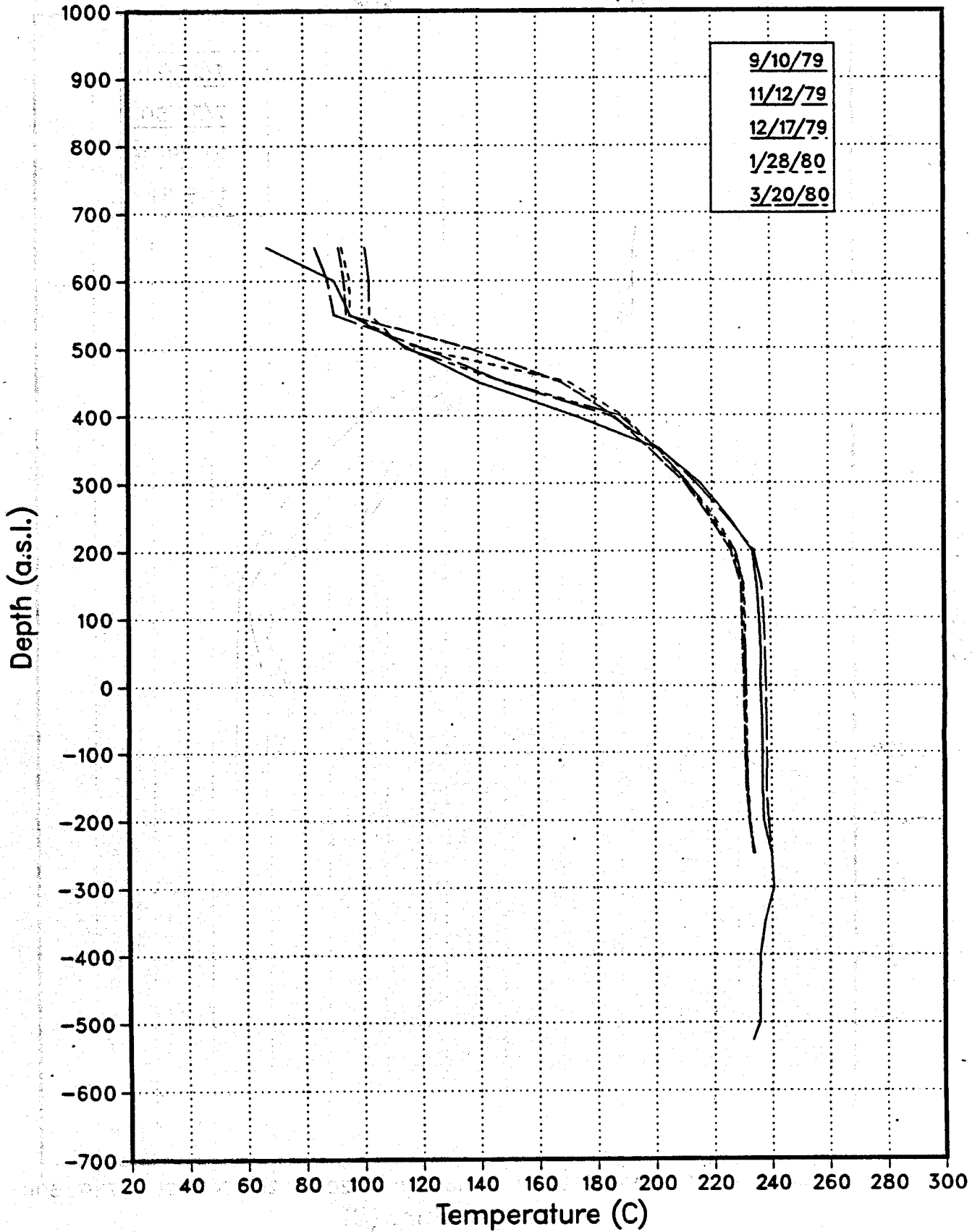
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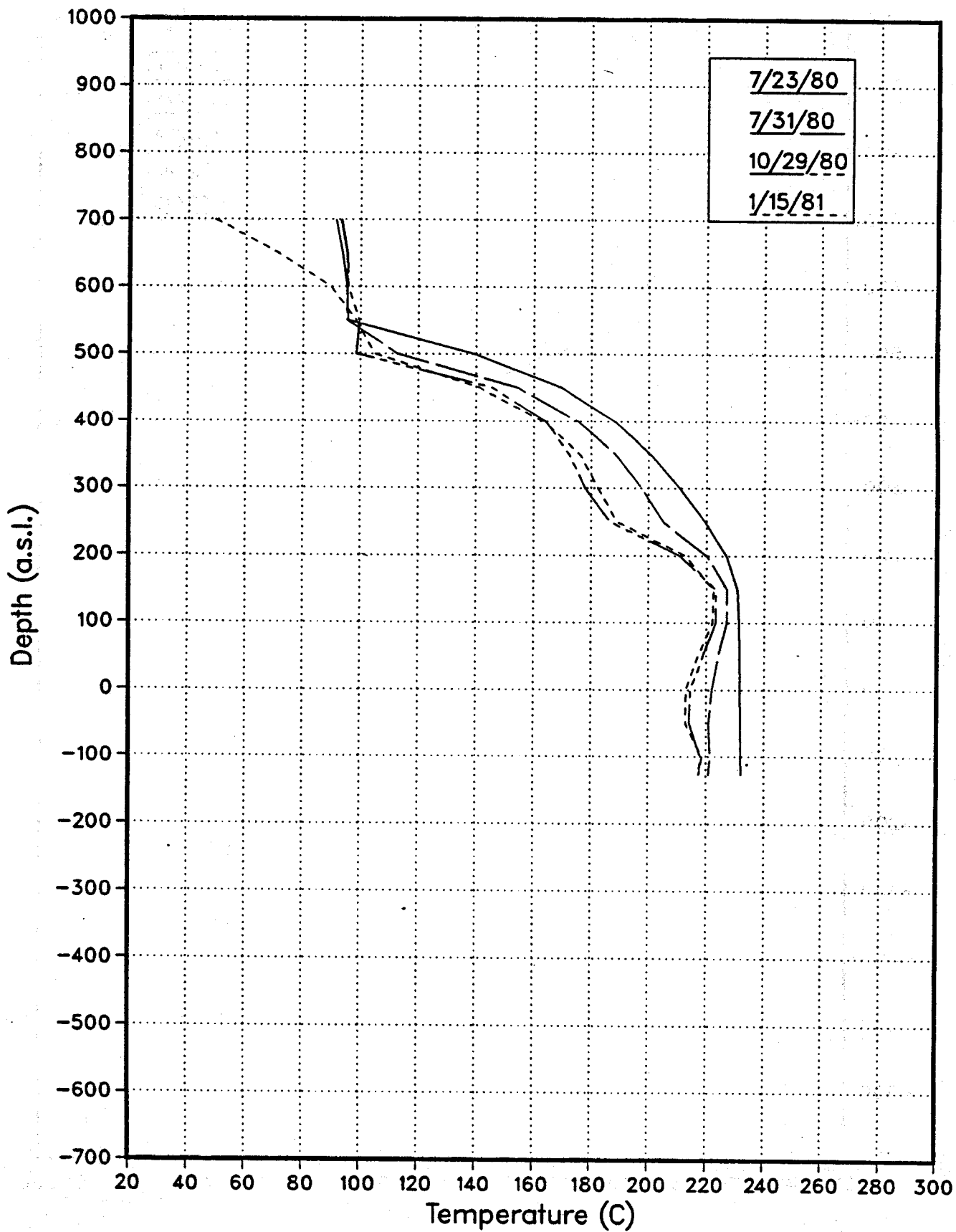
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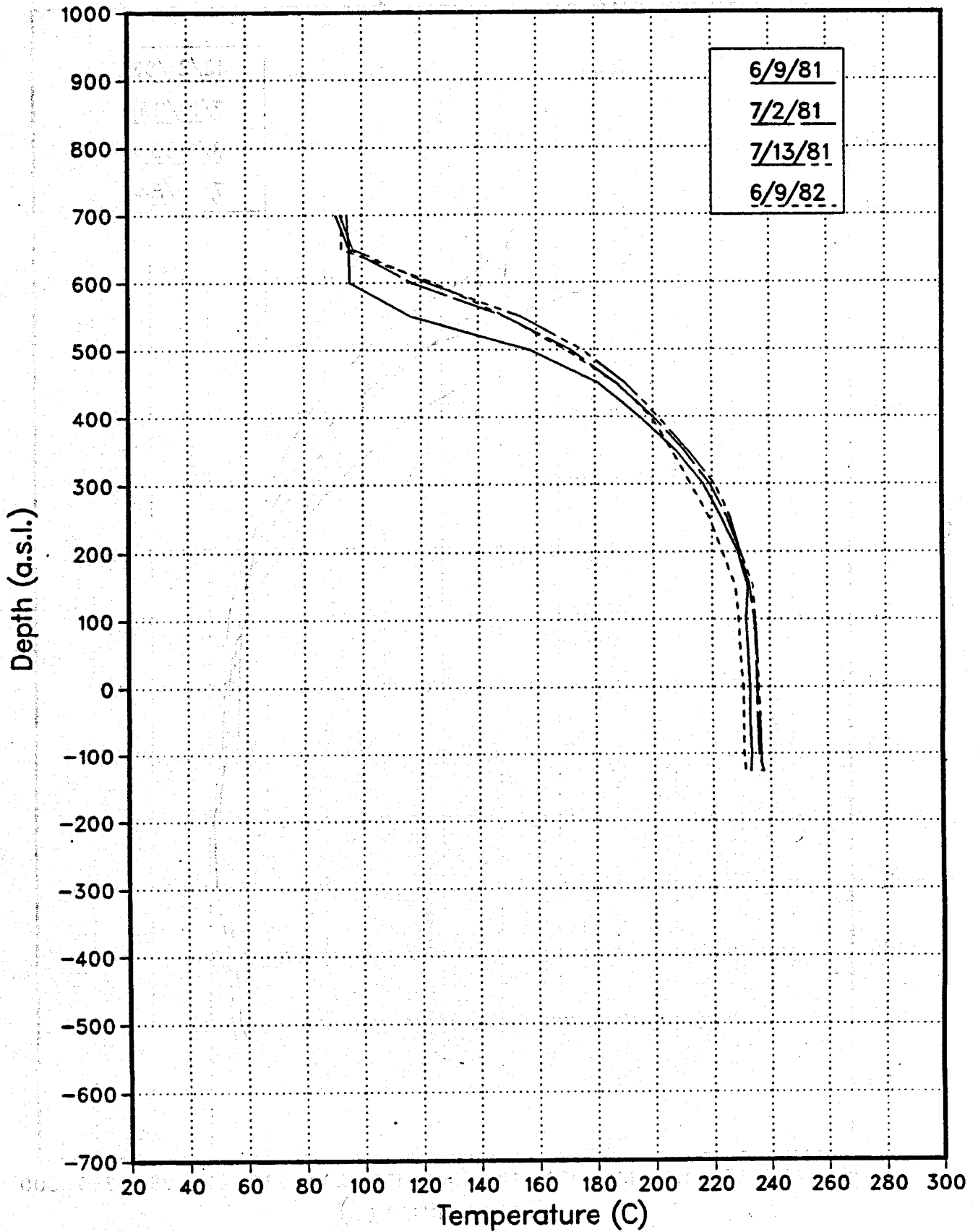
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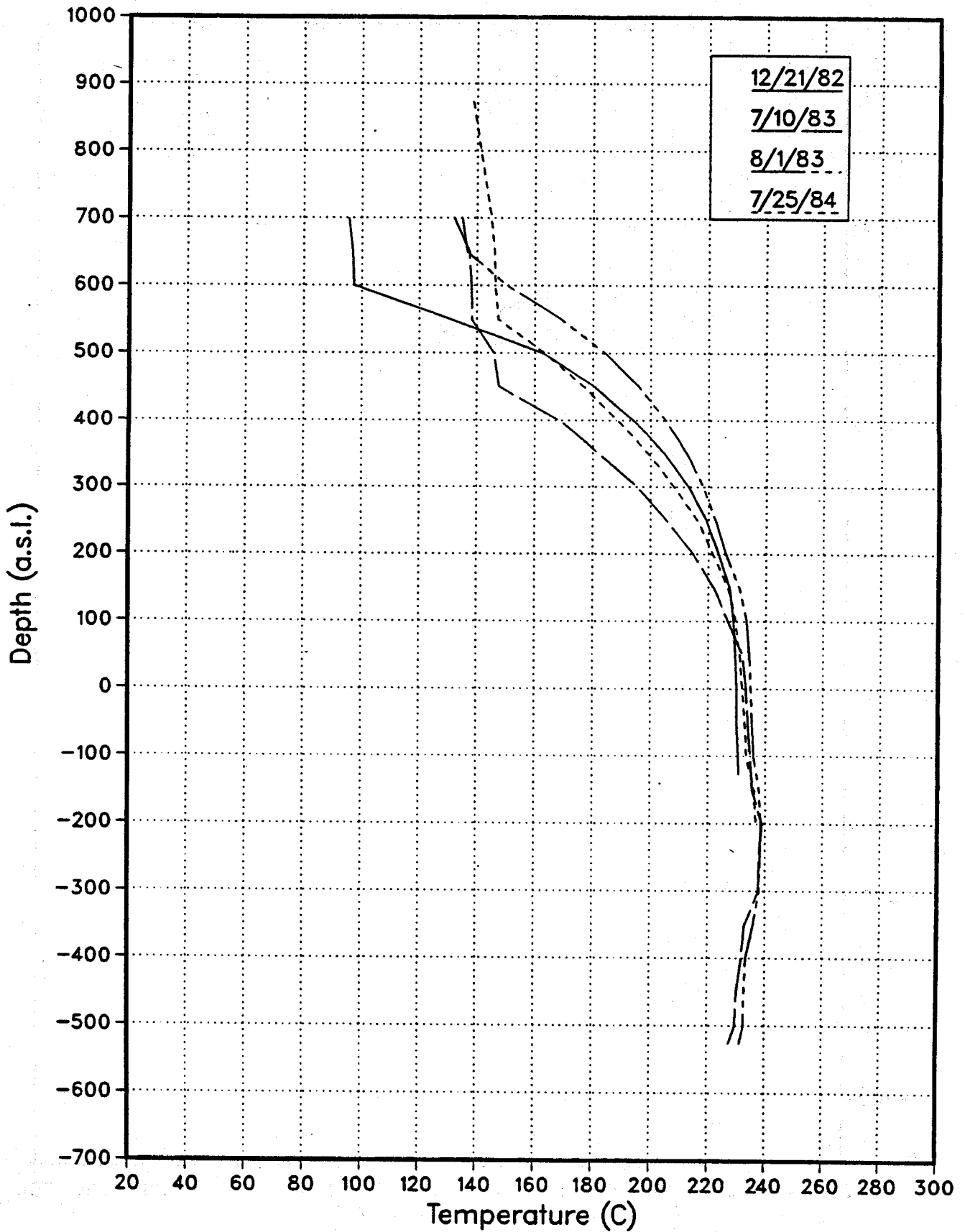
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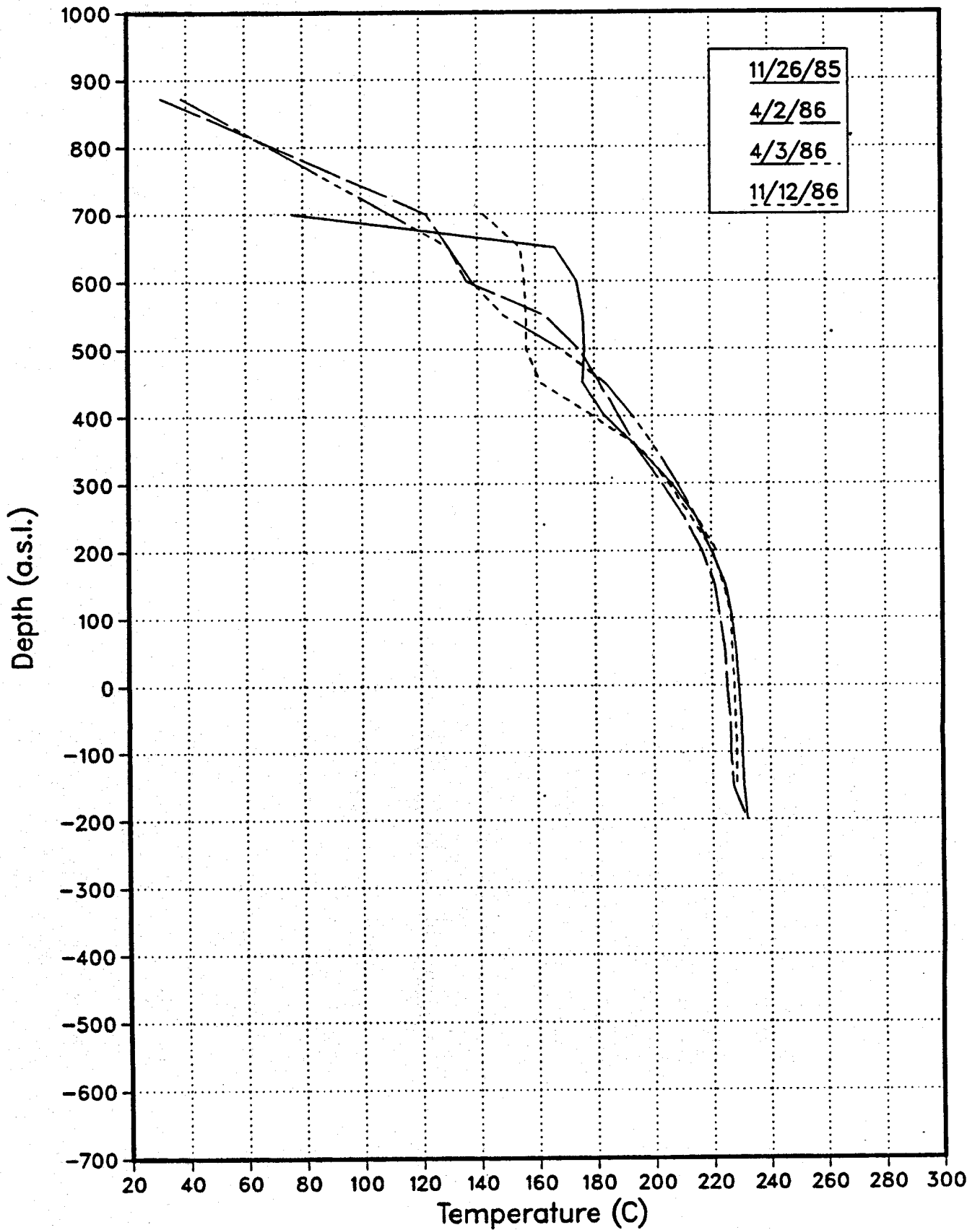
AH19 Temperature Surveys



AH19 Temperature Surveys



AH19 Temperature Surveys



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FROM : [Name]

SUBJECT: [Subject]

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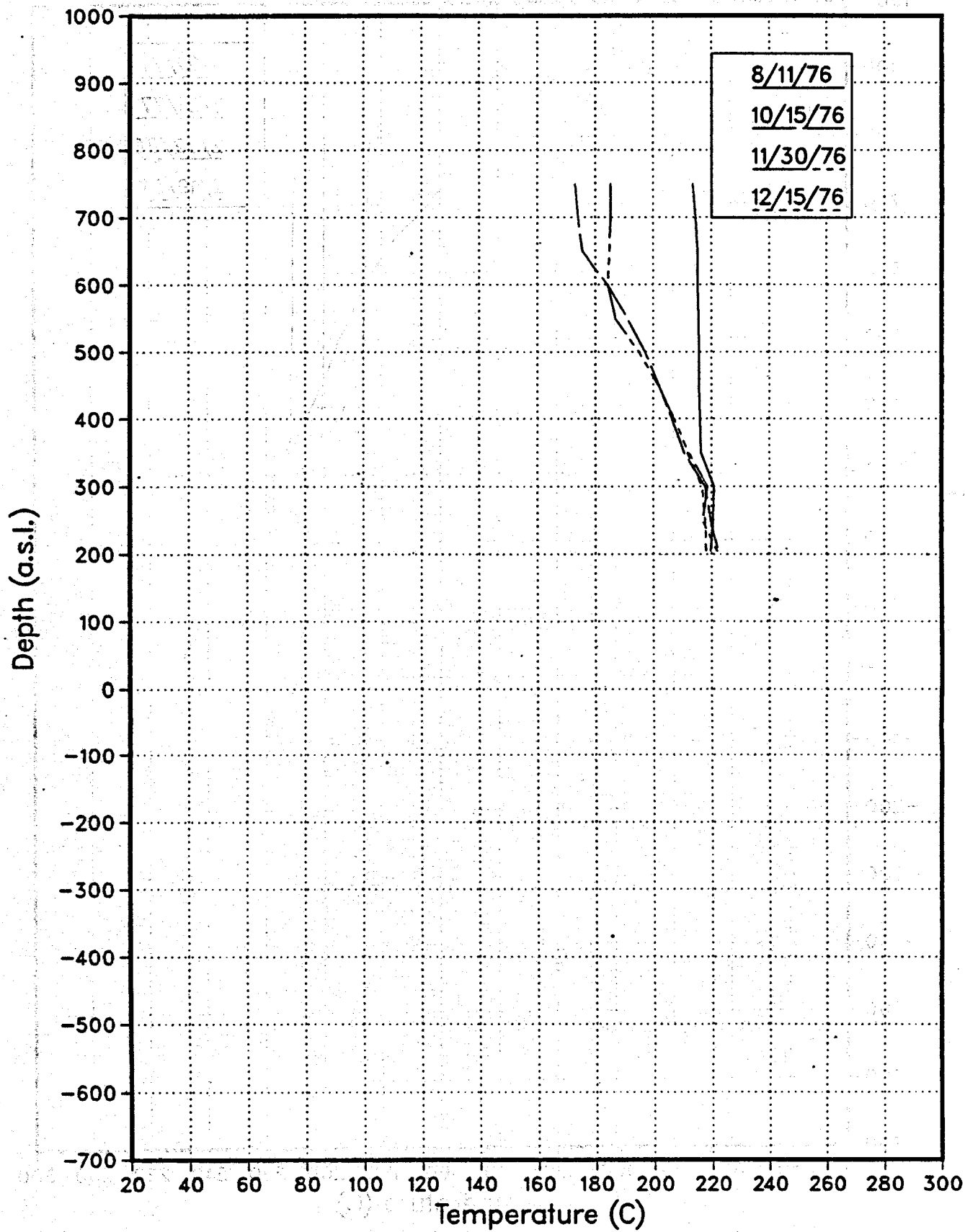
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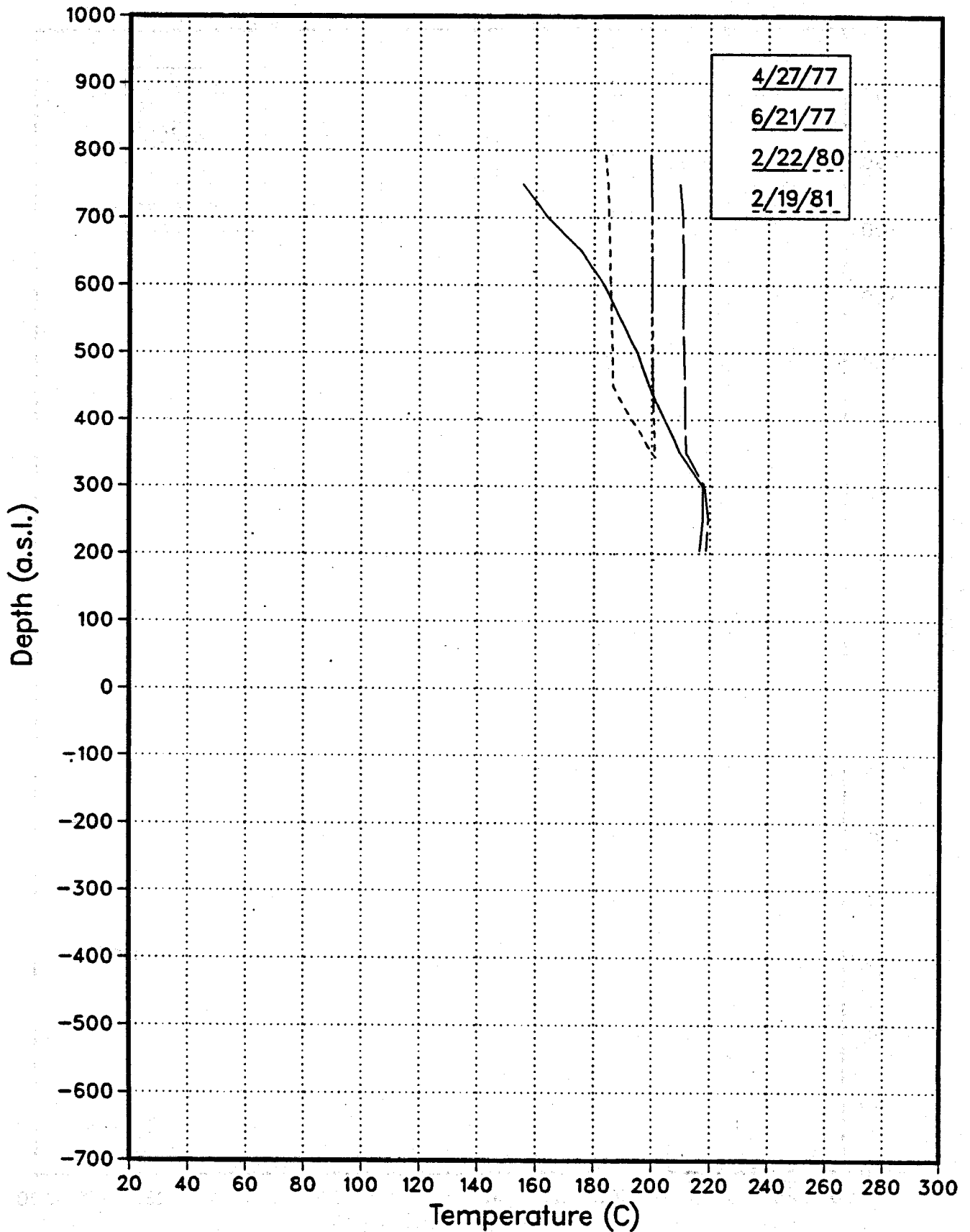
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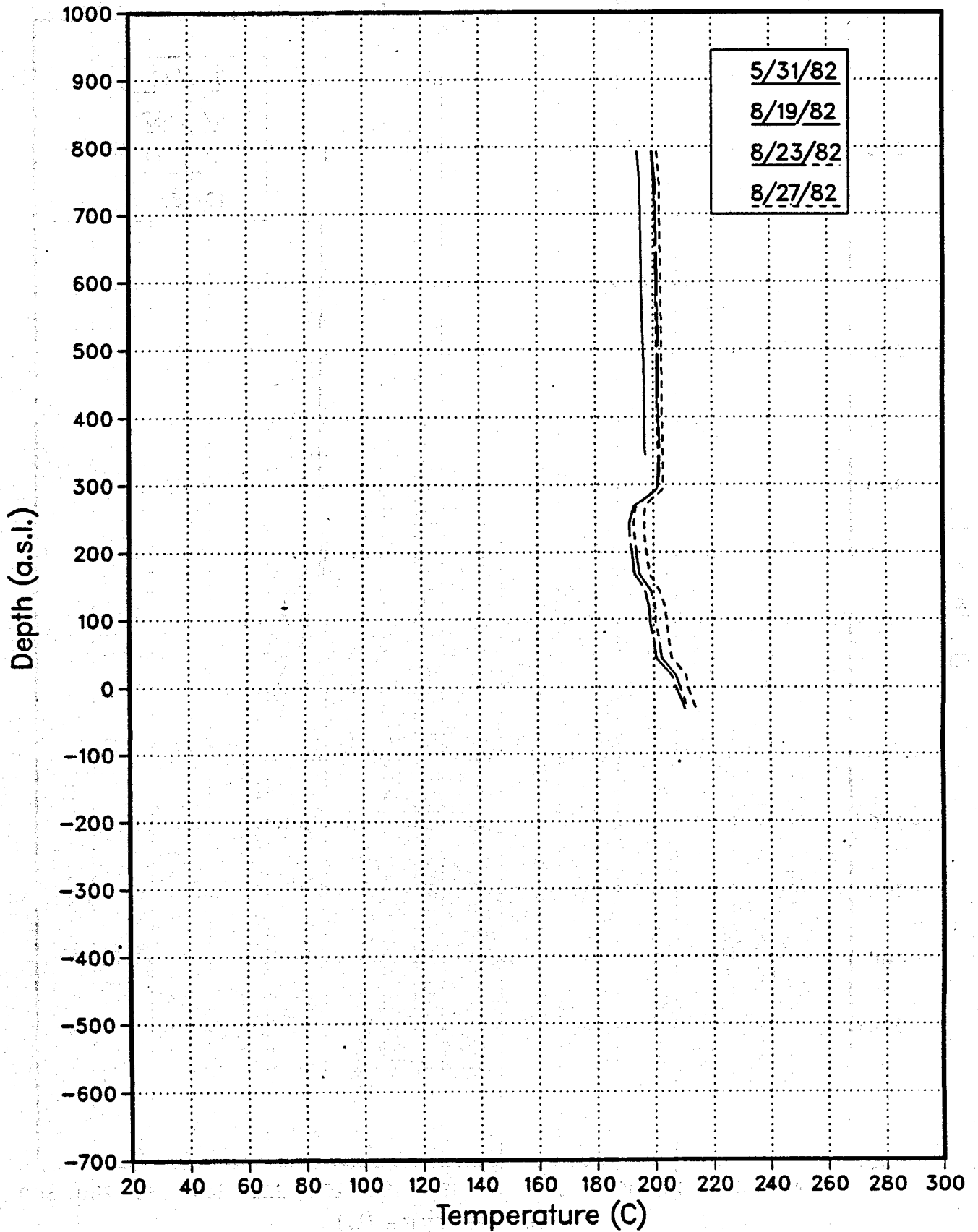
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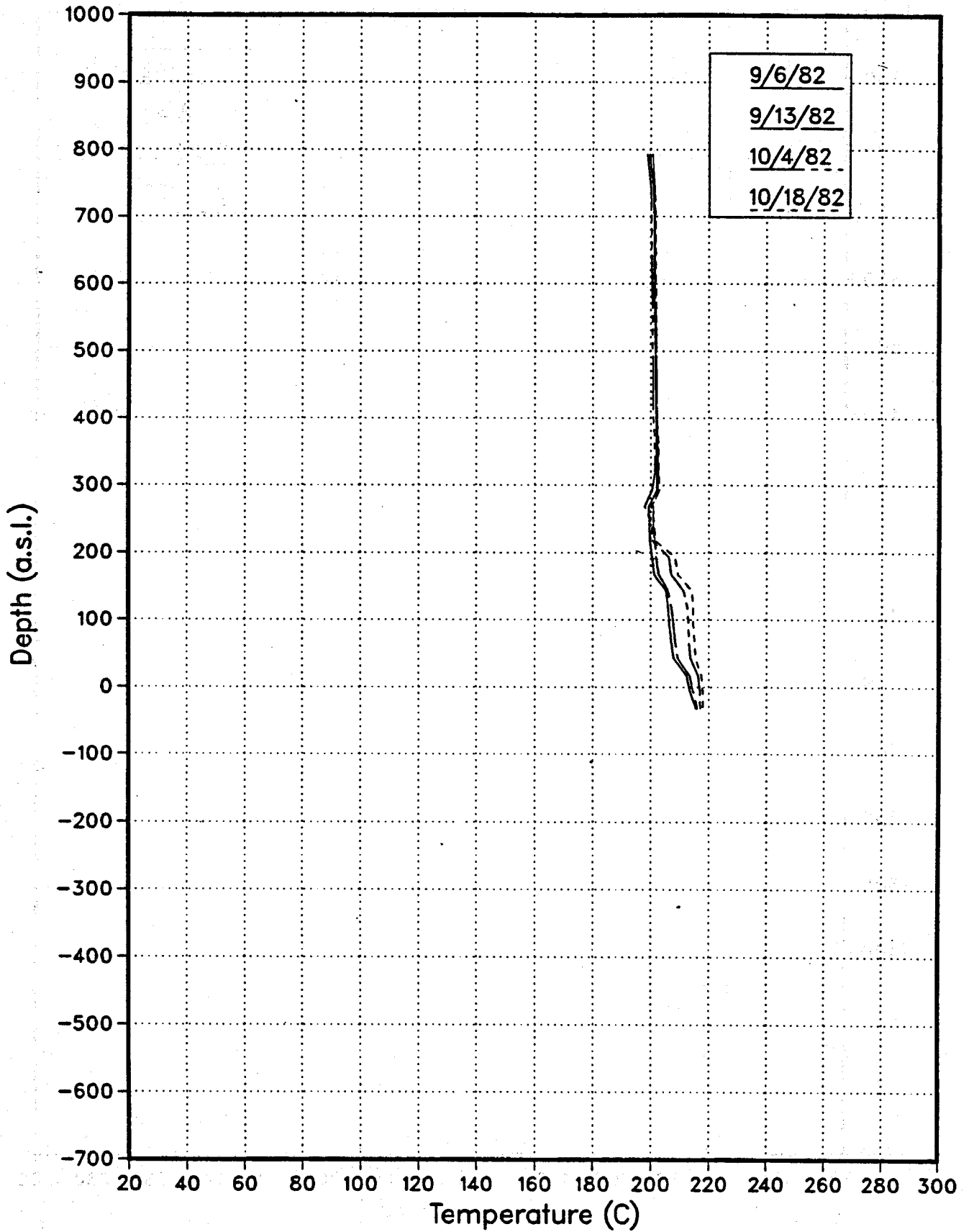
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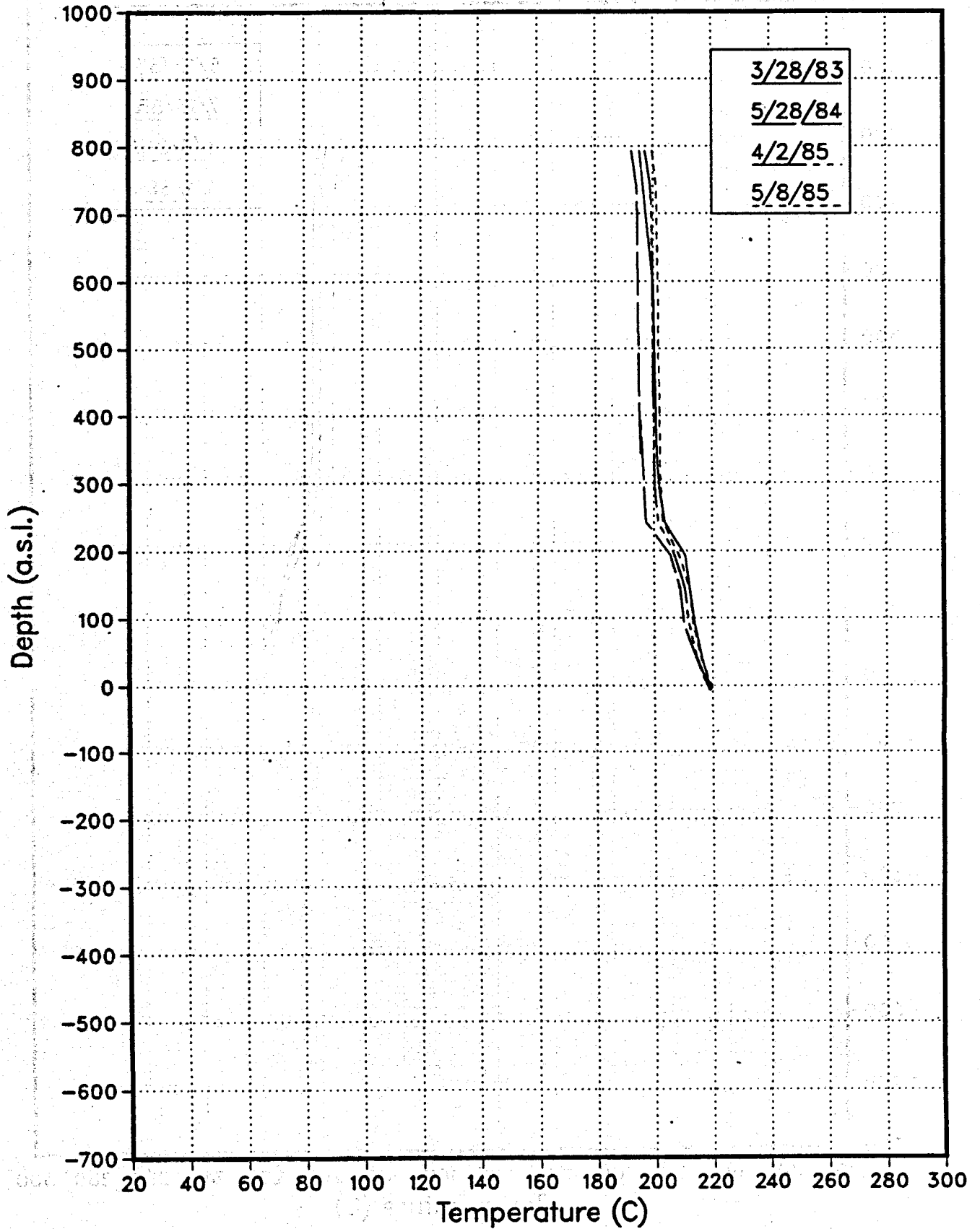
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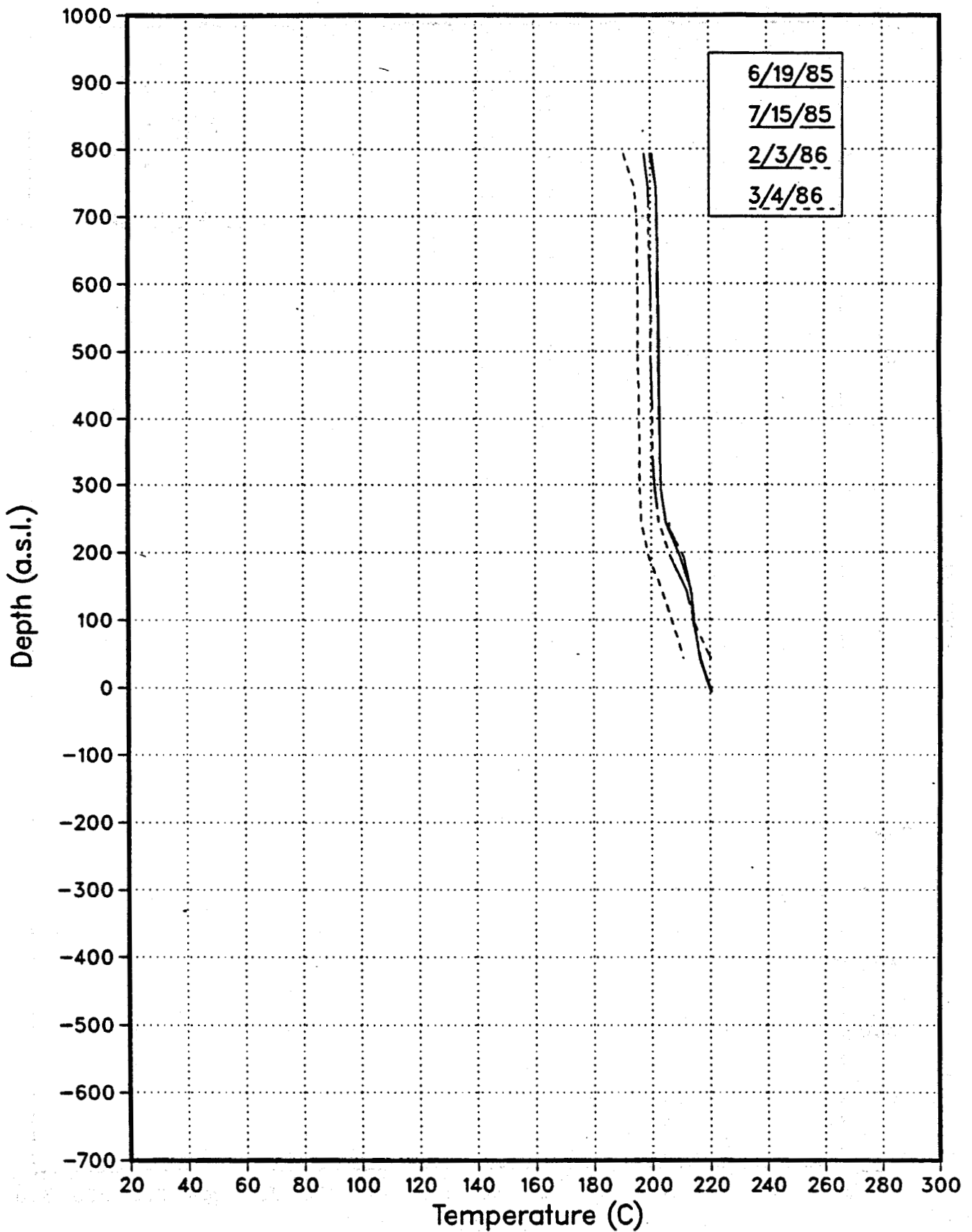
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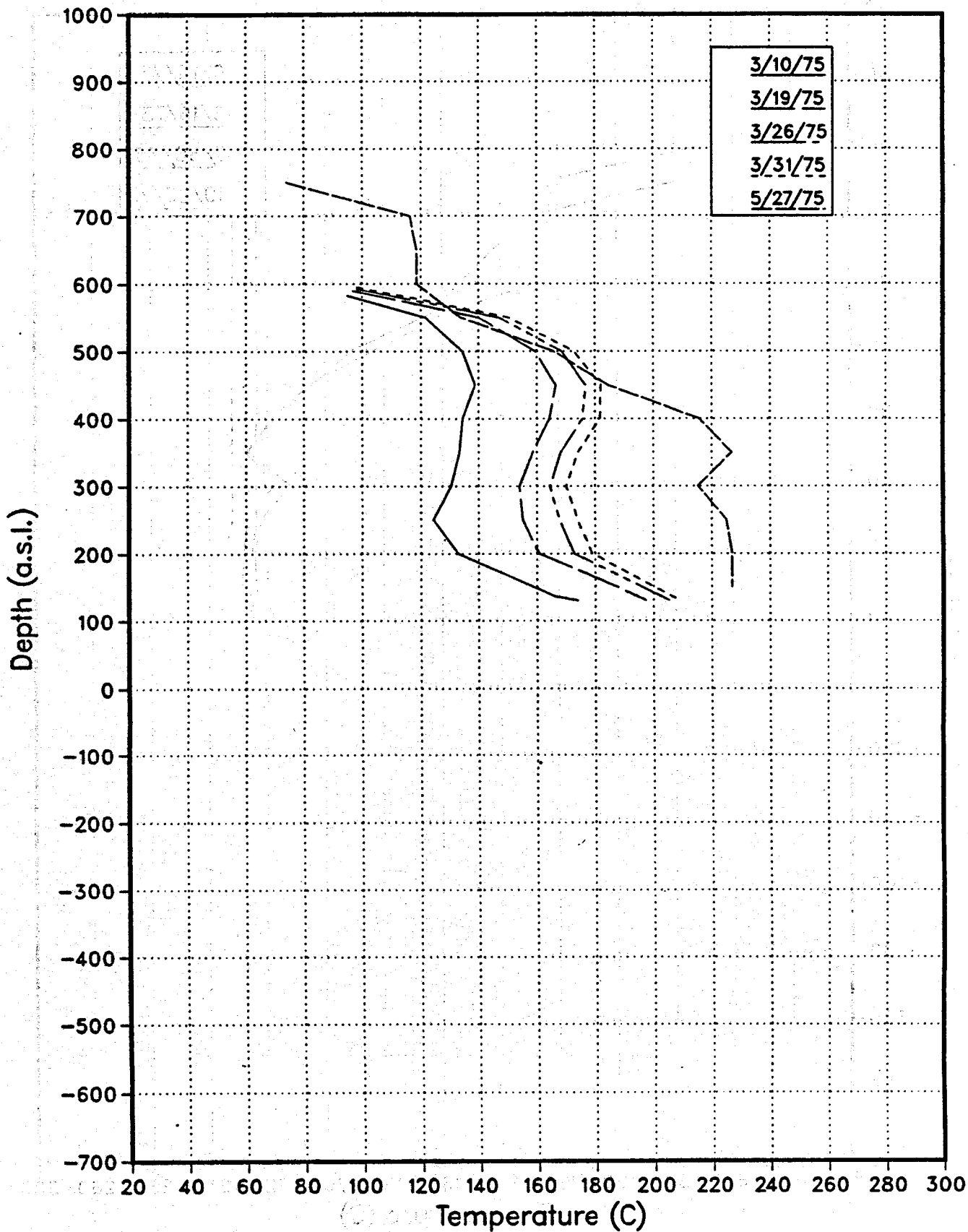
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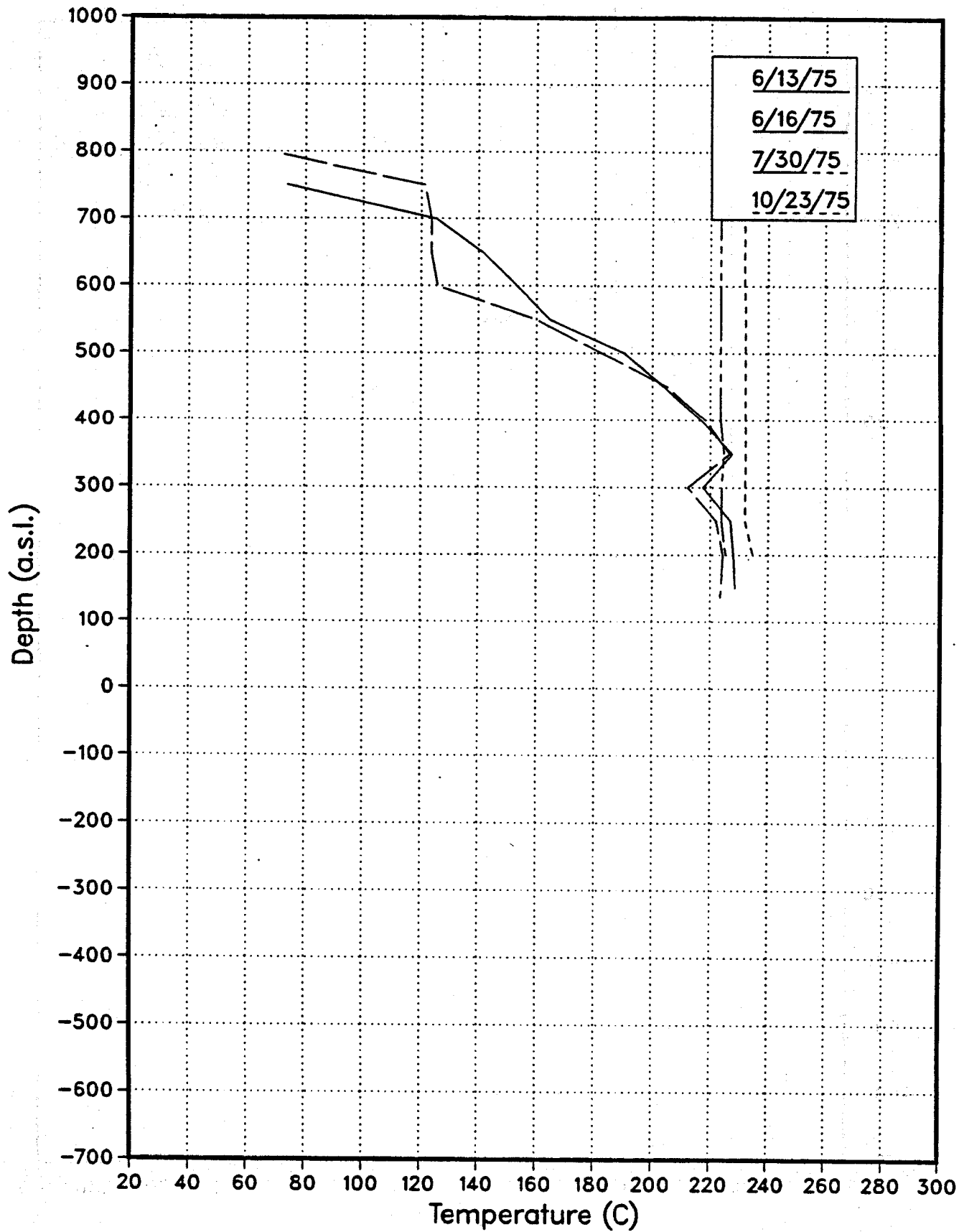
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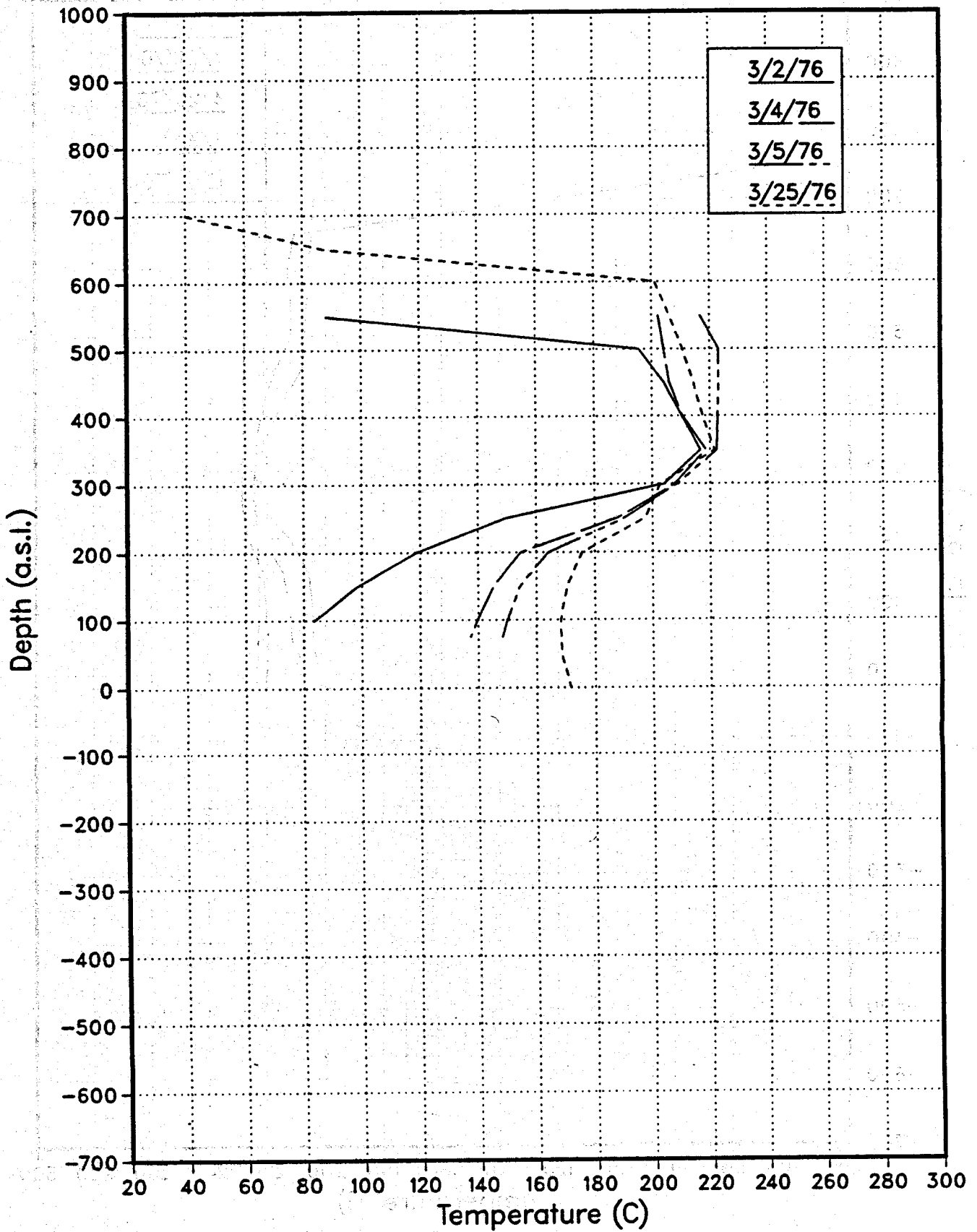
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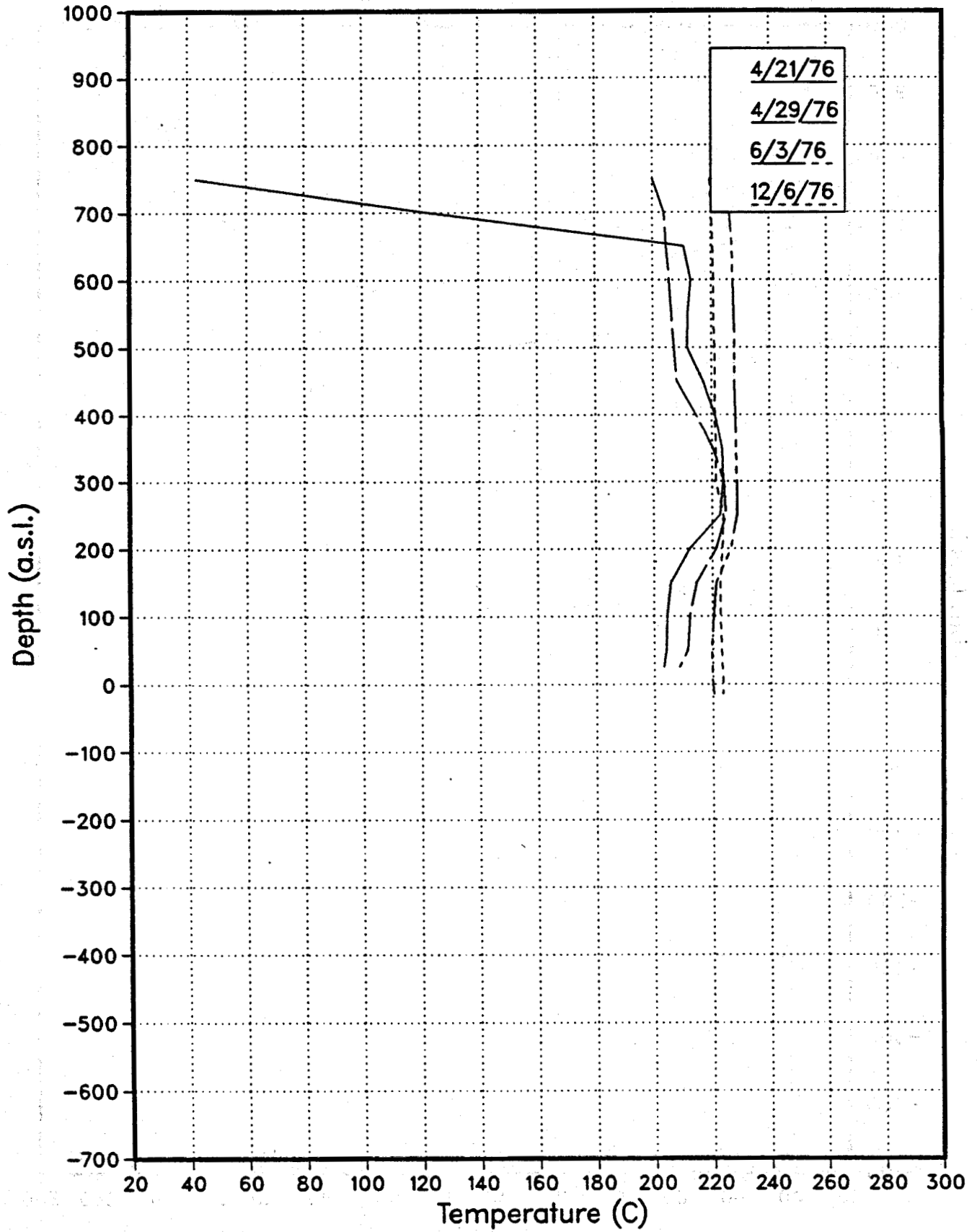
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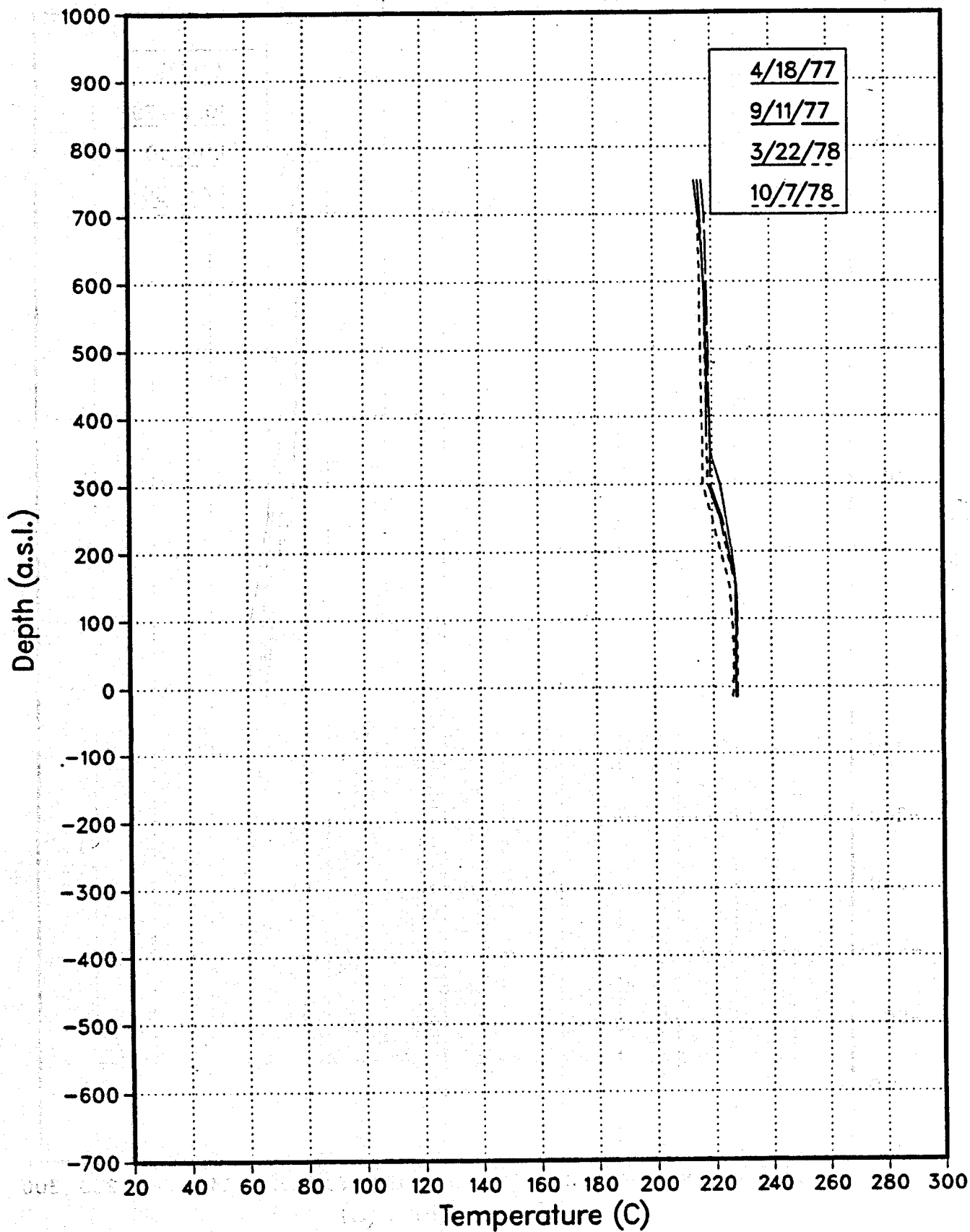
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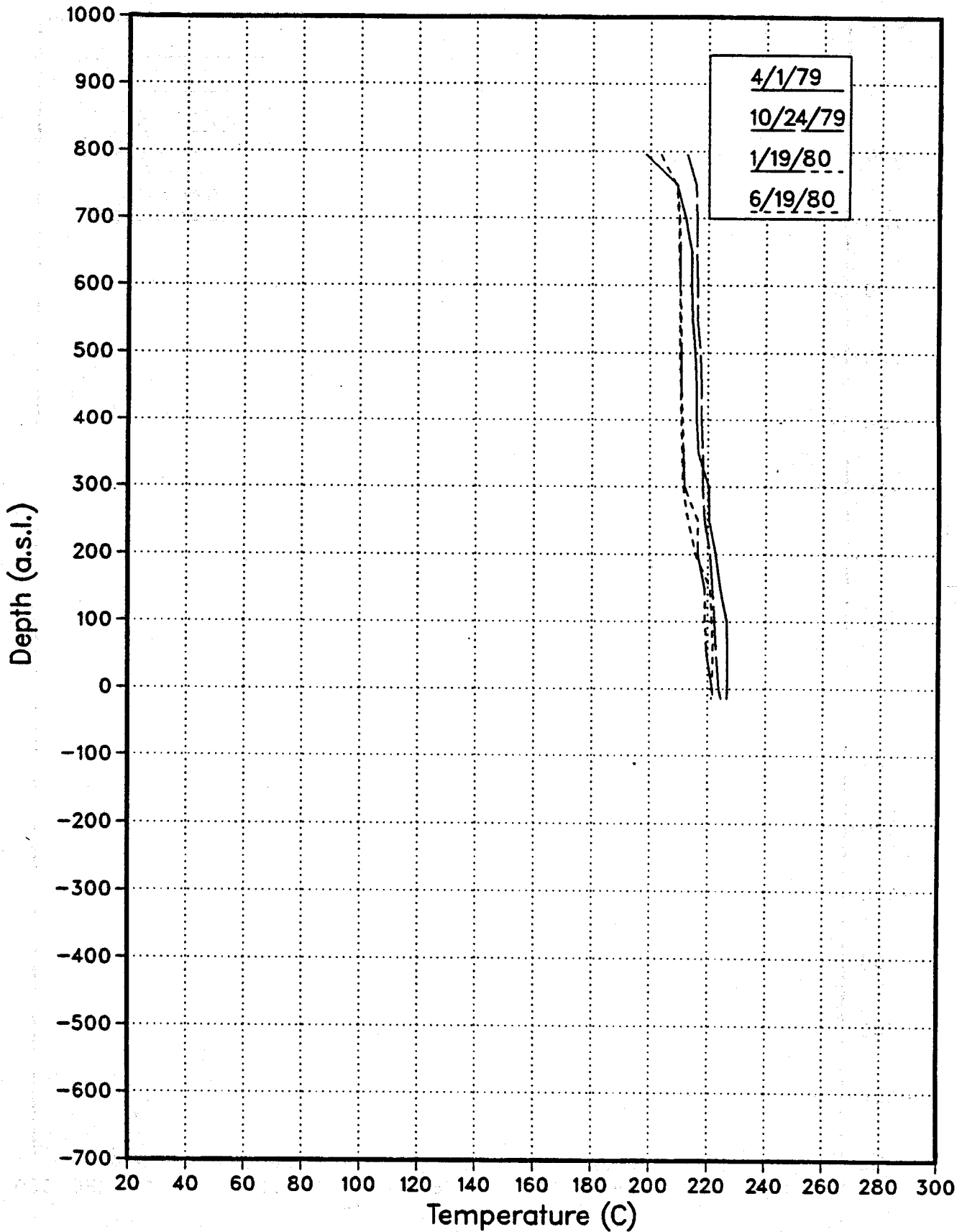
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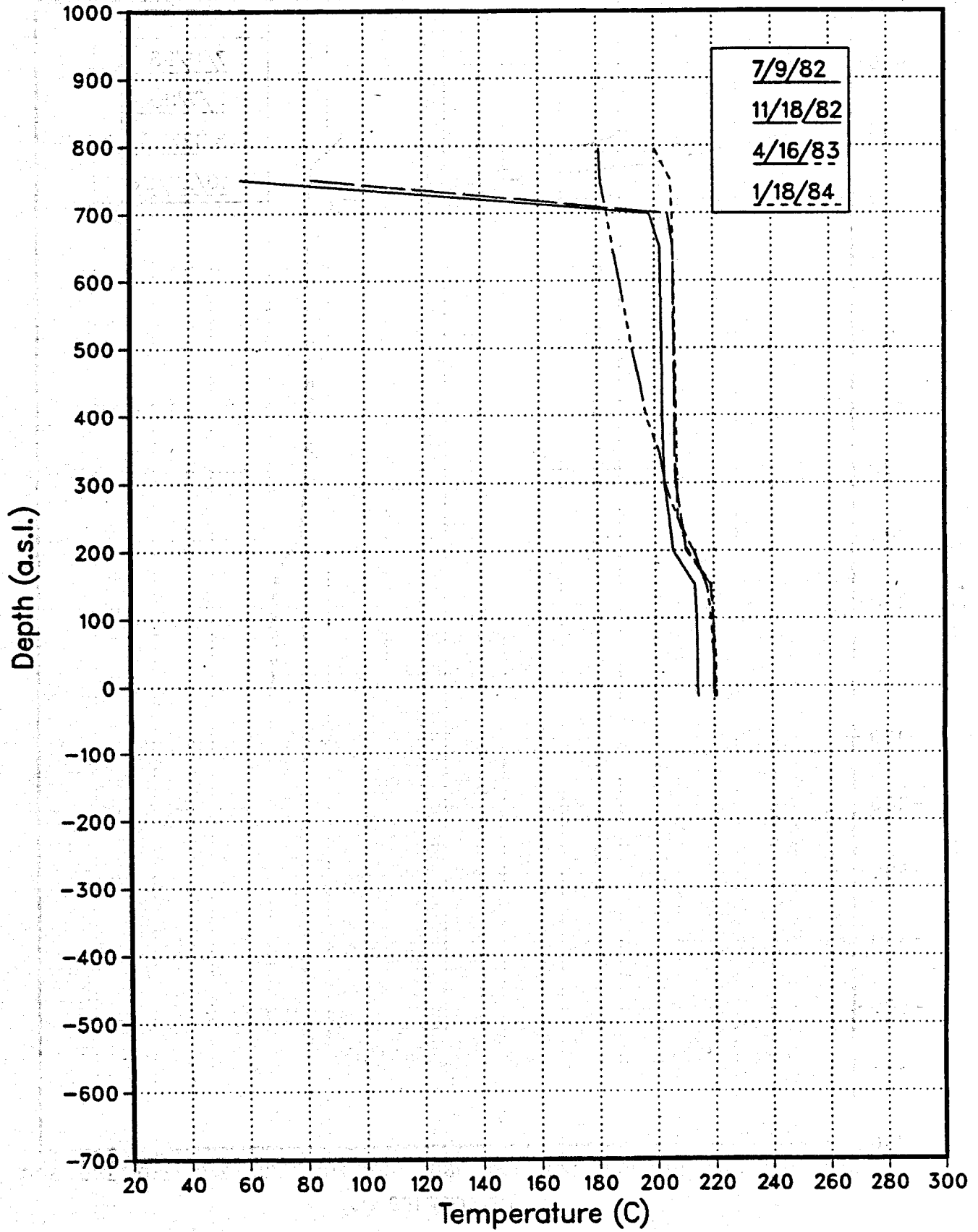
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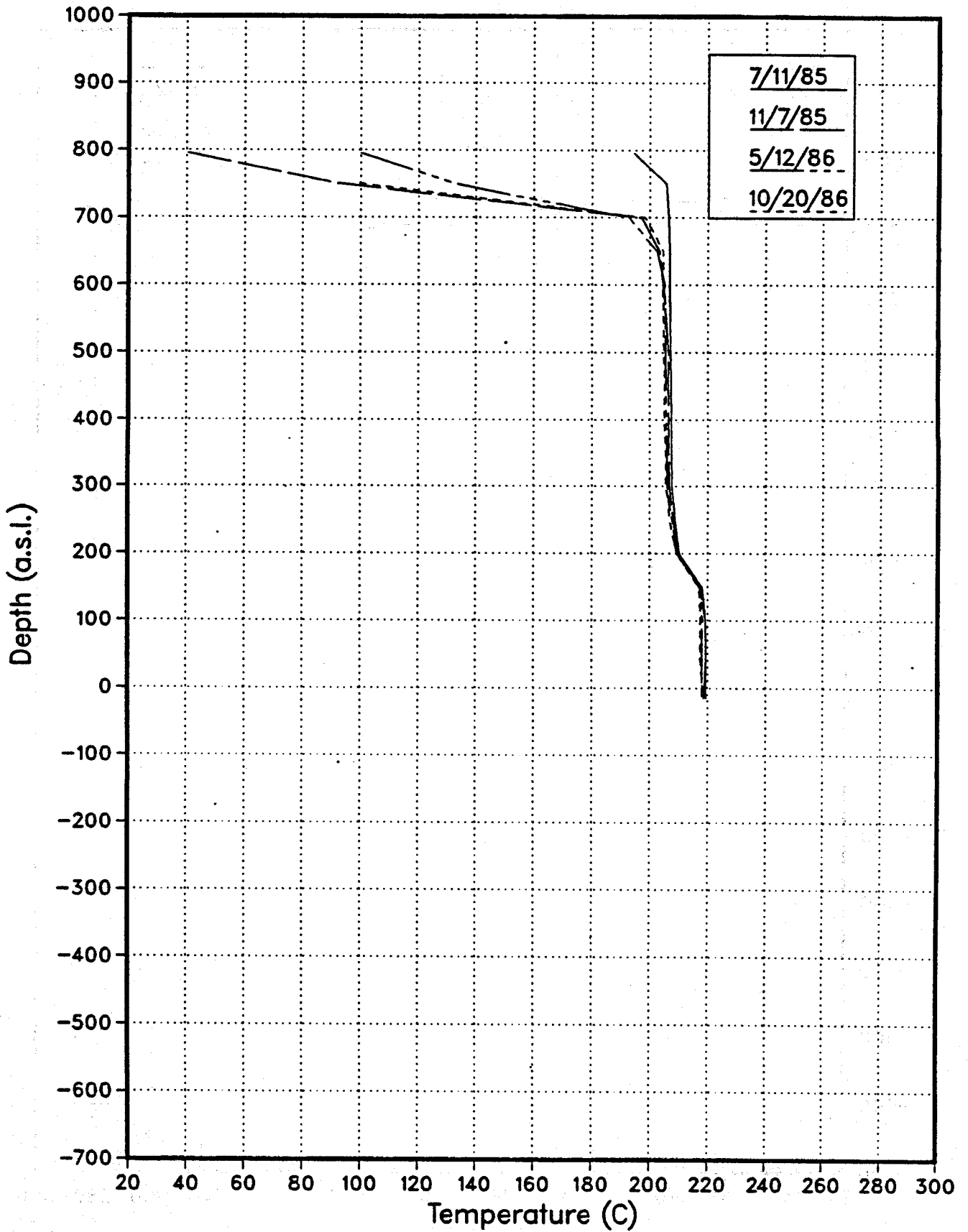
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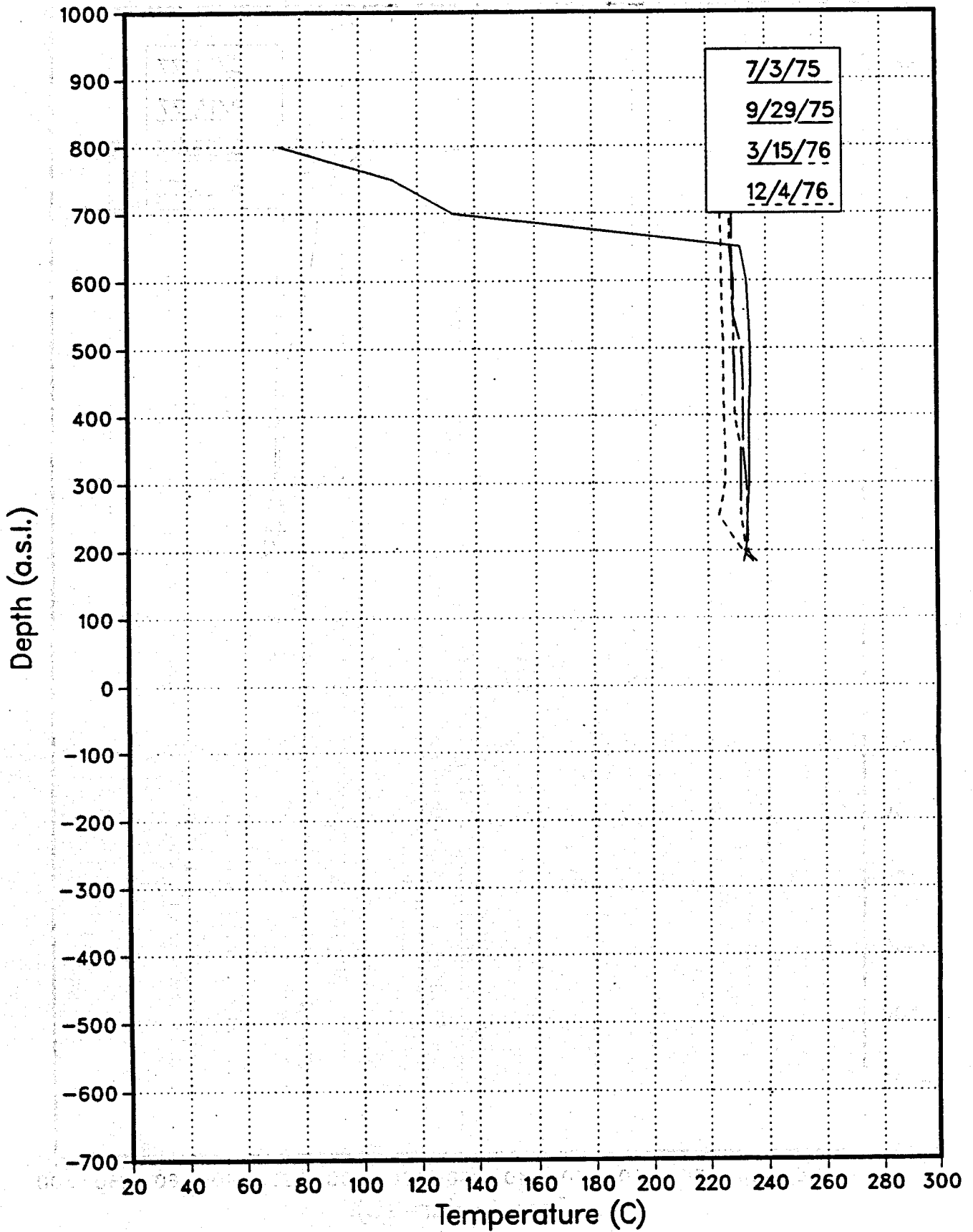
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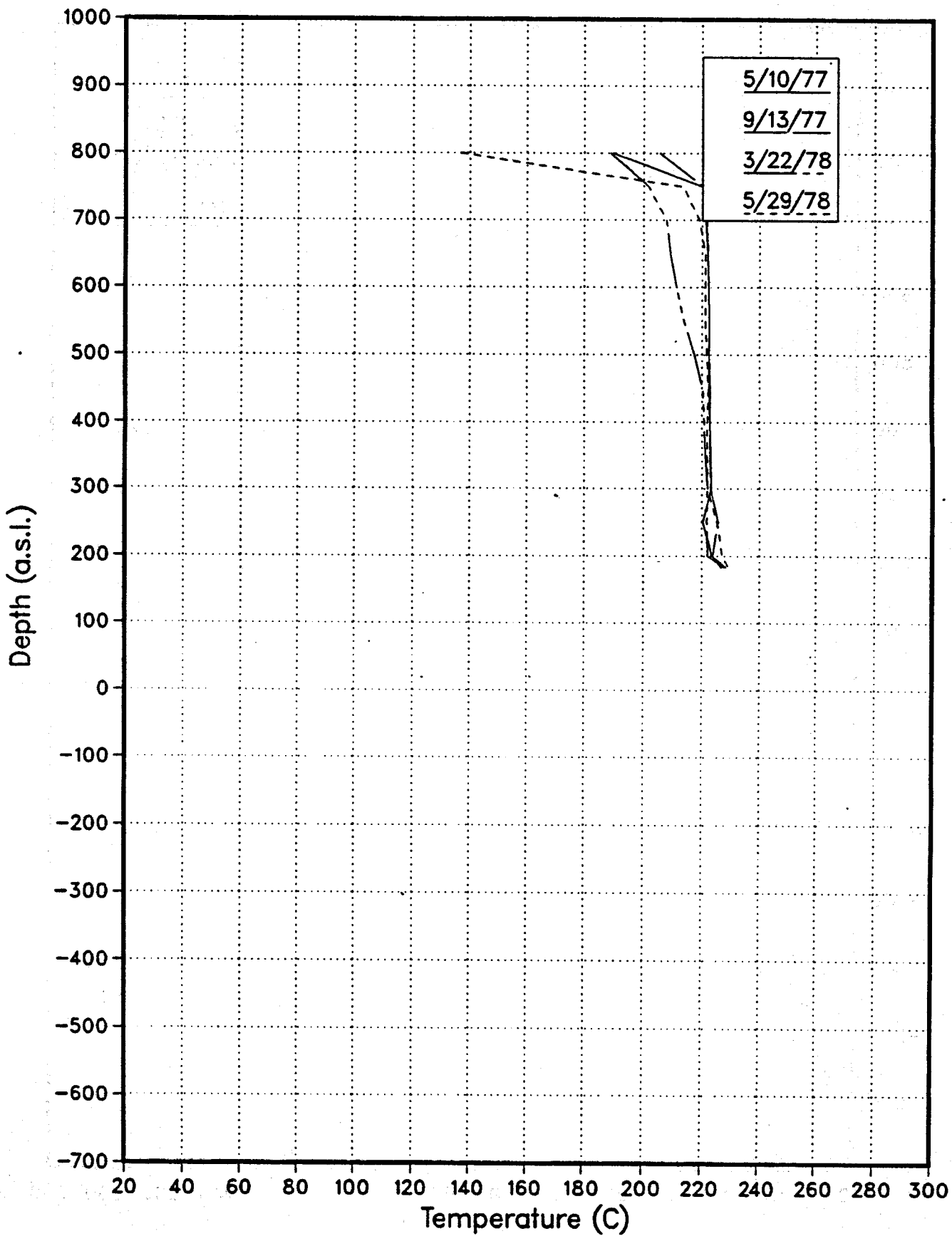
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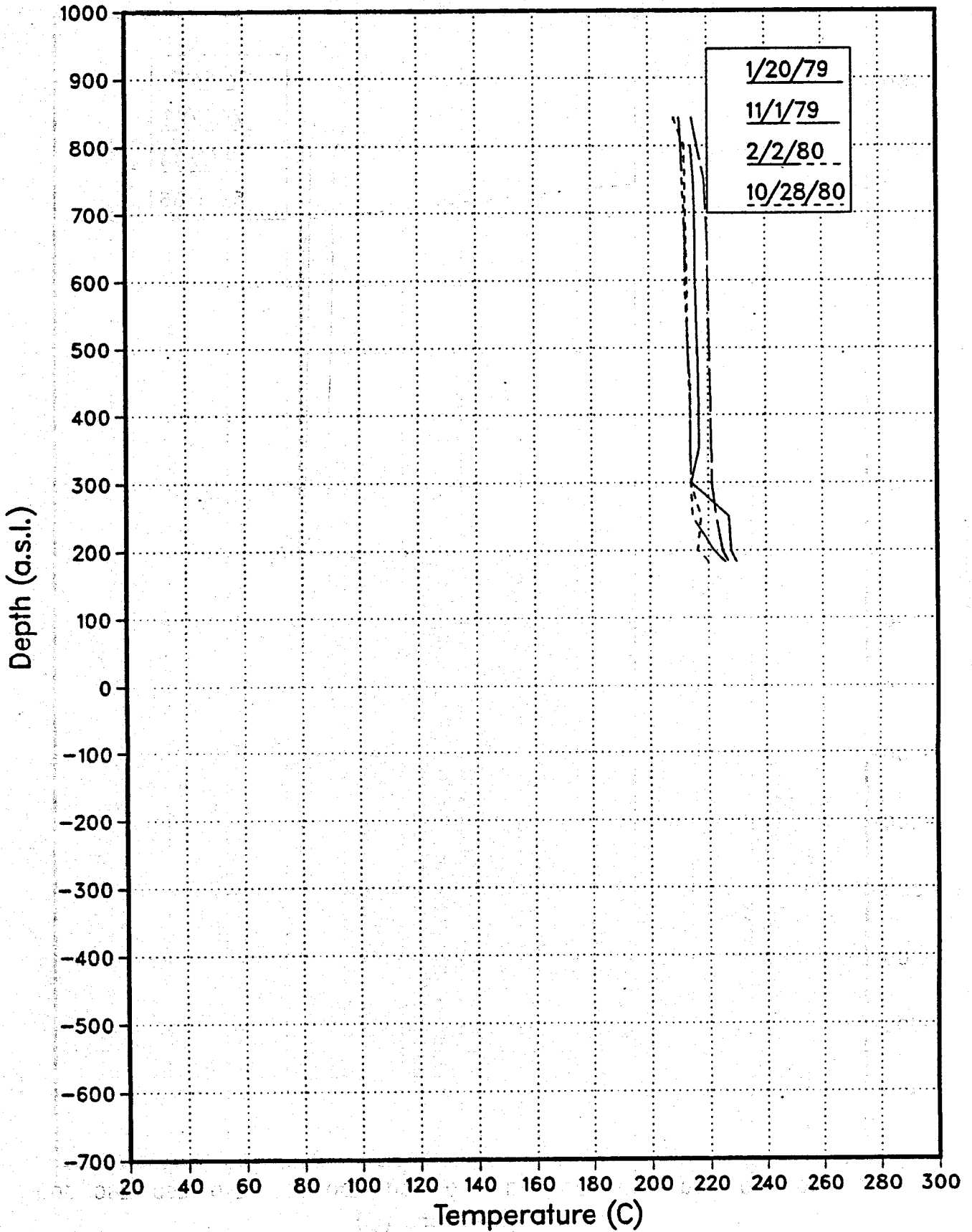
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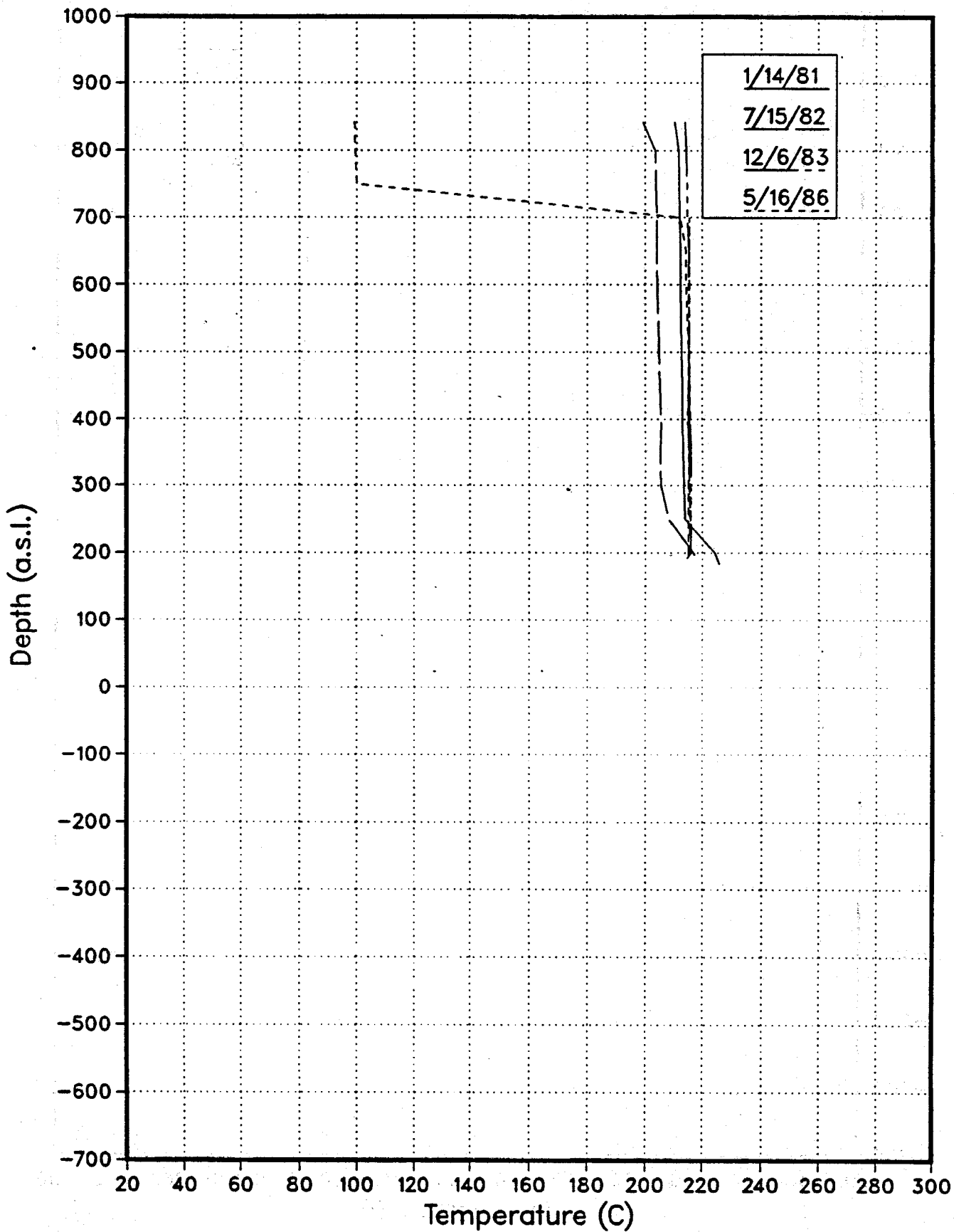
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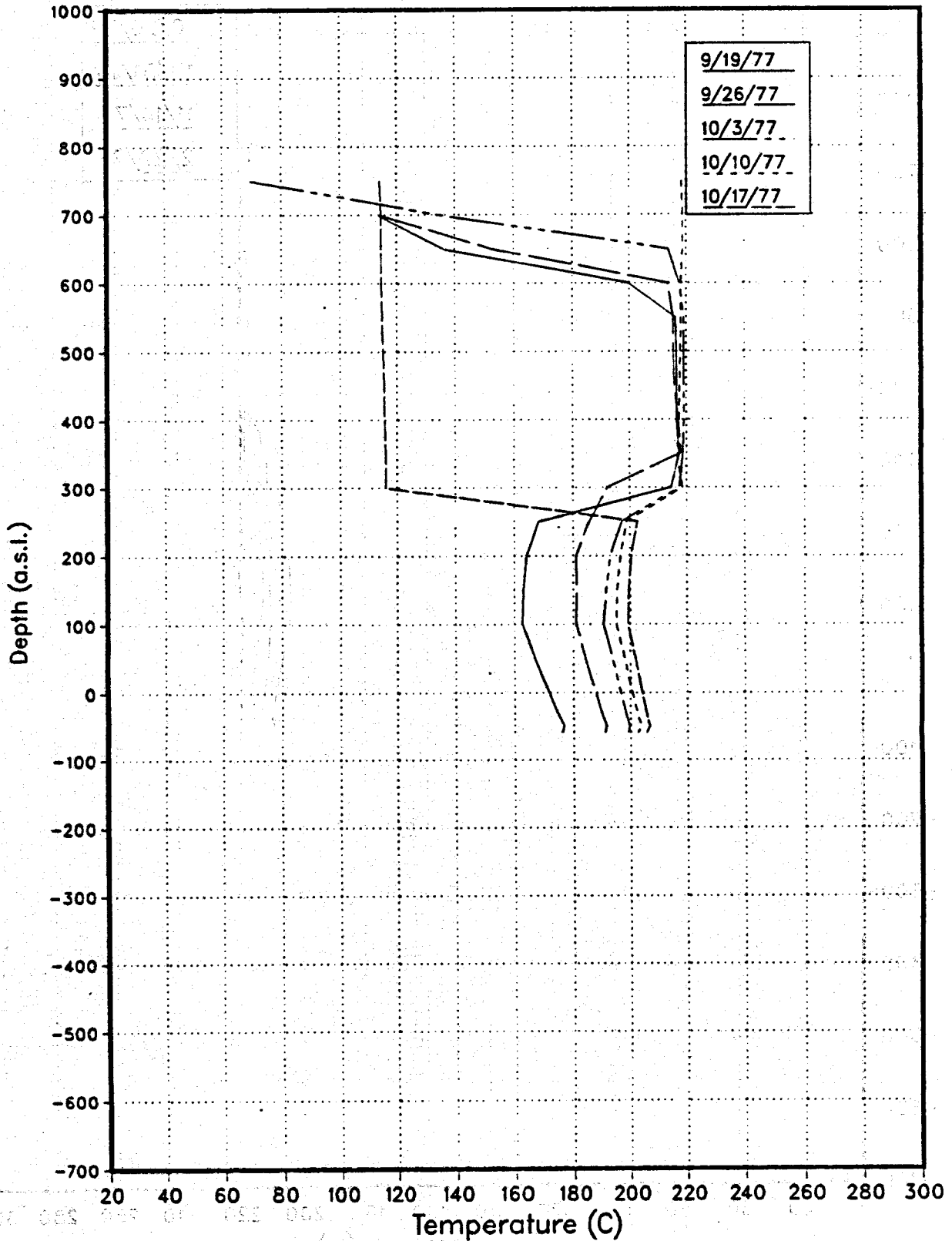
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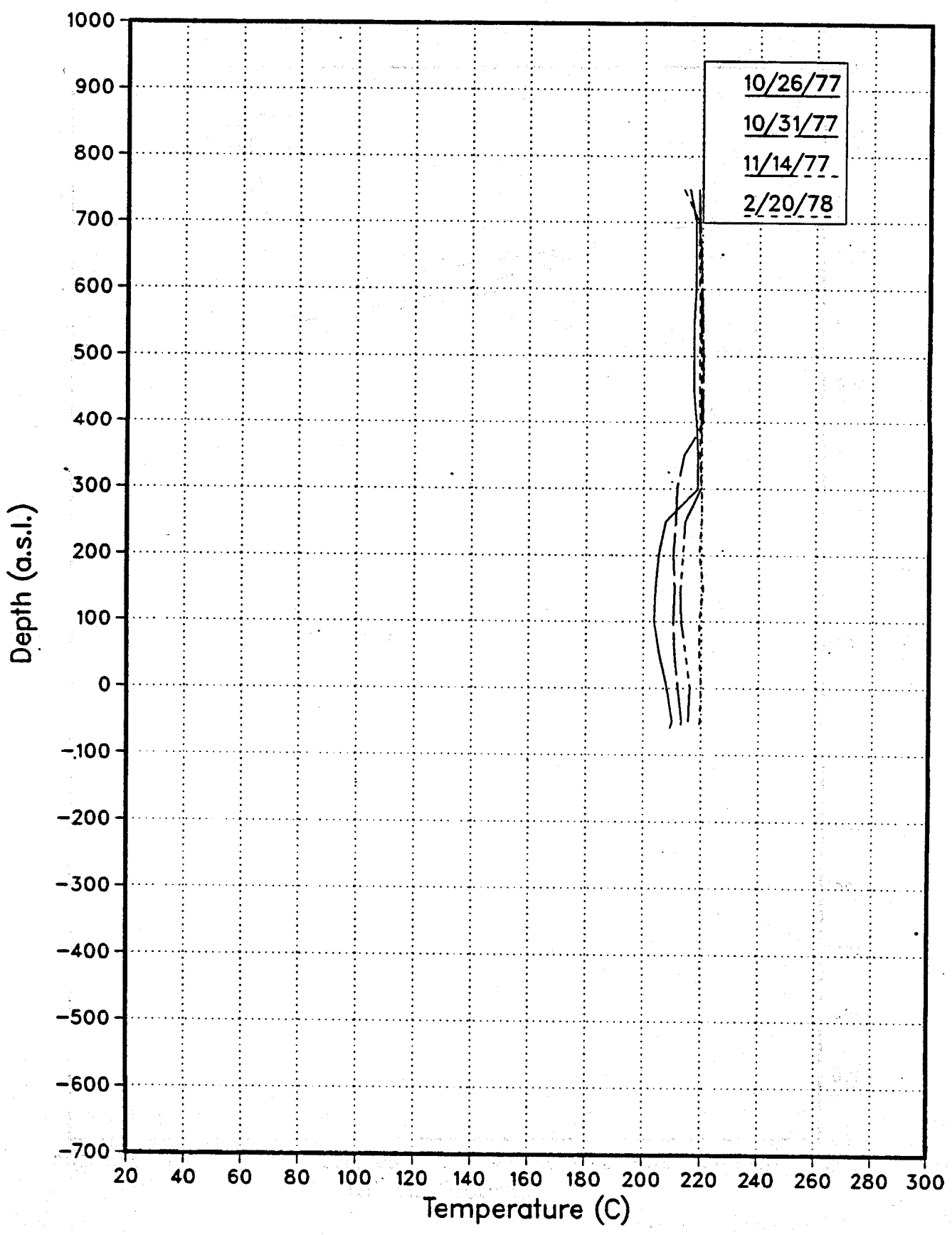
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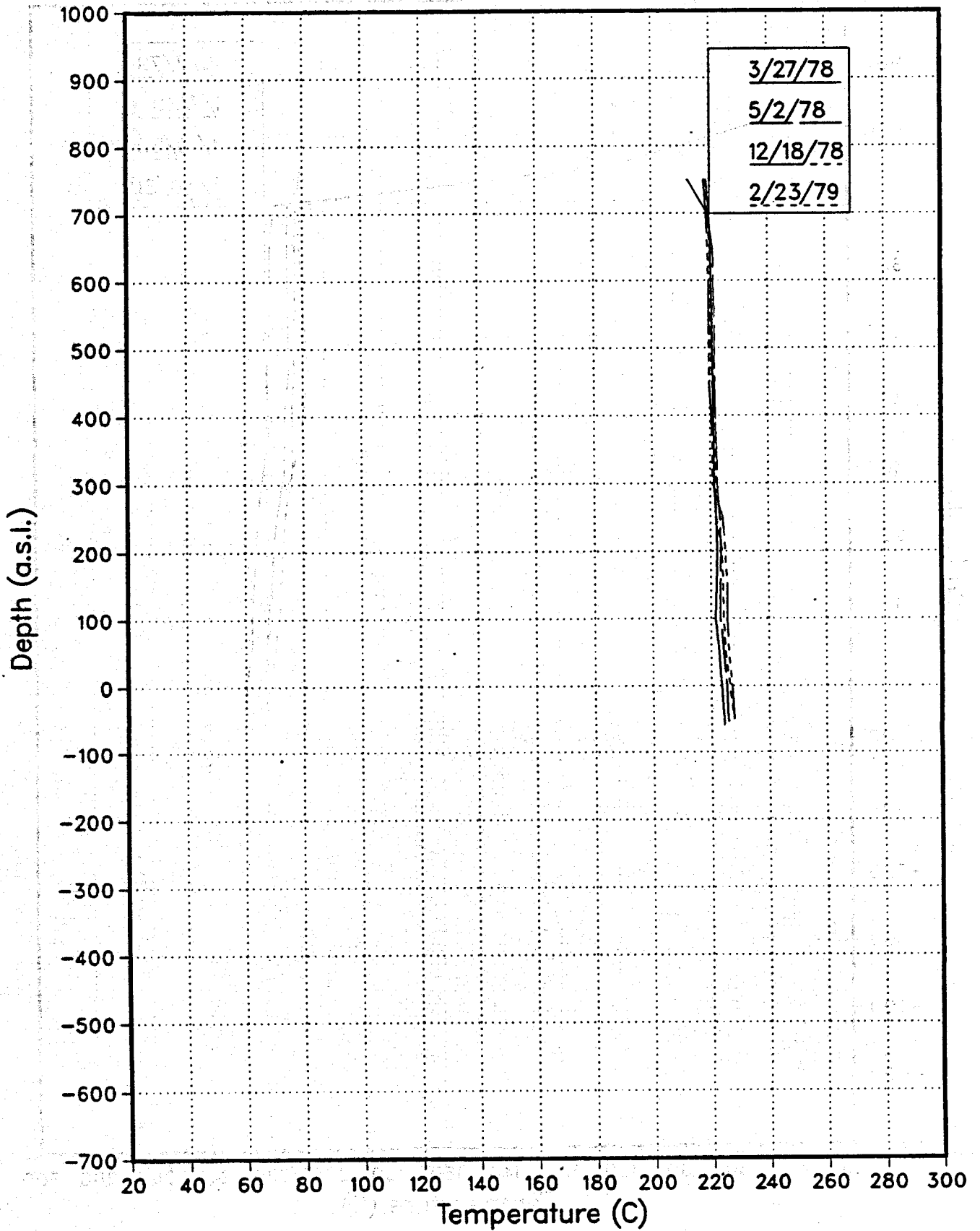
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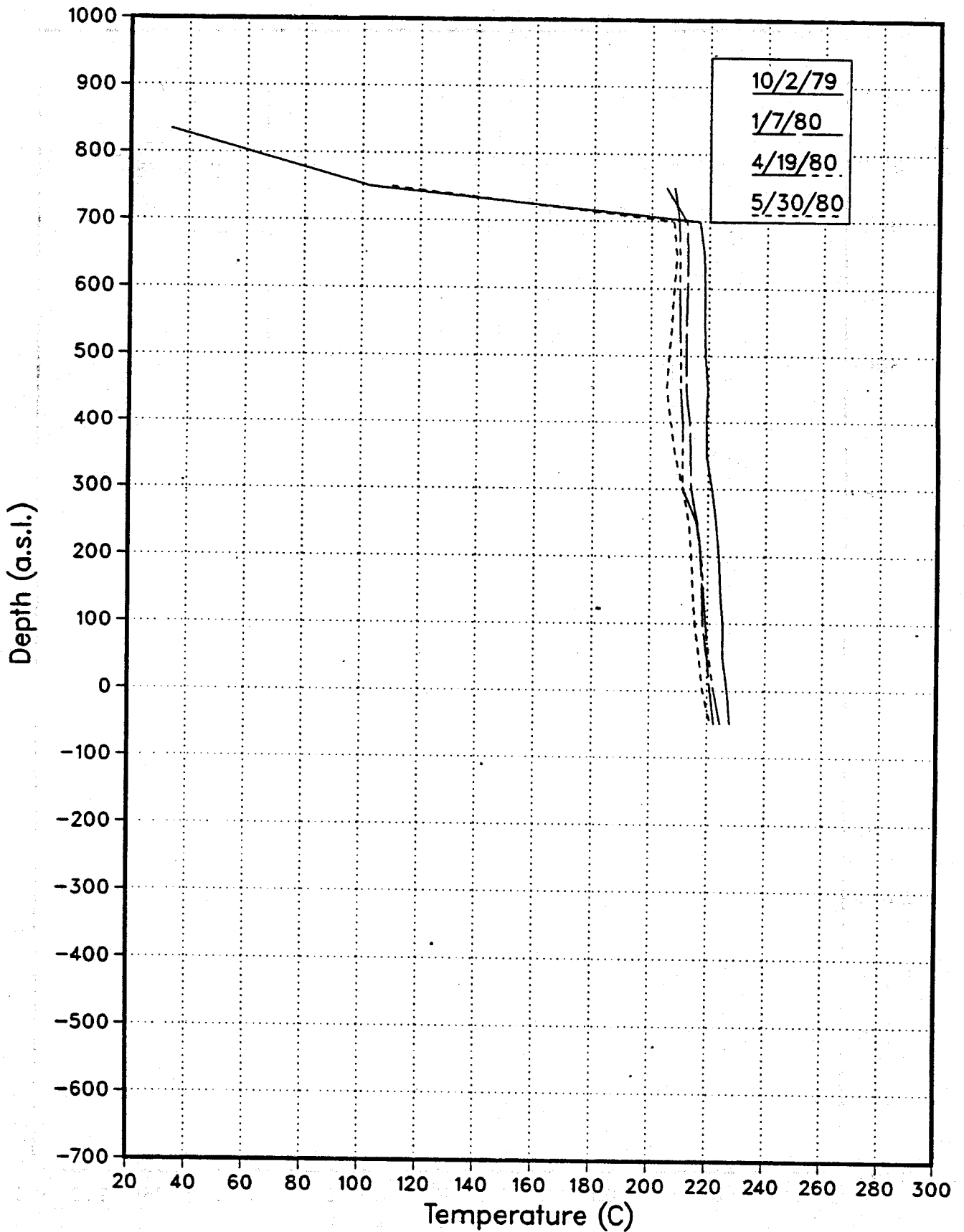
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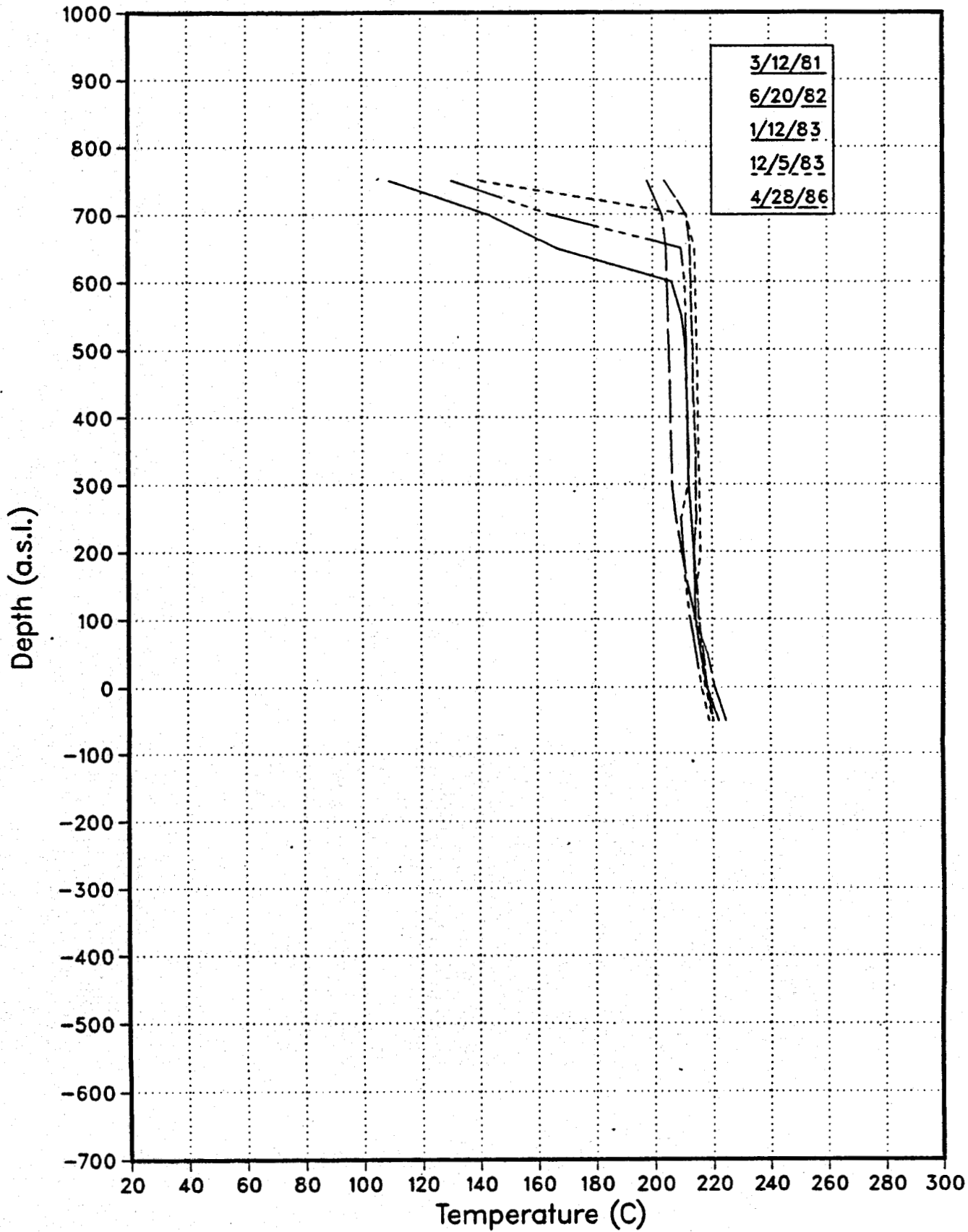
AH23 Temperature Surveys



AH23 Temperature Surveys



AH23 Temperature Surveys



THE HISTORY OF THE UNITED STATES

The history of the United States is a complex and multifaceted story that spans centuries. It begins with the early Native American civilizations, such as the Mayans, Aztecs, and Incas, who developed advanced societies in the Americas. The arrival of European explorers in the late 15th and early 16th centuries marked the beginning of a new era of discovery and conquest. The Spanish, French, and British established colonies across the continent, each with its own unique culture and traditions.

The American Revolution (1775-1783) was a pivotal moment in the nation's history, as the thirteen colonies declared their independence from Great Britain. This led to the signing of the Declaration of Independence in 1776 and the drafting of the U.S. Constitution in 1787. The Constitution established a federal government with three branches: the executive, legislative, and judicial.

The 19th century was a period of rapid expansion and growth for the United States. The westward movement, known as Manifest Destiny, led to the acquisition of vast territories, including the Louisiana Purchase and the Texas Annexation. The Civil War (1861-1865) was a defining moment in the nation's history, as it resolved the issue of slavery and preserved the Union. The war resulted in the Emancipation Proclamation and the 13th Amendment, which abolished slavery.

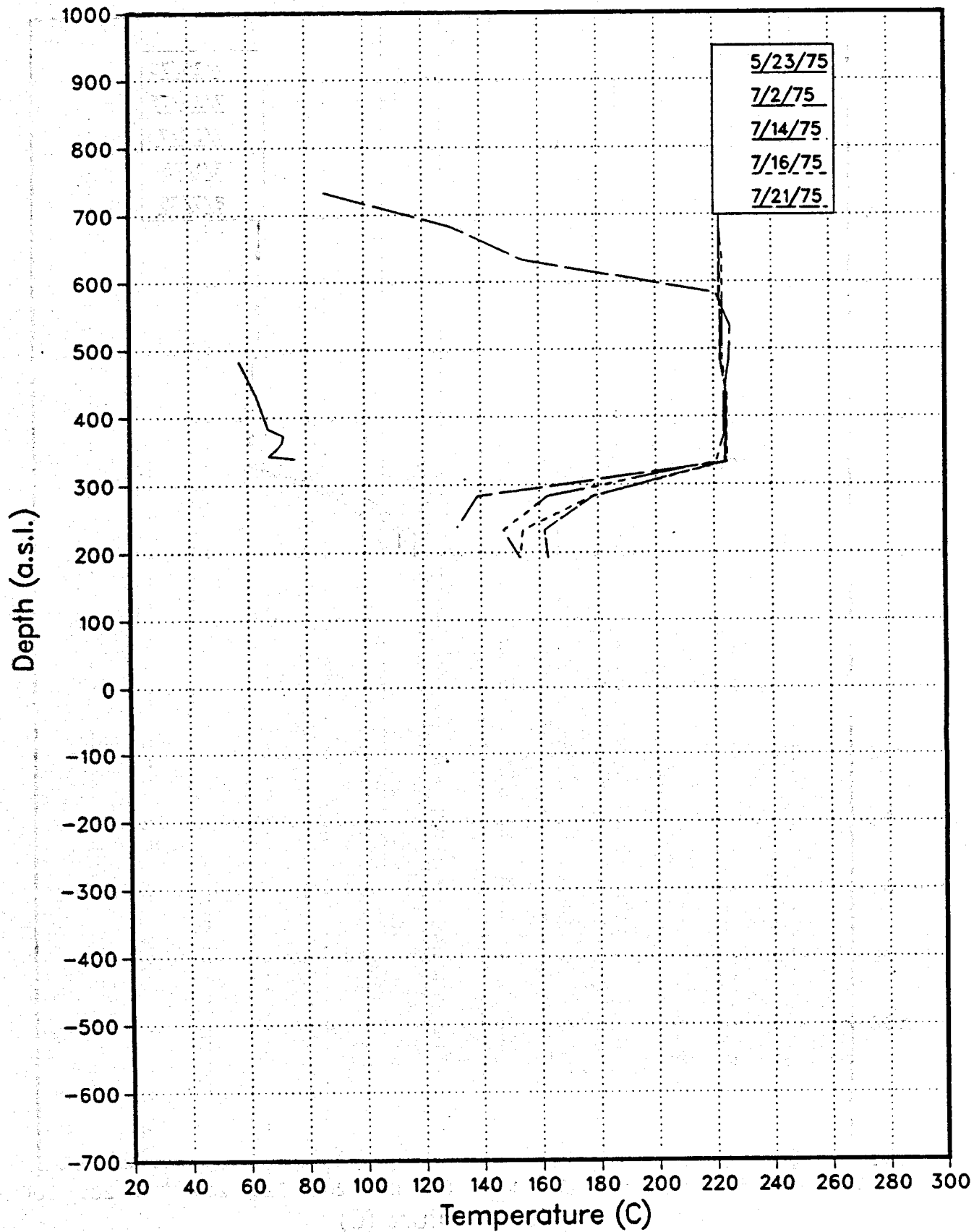
The 20th century was a time of significant social and political change. The Progressive Era (1890s-1920s) saw the rise of reform movements that sought to address social inequalities and improve government efficiency. The Great Depression (1929-1939) led to the New Deal, a series of programs and policies that provided relief, recovery, and reform. World War II (1941-1945) was a global conflict that tested the nation's resolve and led to the emergence of the United States as a superpower.

The Cold War (1947-1991) was a period of tension and rivalry between the United States and the Soviet Union. This era saw the development of nuclear weapons and the space race. The Vietnam War (1955-1975) was a controversial conflict that led to widespread protests and a reevaluation of the nation's role in the world. The Civil Rights Movement (1950s-1960s) fought for equality and justice for African Americans, leading to the passage of the Civil Rights Act of 1964 and the Voting Rights Act of 1965.

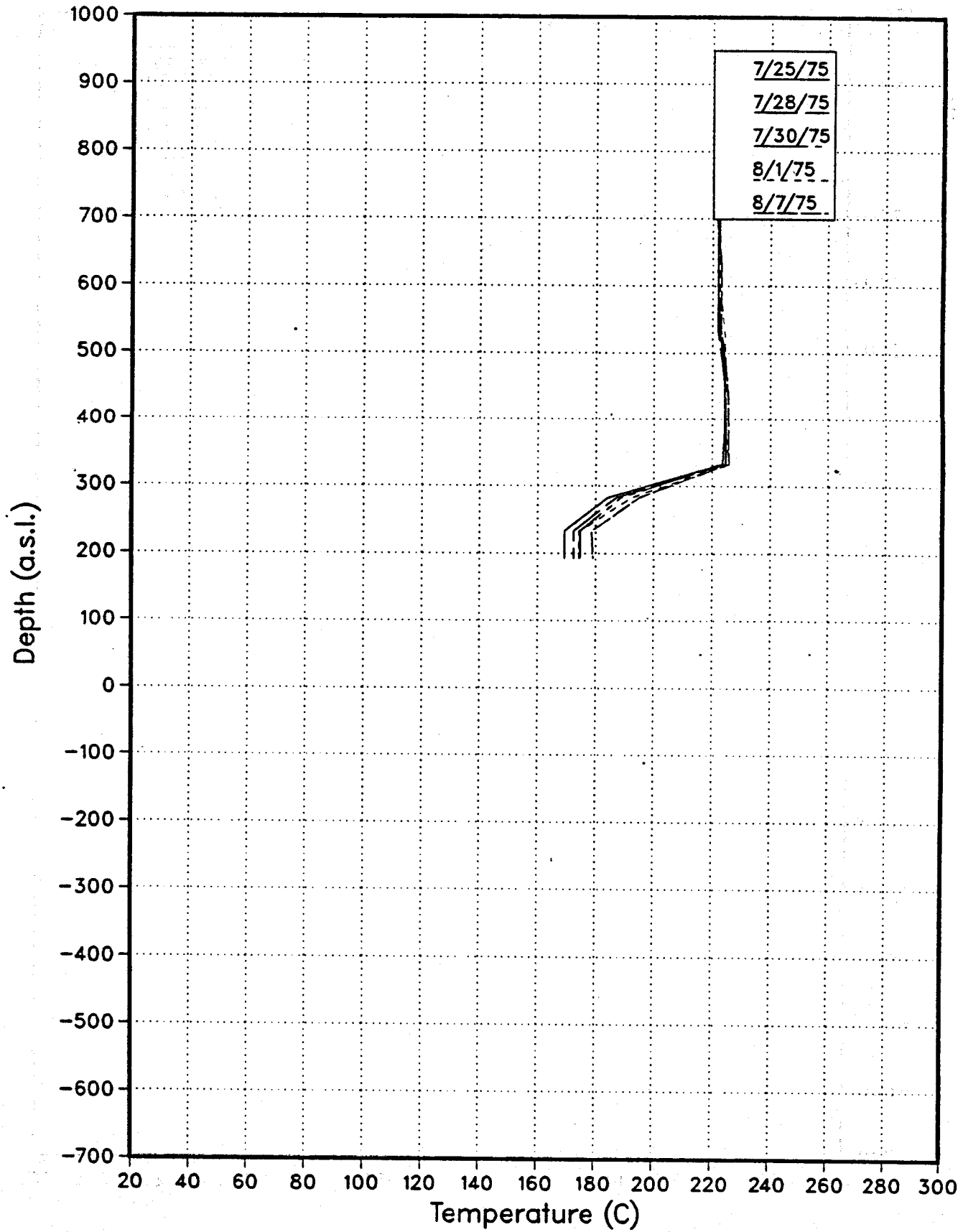
The late 20th and early 21st centuries have been marked by technological advancements, globalization, and new challenges. The 9/11 attacks (2001) led to the War on Terror and the invasion of Iraq (2003). The 2008 financial crisis and the subsequent Great Recession (2008-2009) tested the nation's economic resilience. The 2016 presidential election and the rise of populism have brought new issues to the forefront of the national agenda.



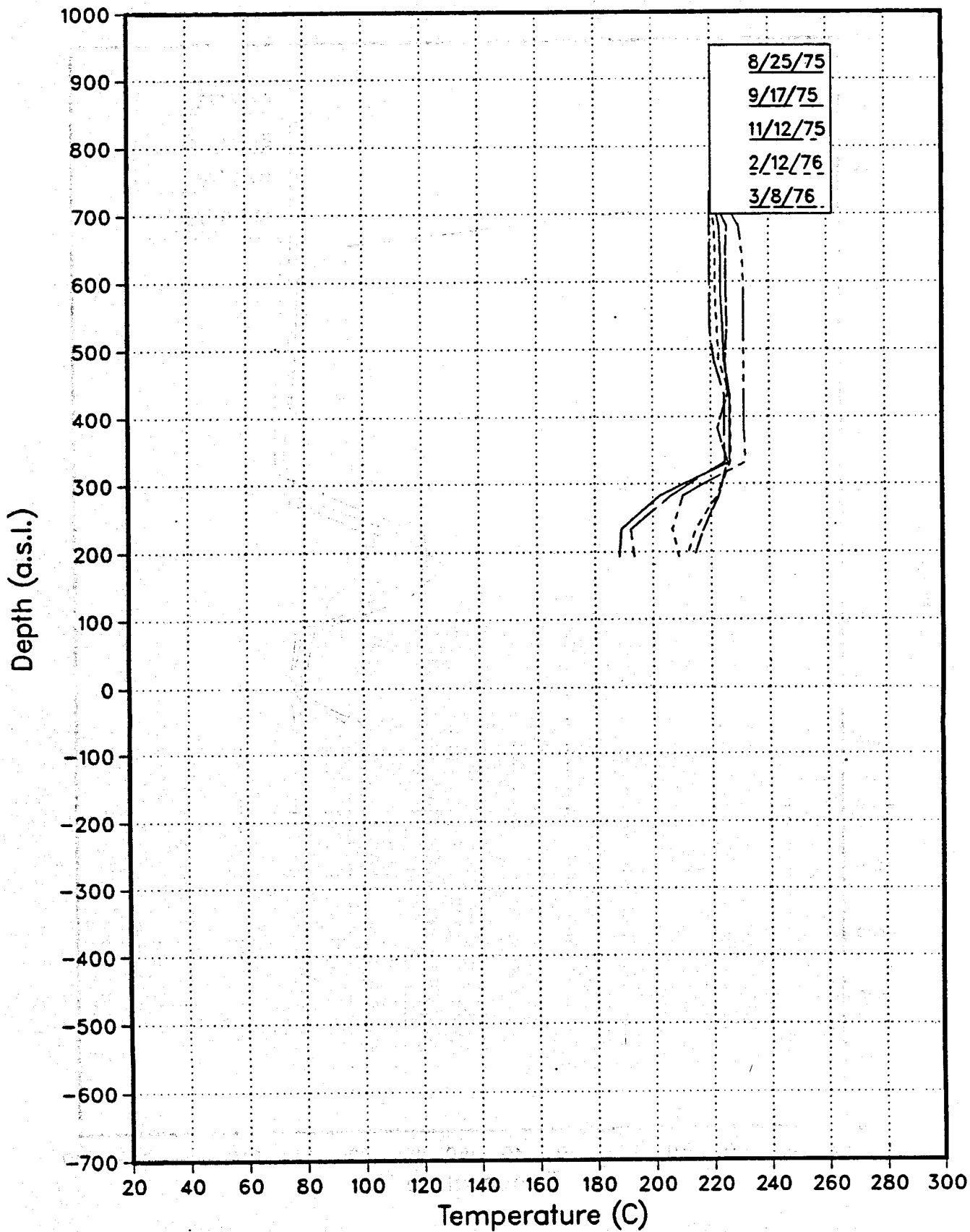
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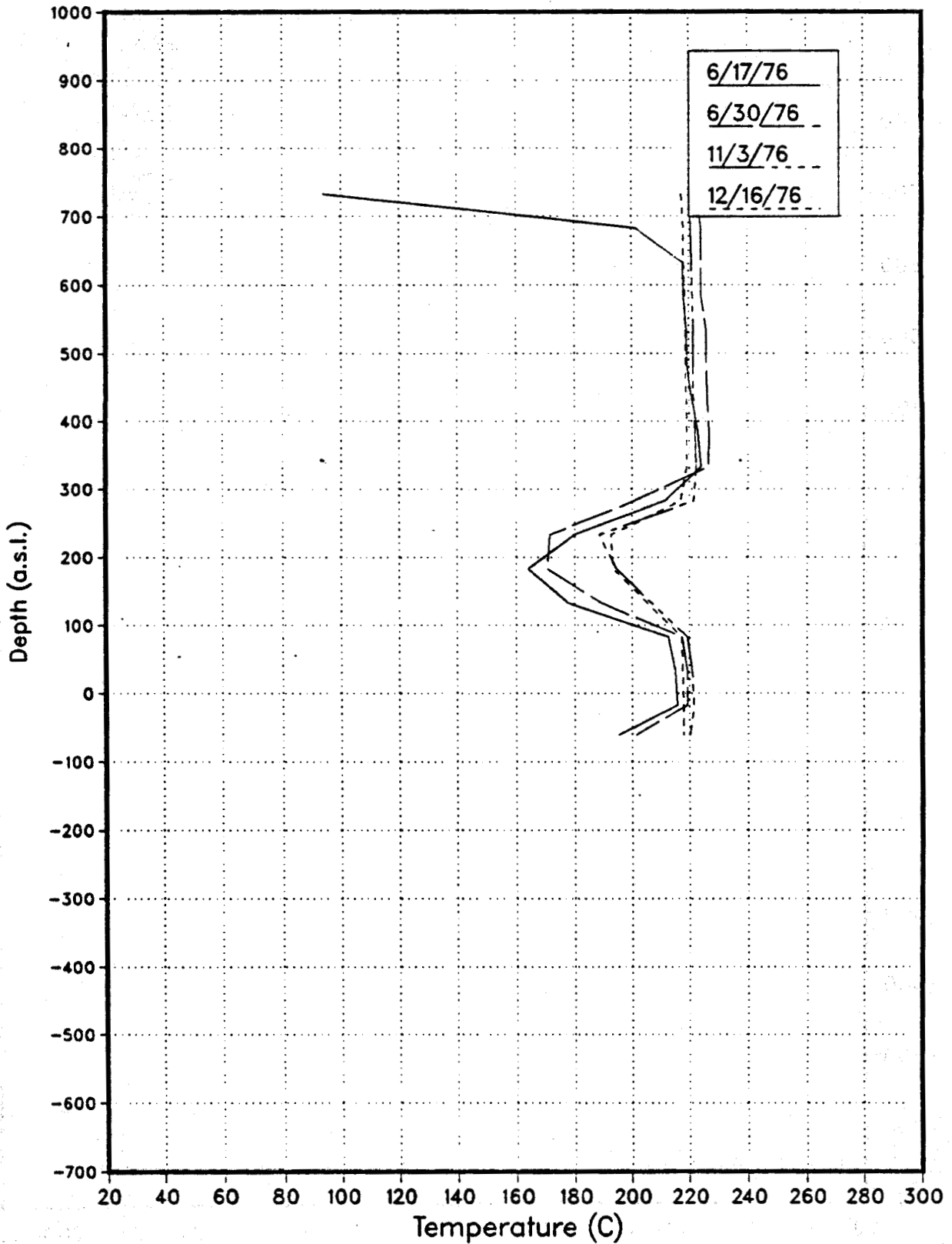
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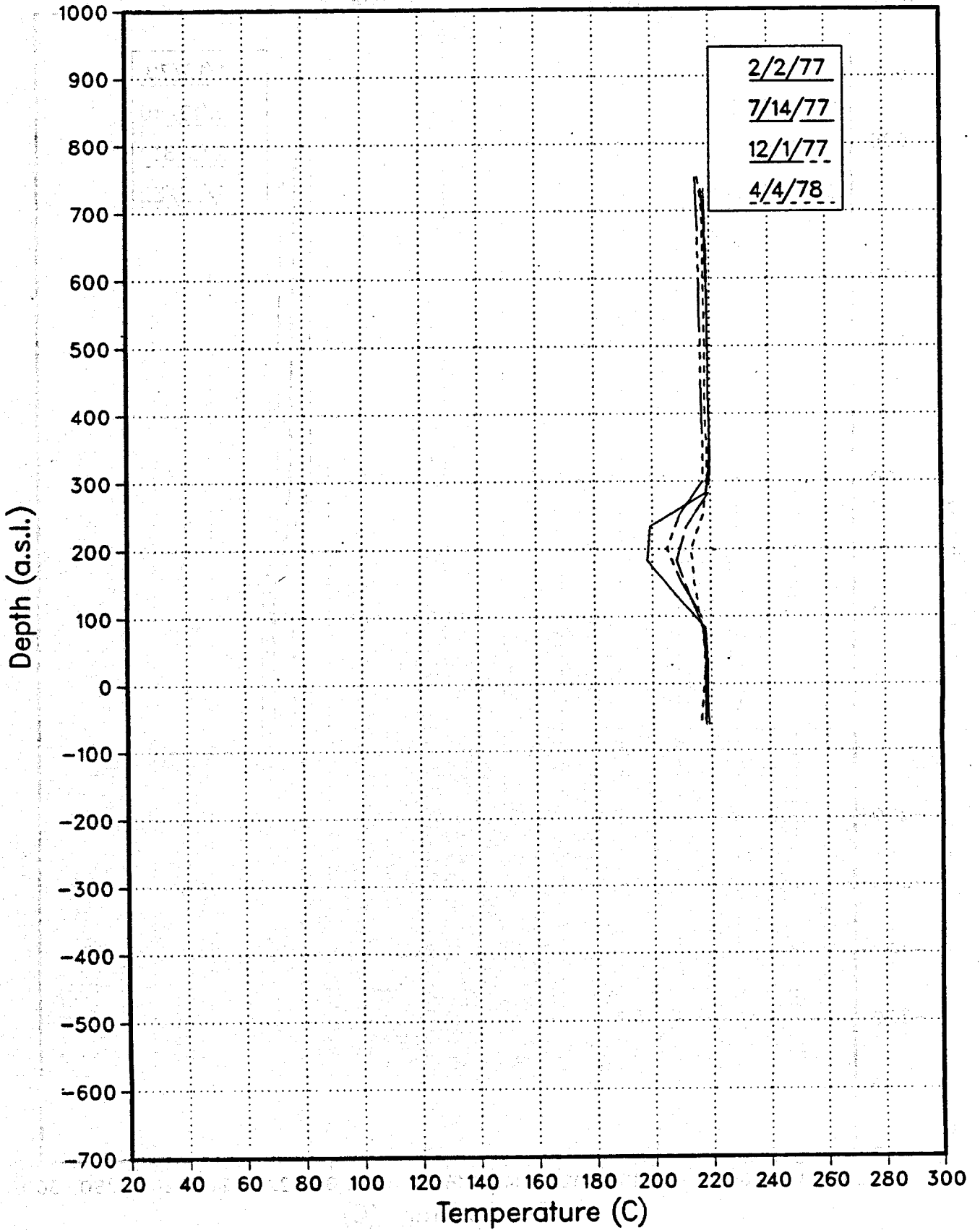
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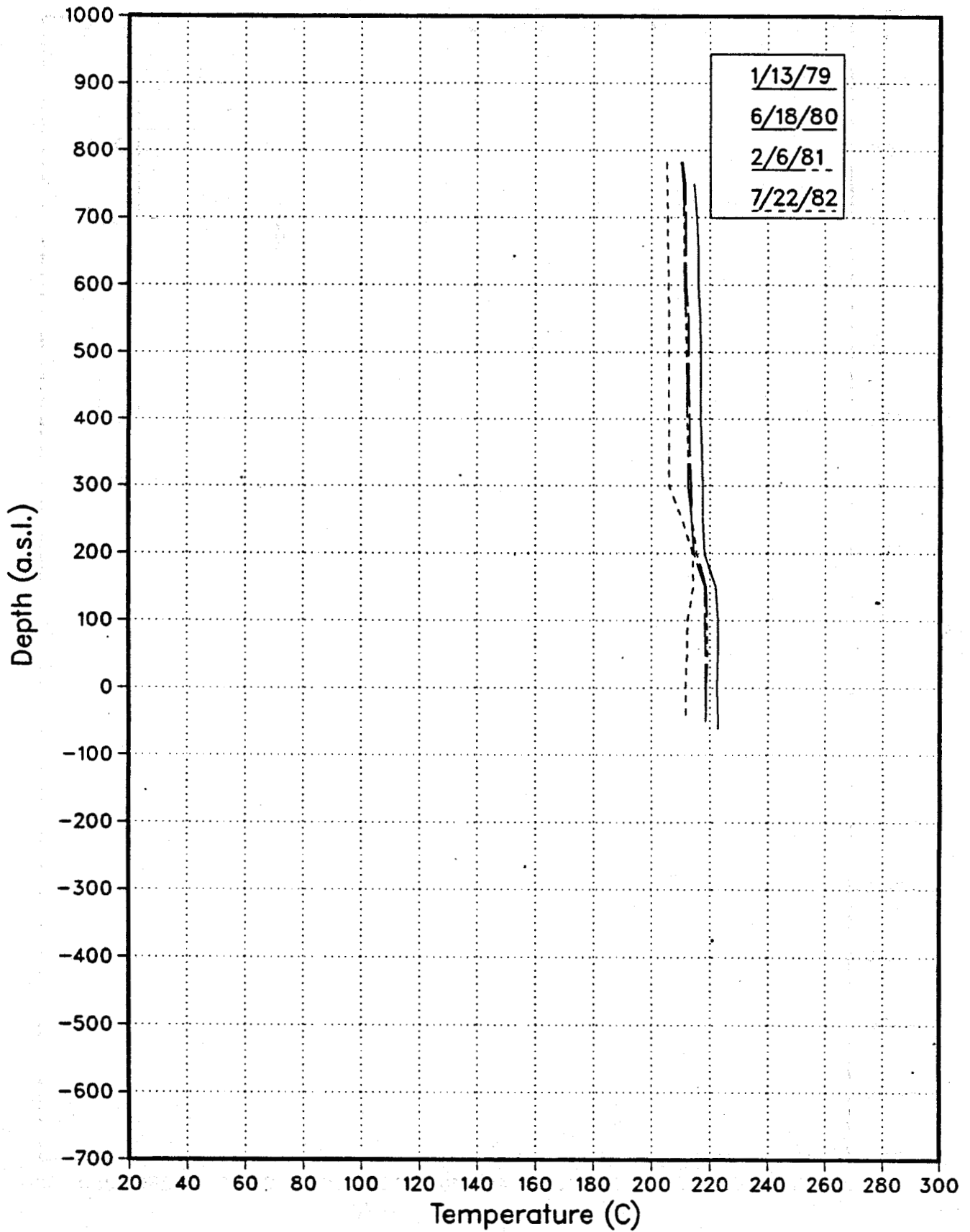
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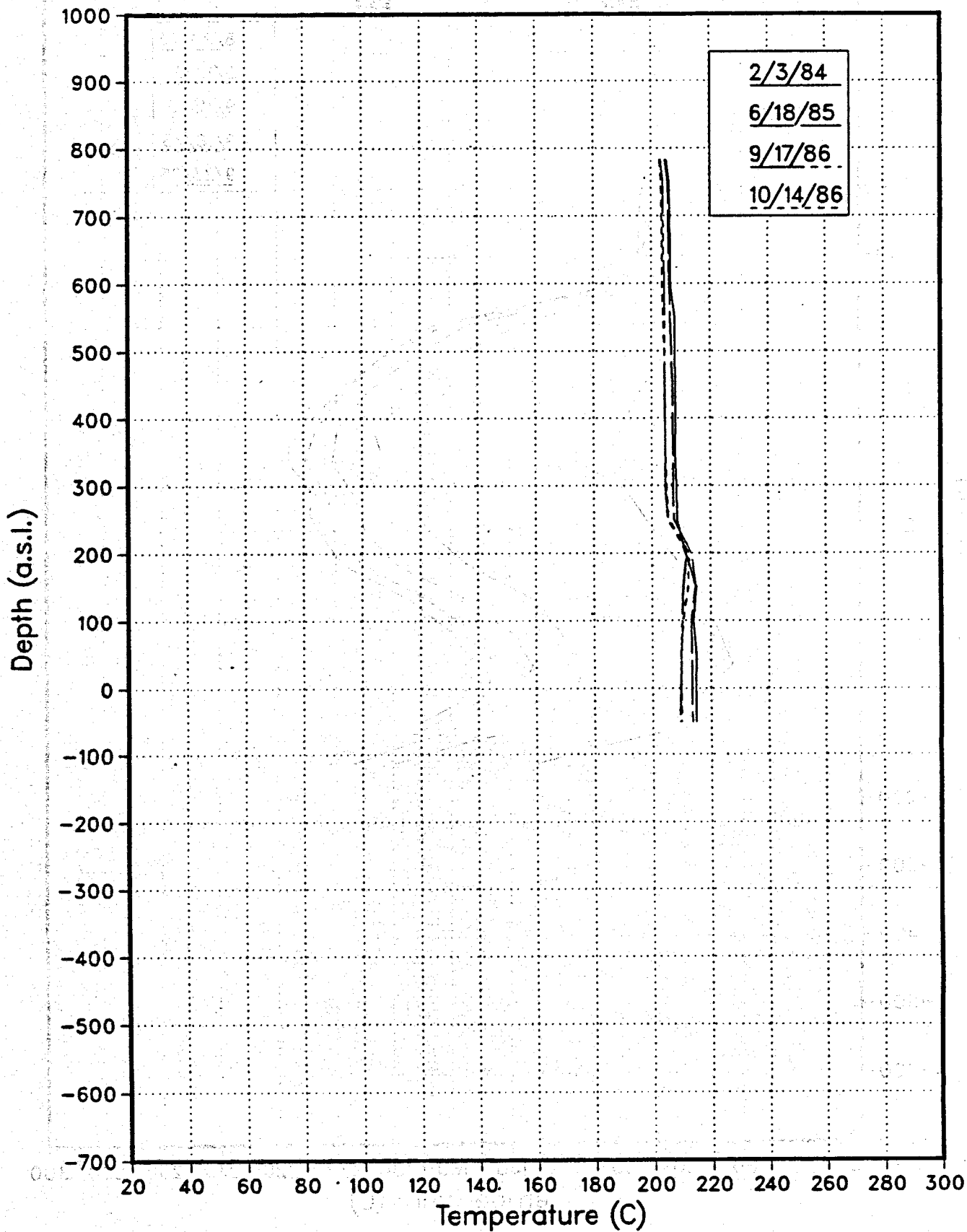
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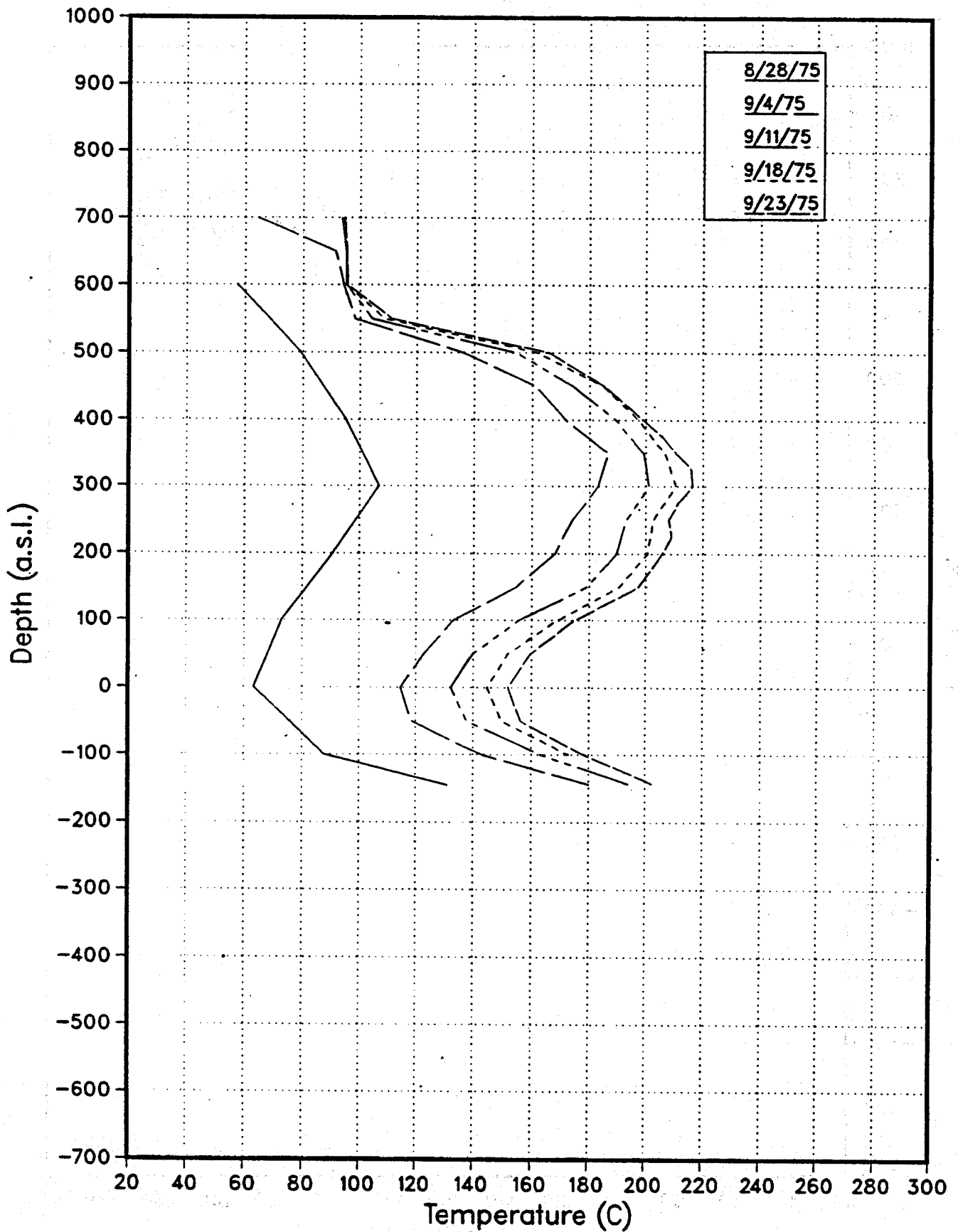
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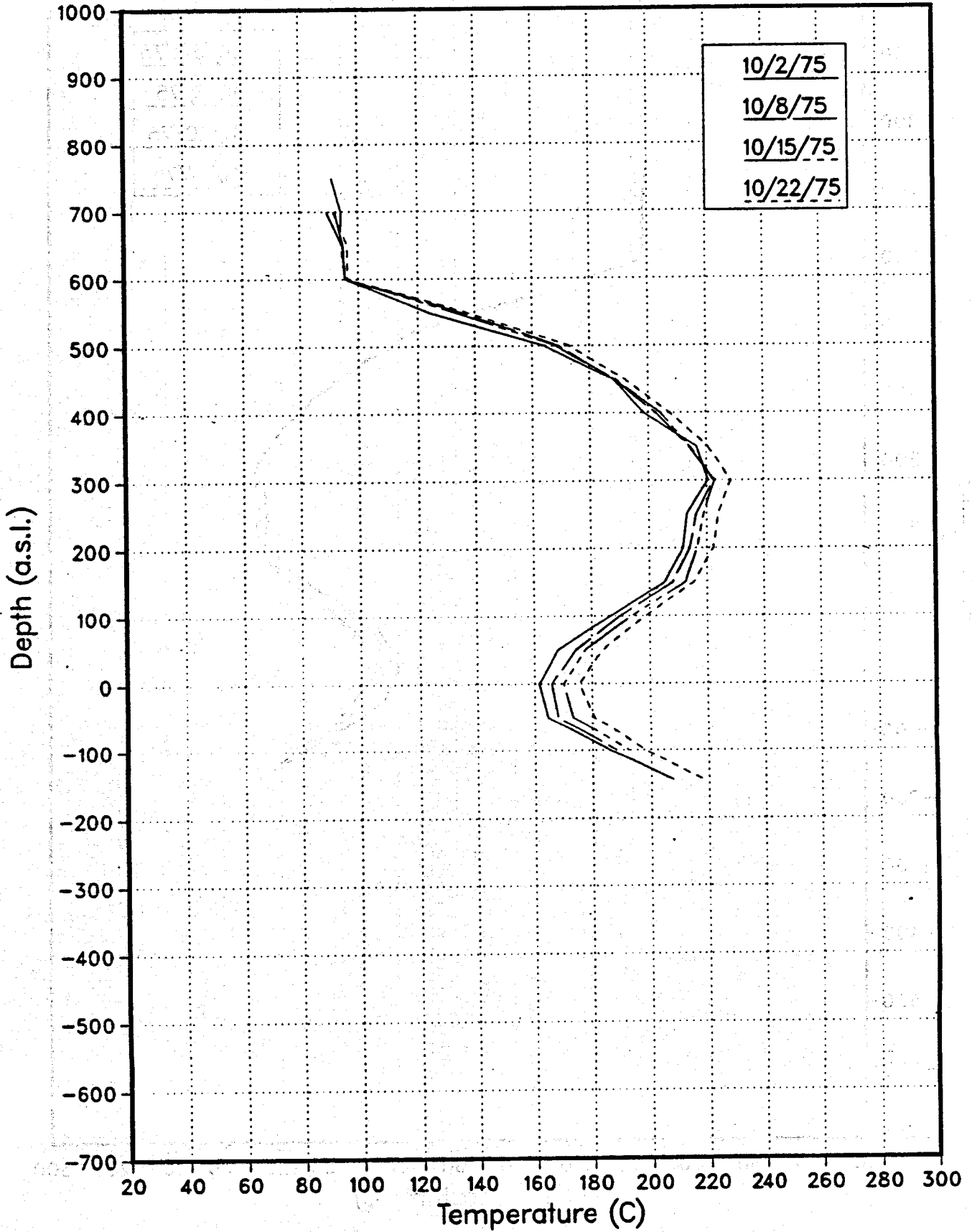
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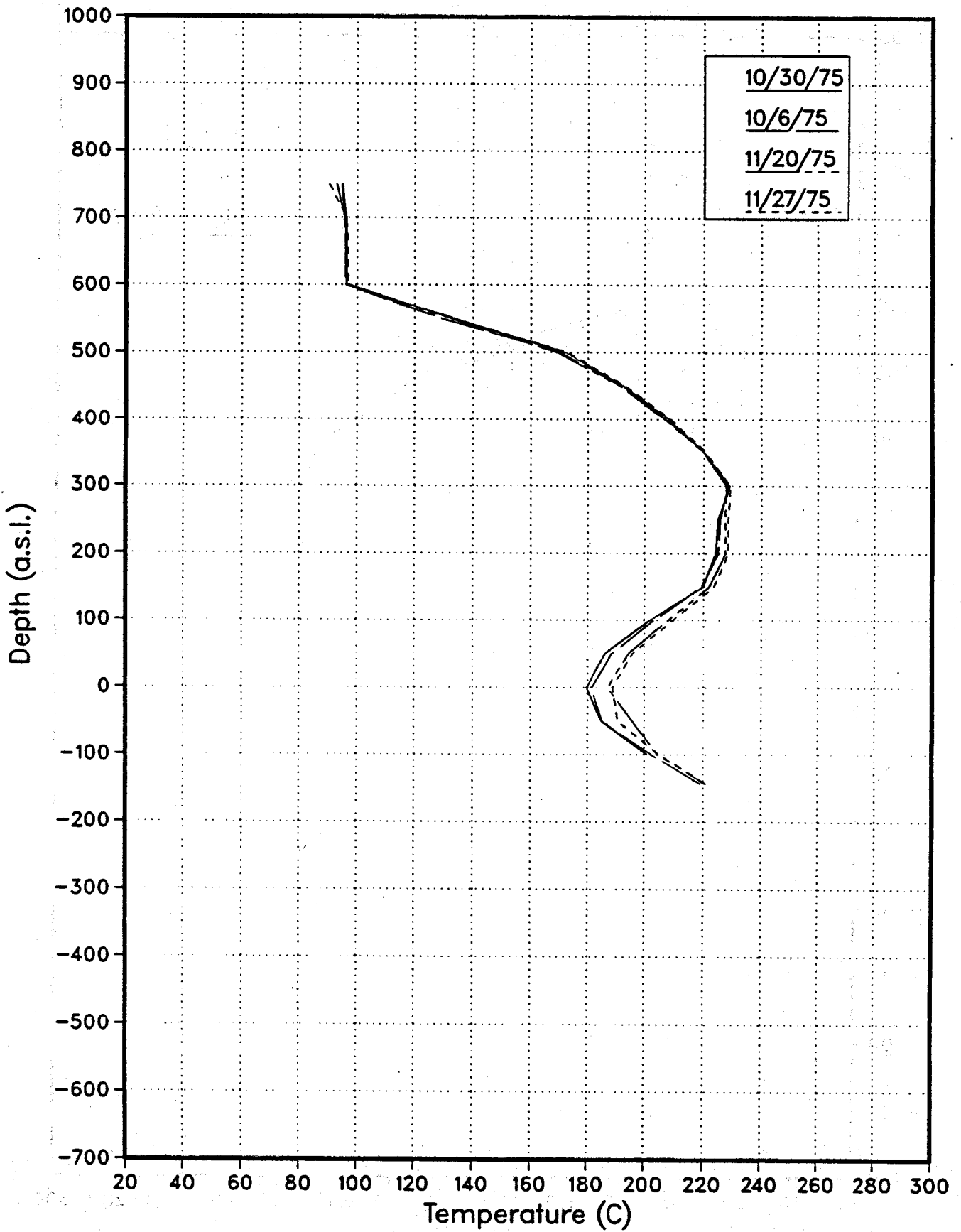
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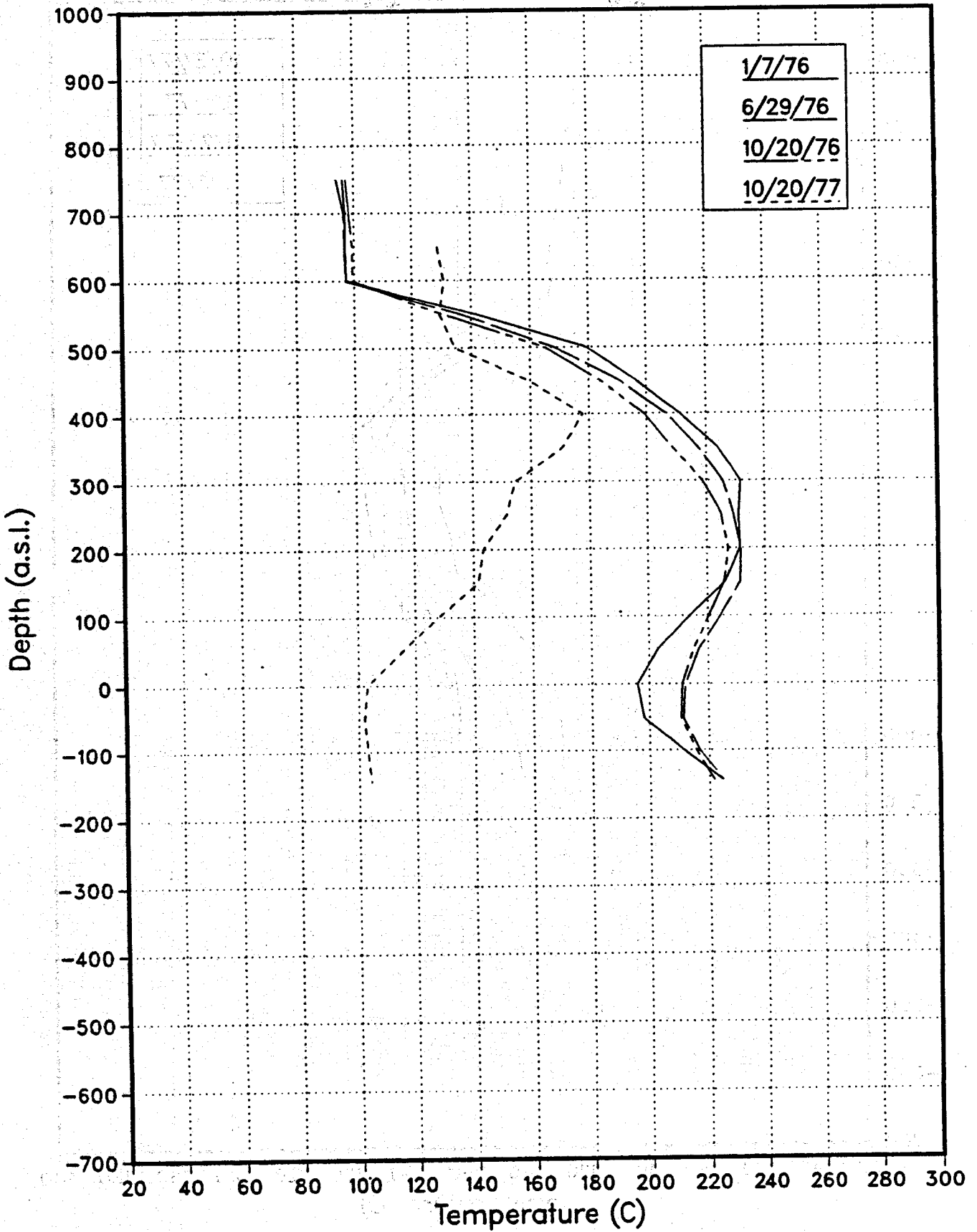
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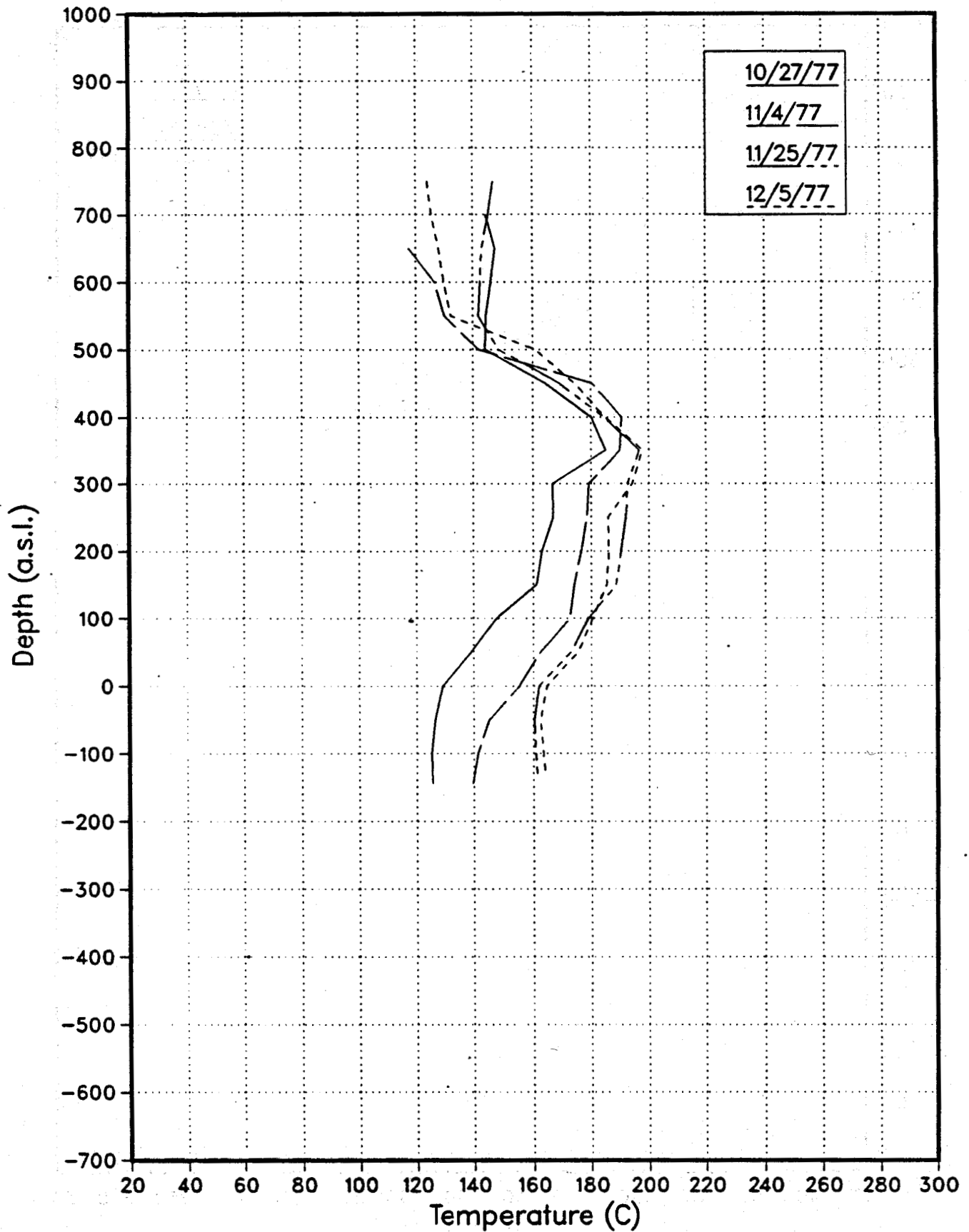
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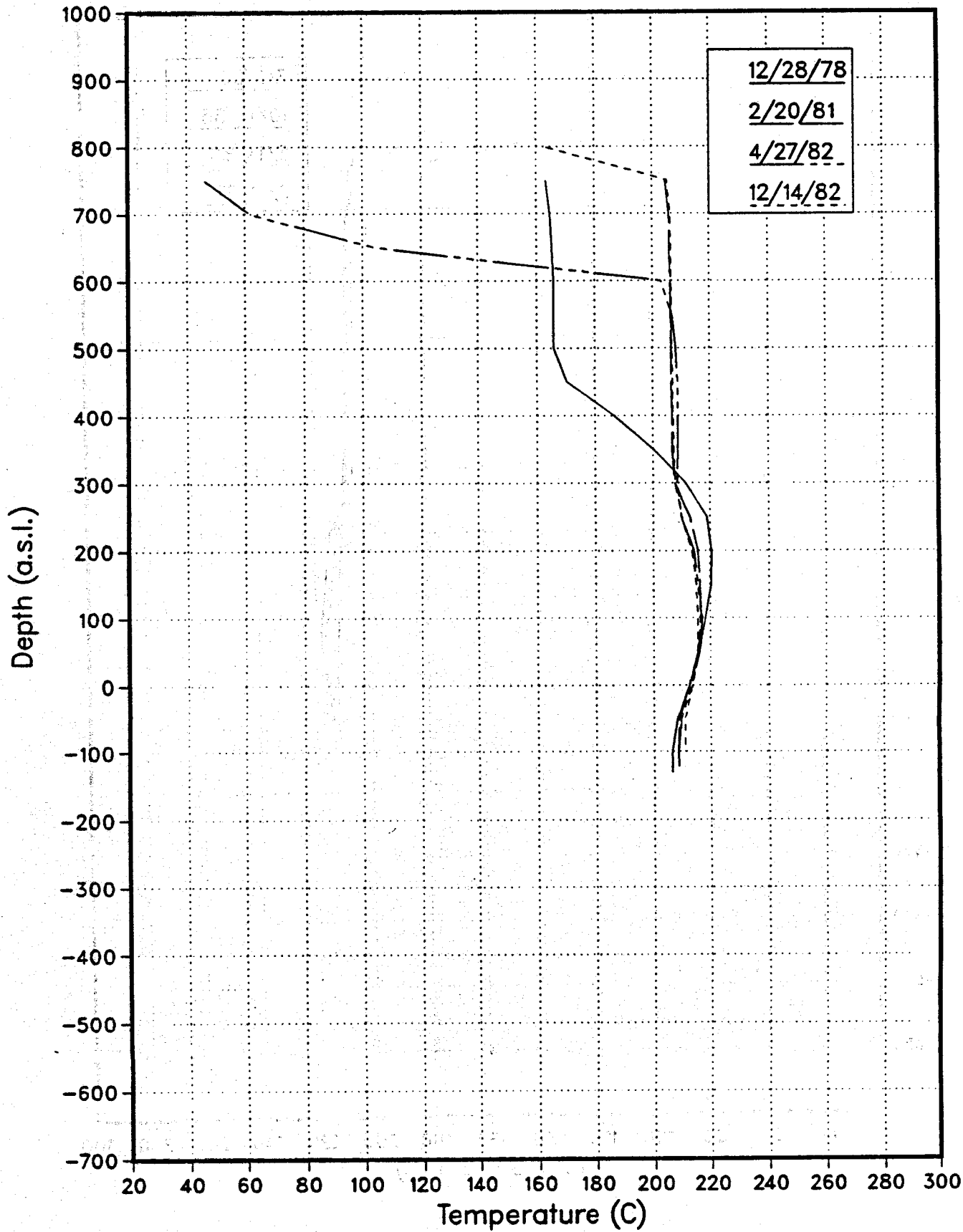
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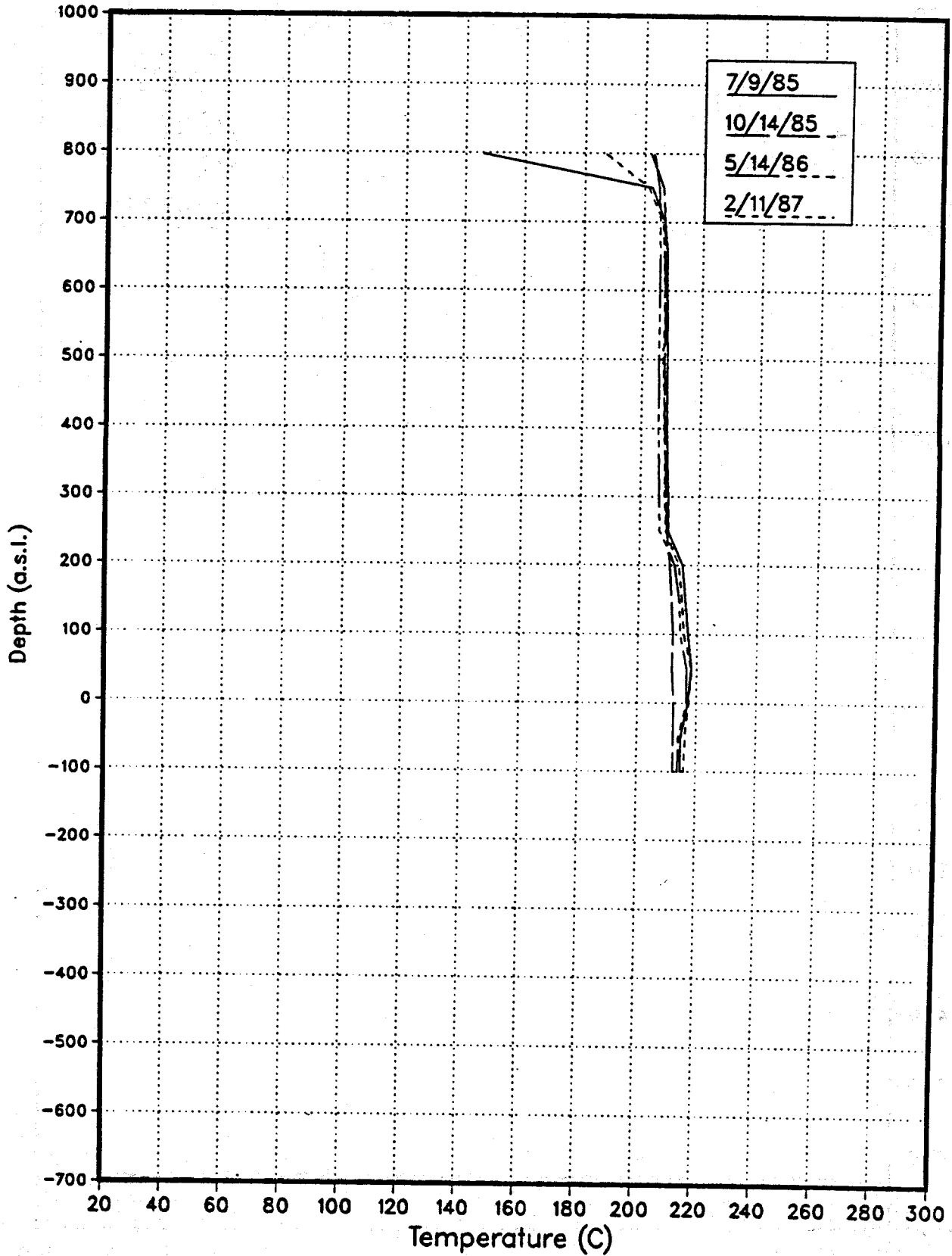
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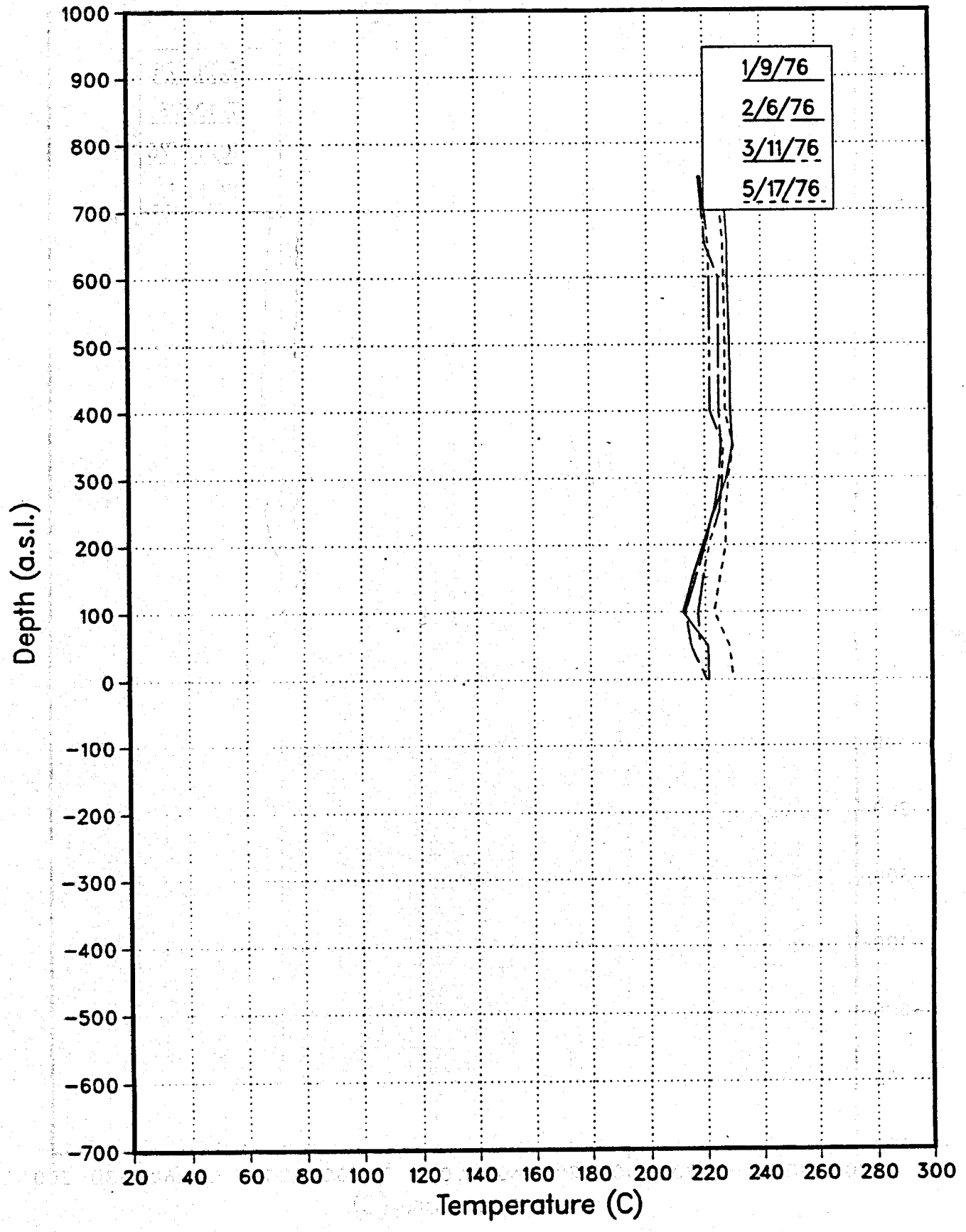
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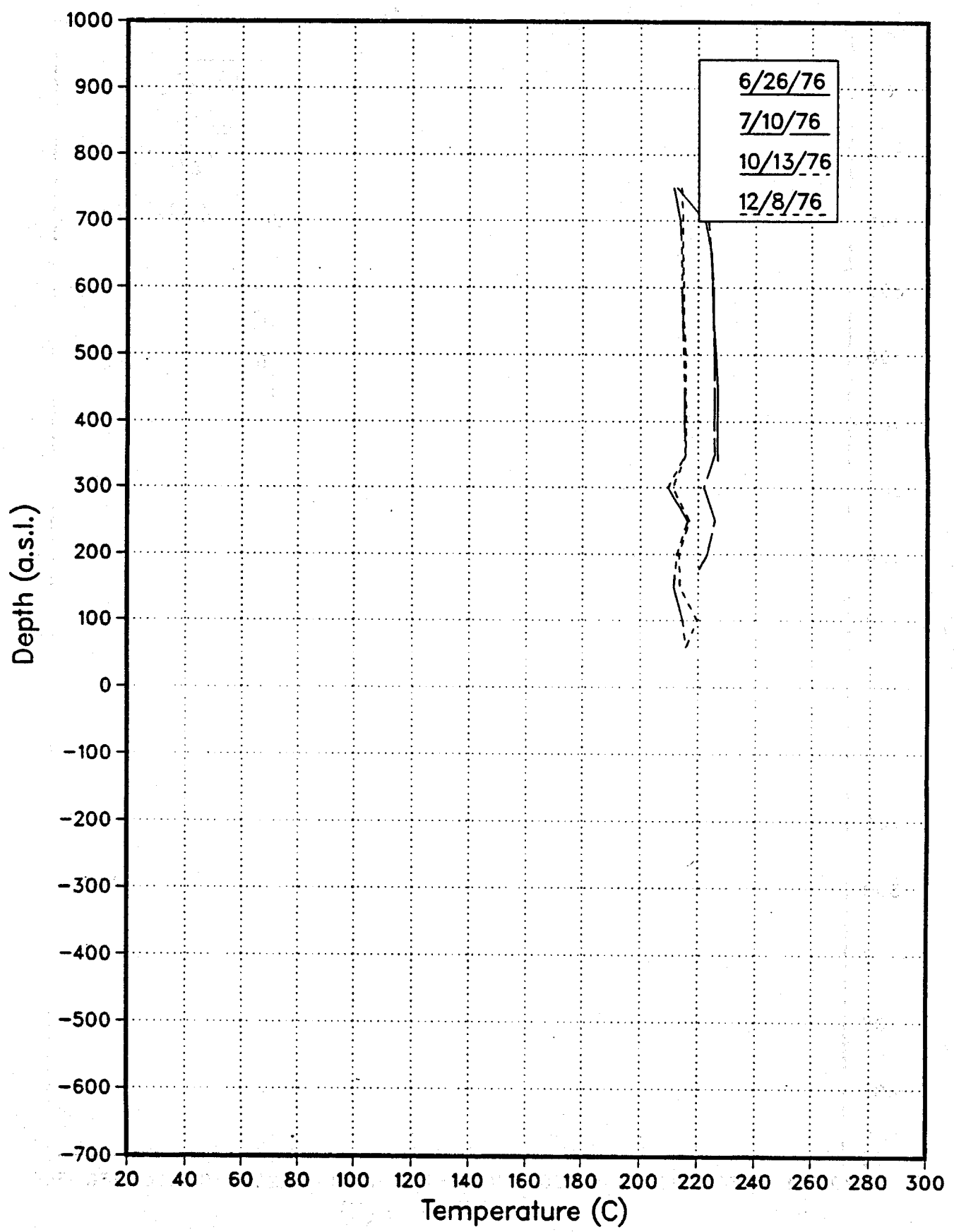
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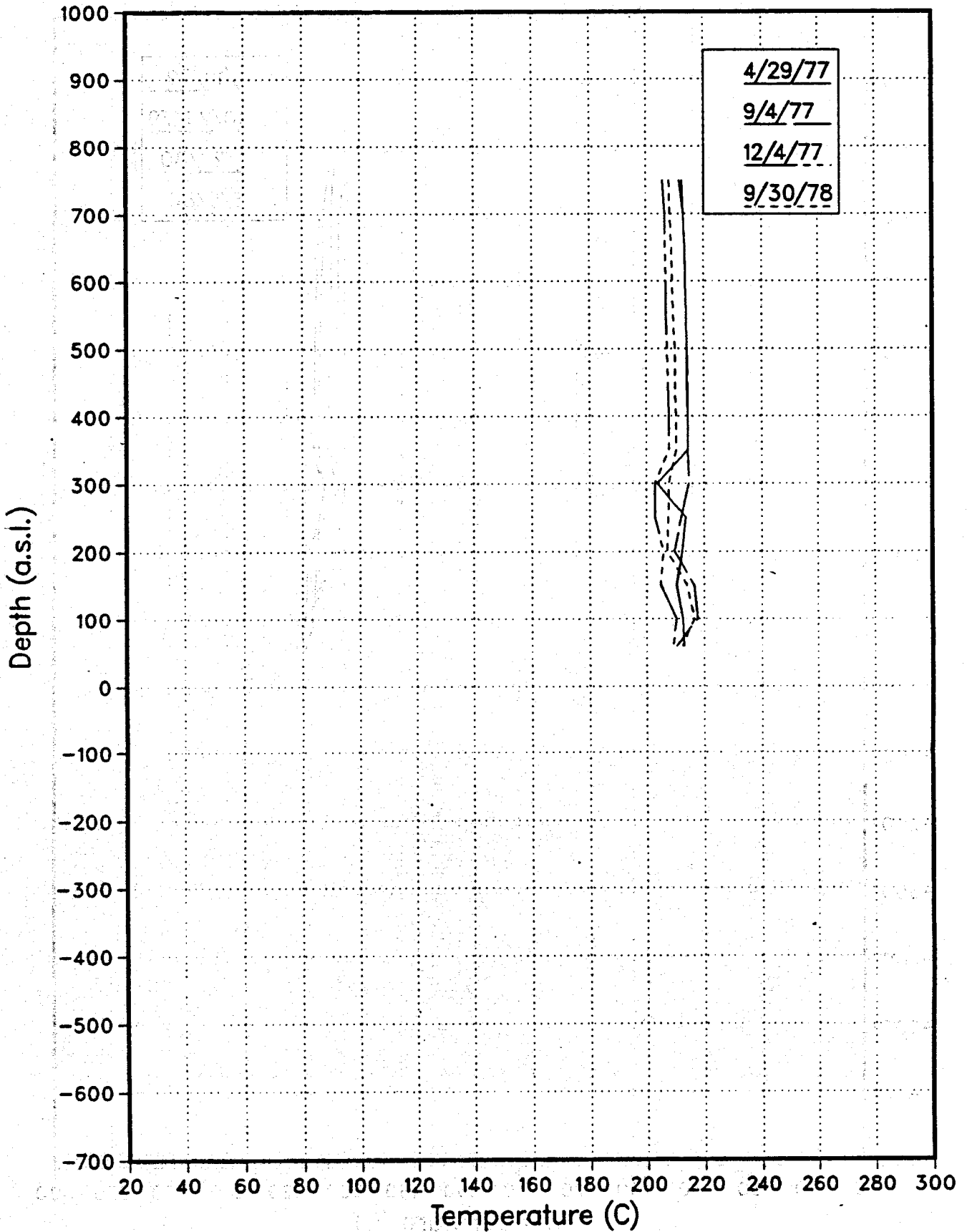
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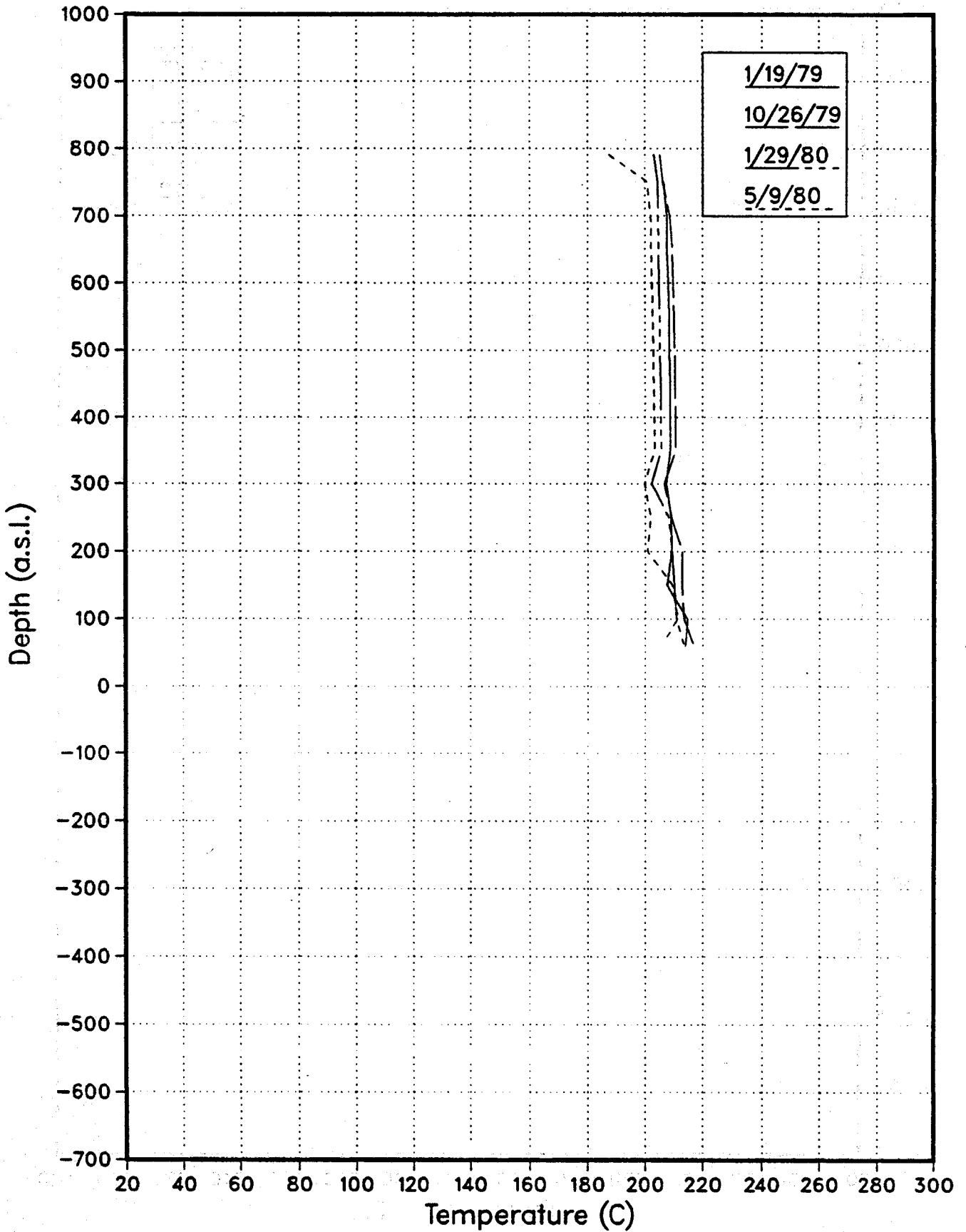
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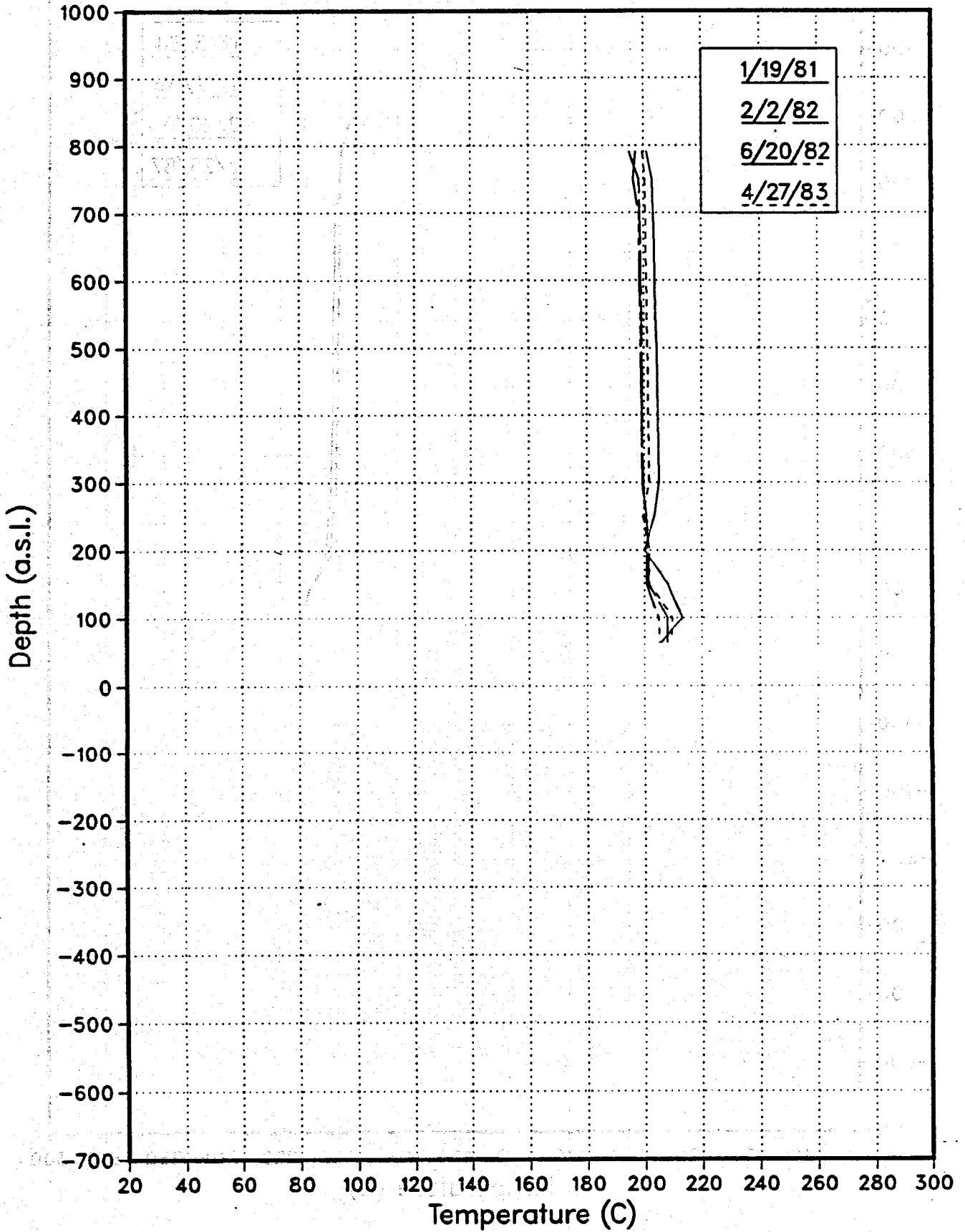
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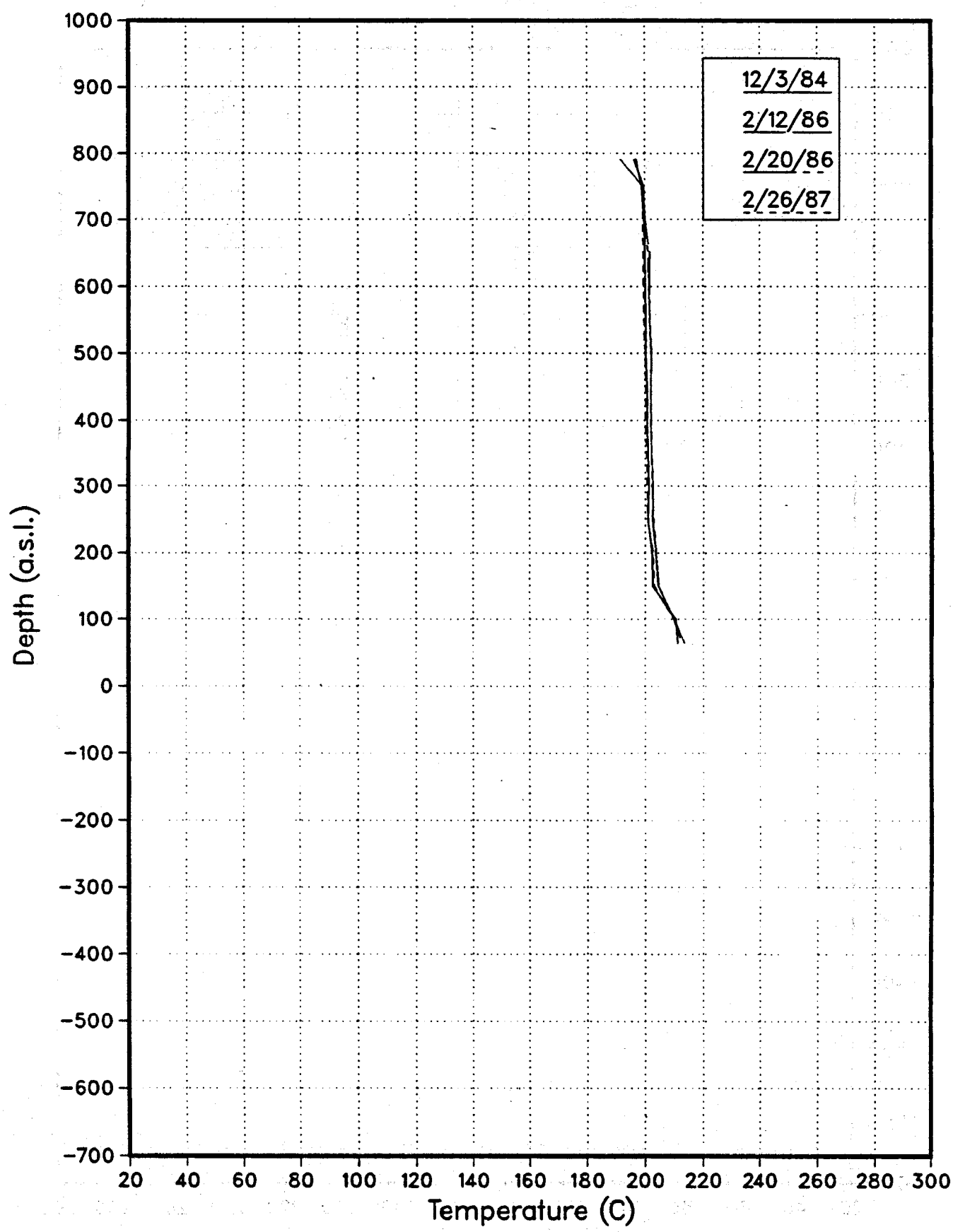
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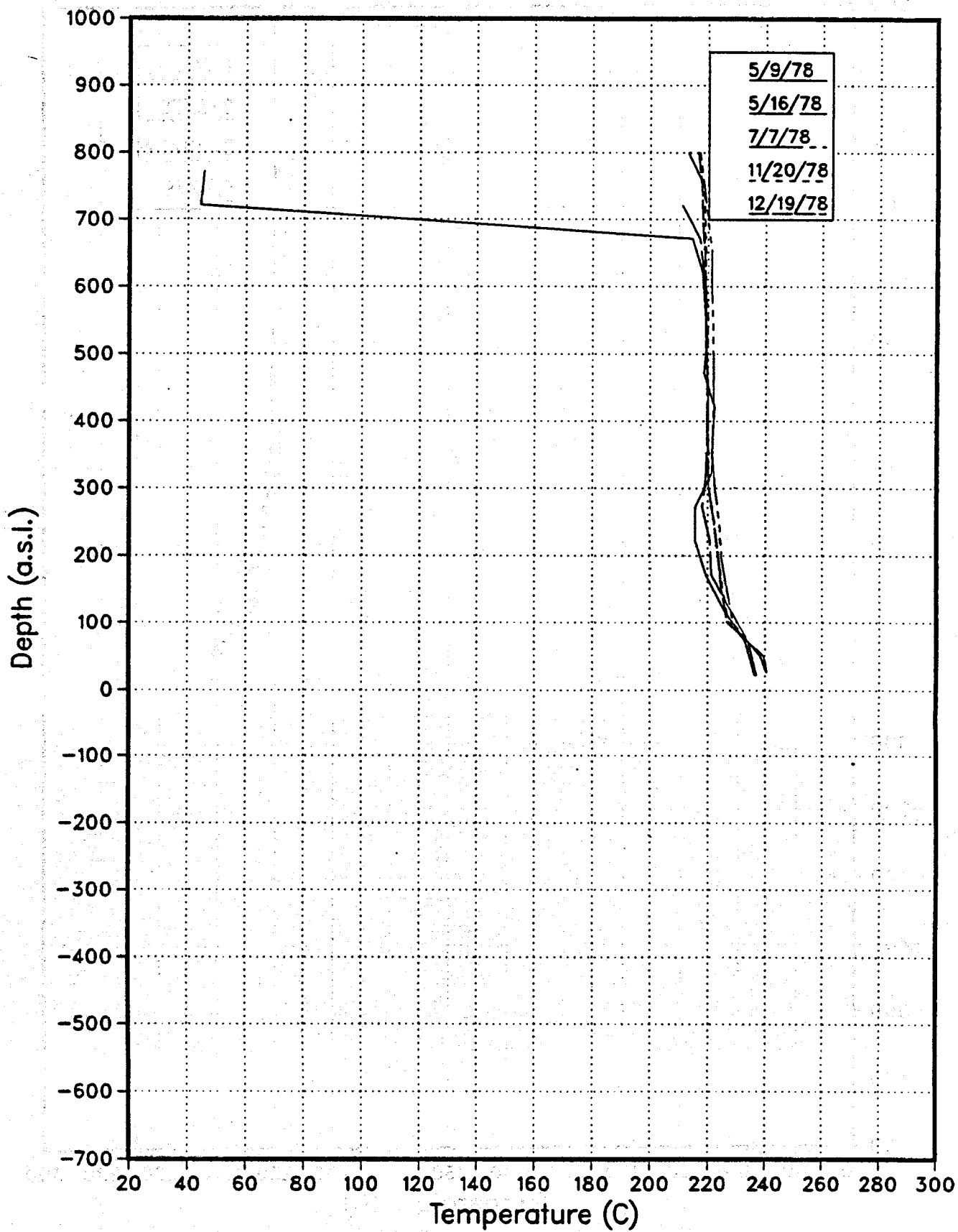
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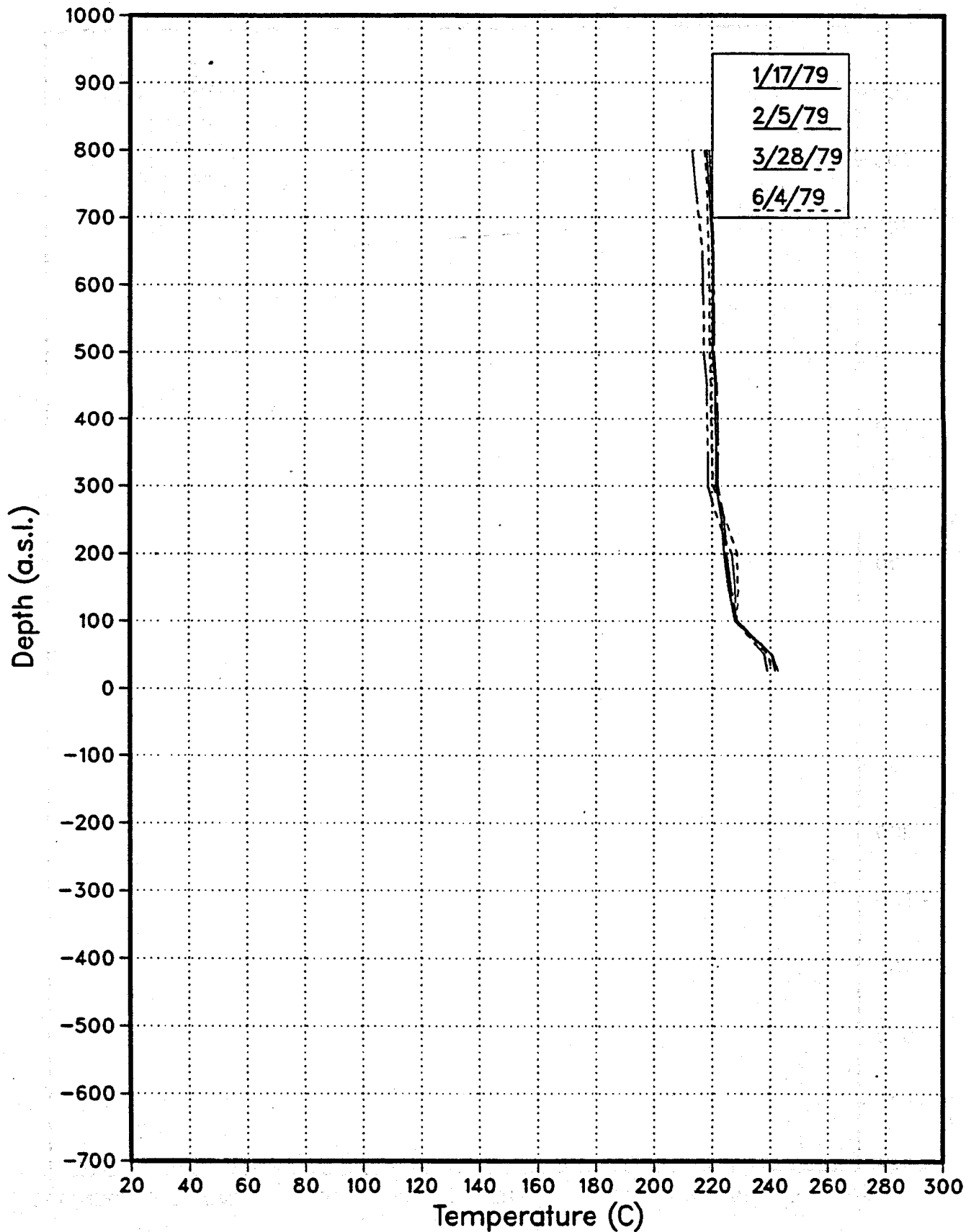
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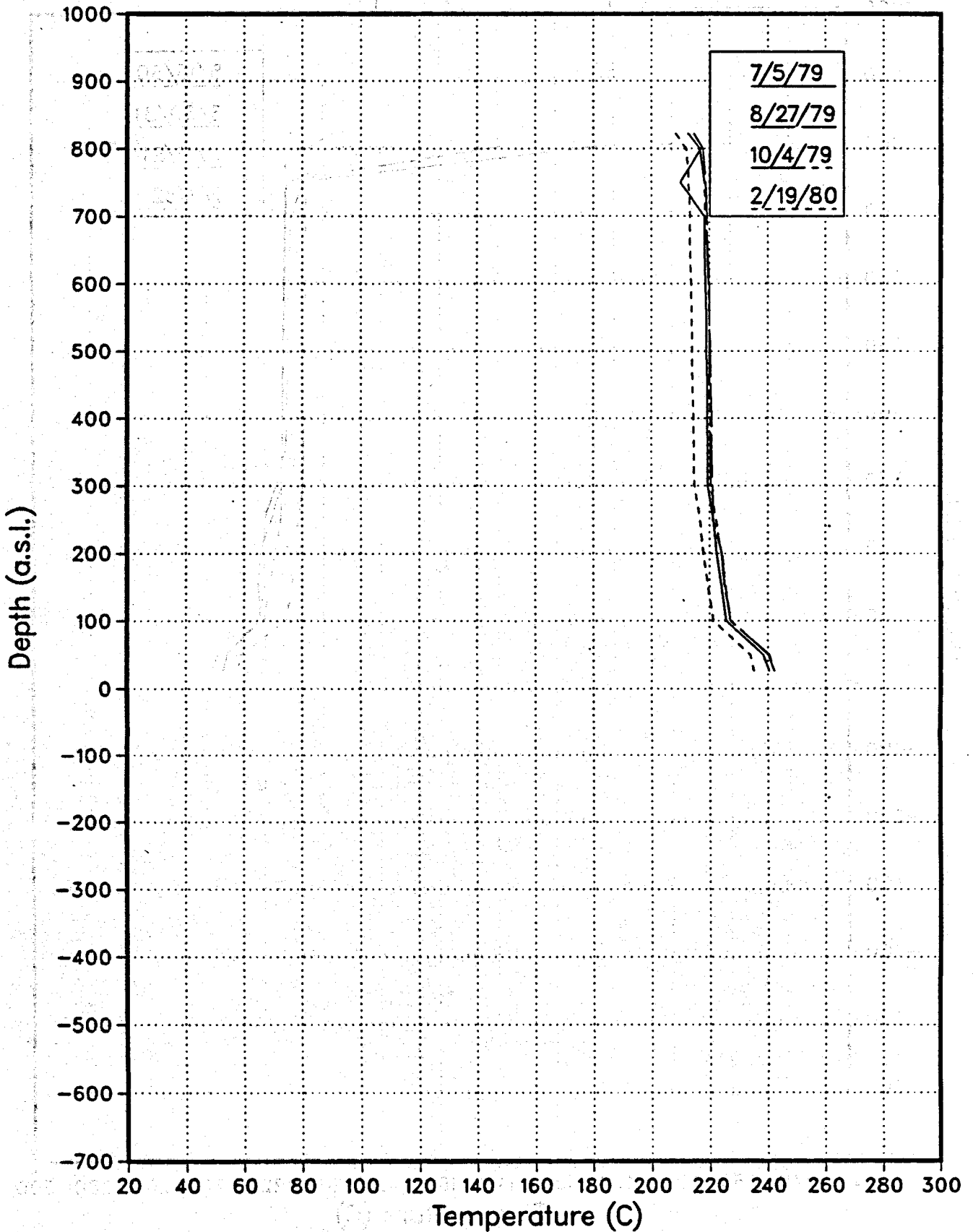
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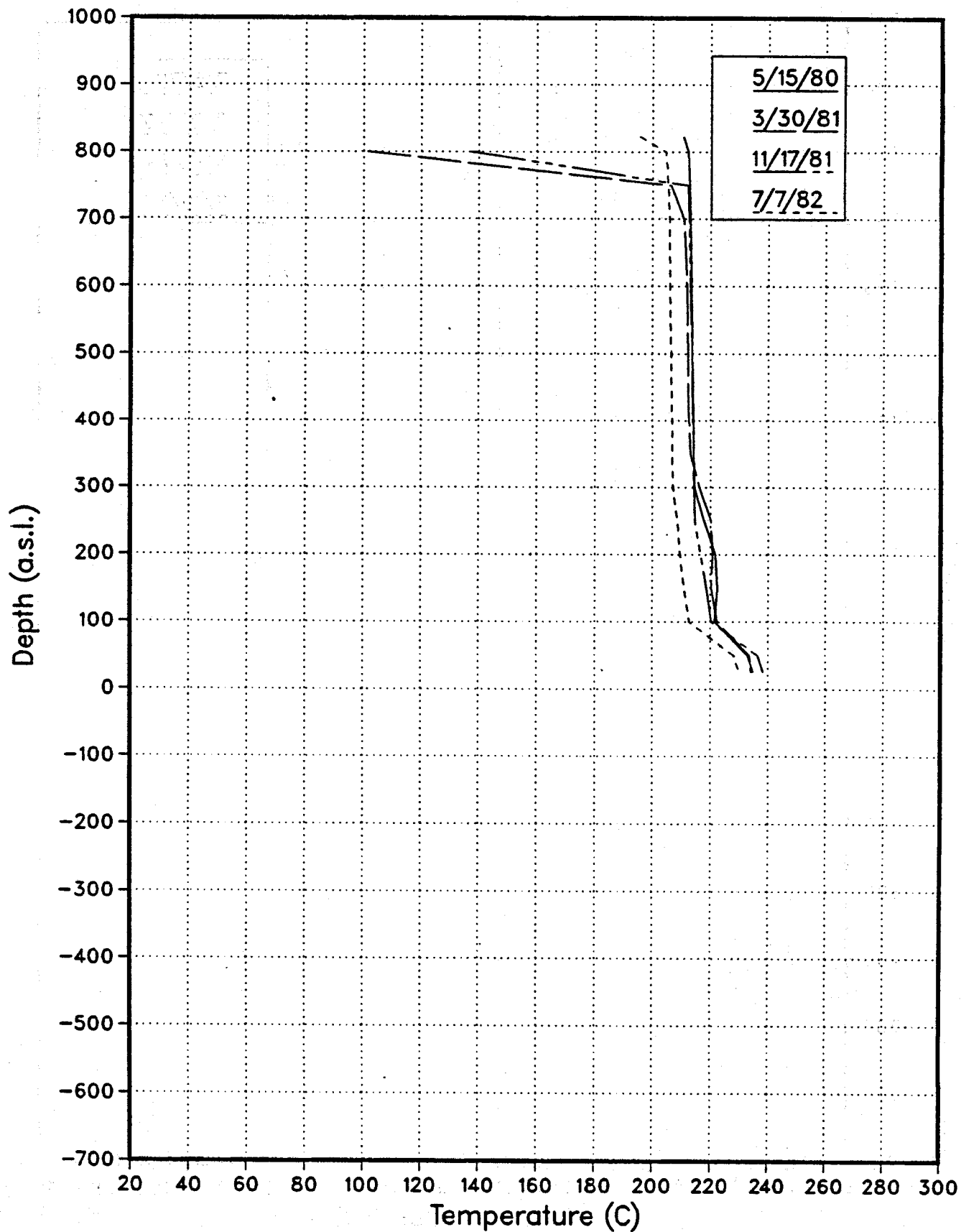
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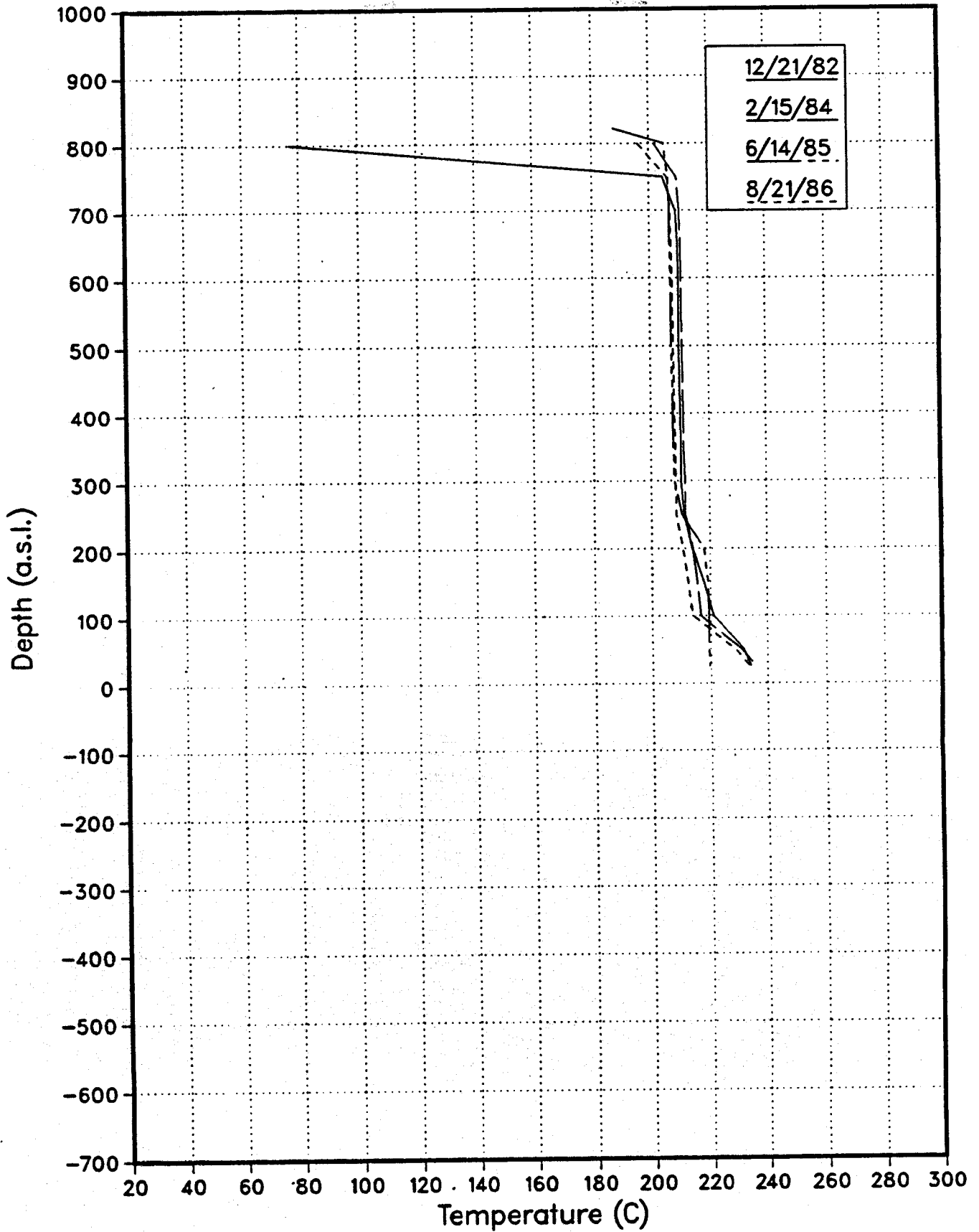
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AH27 Temperature Surveys



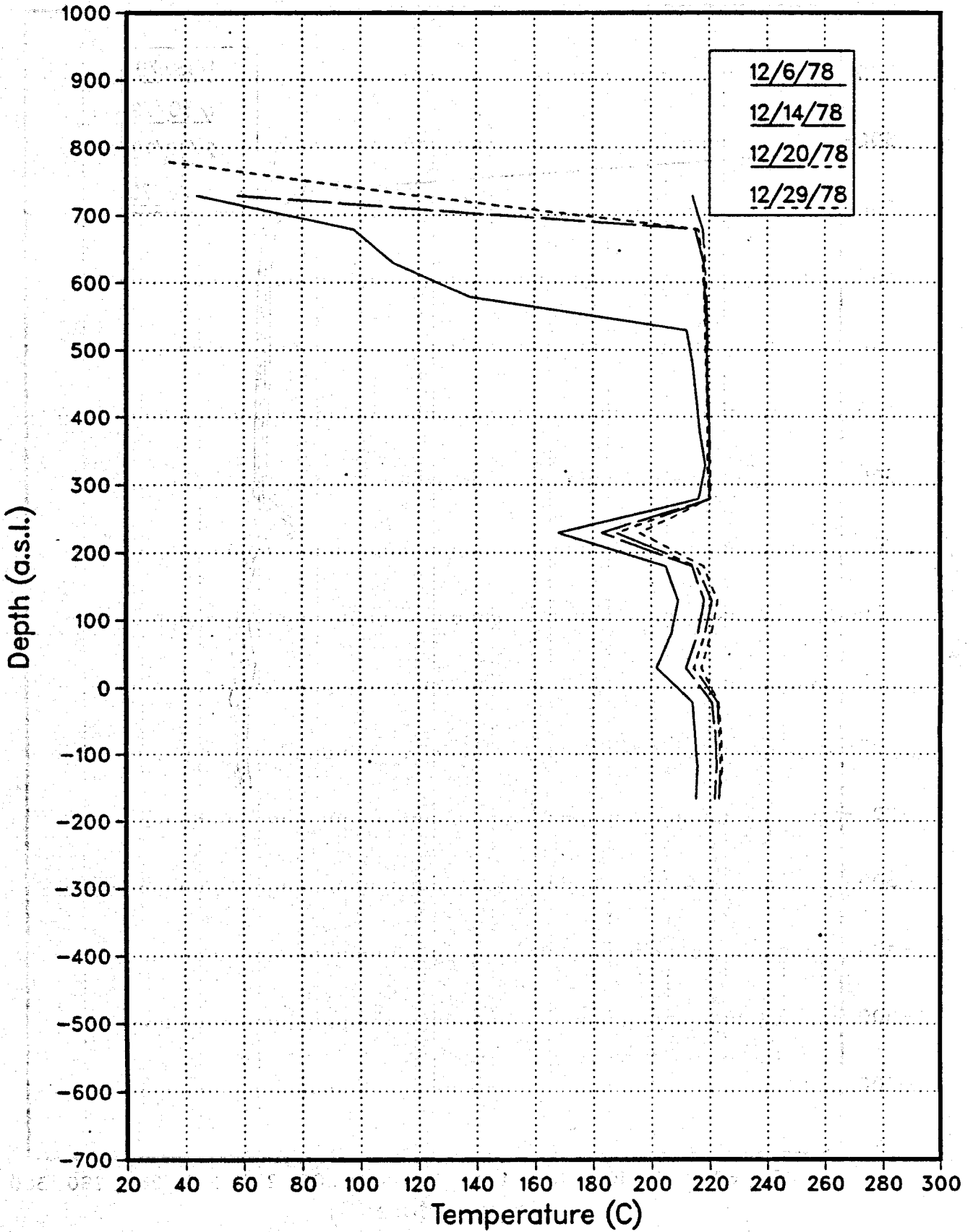
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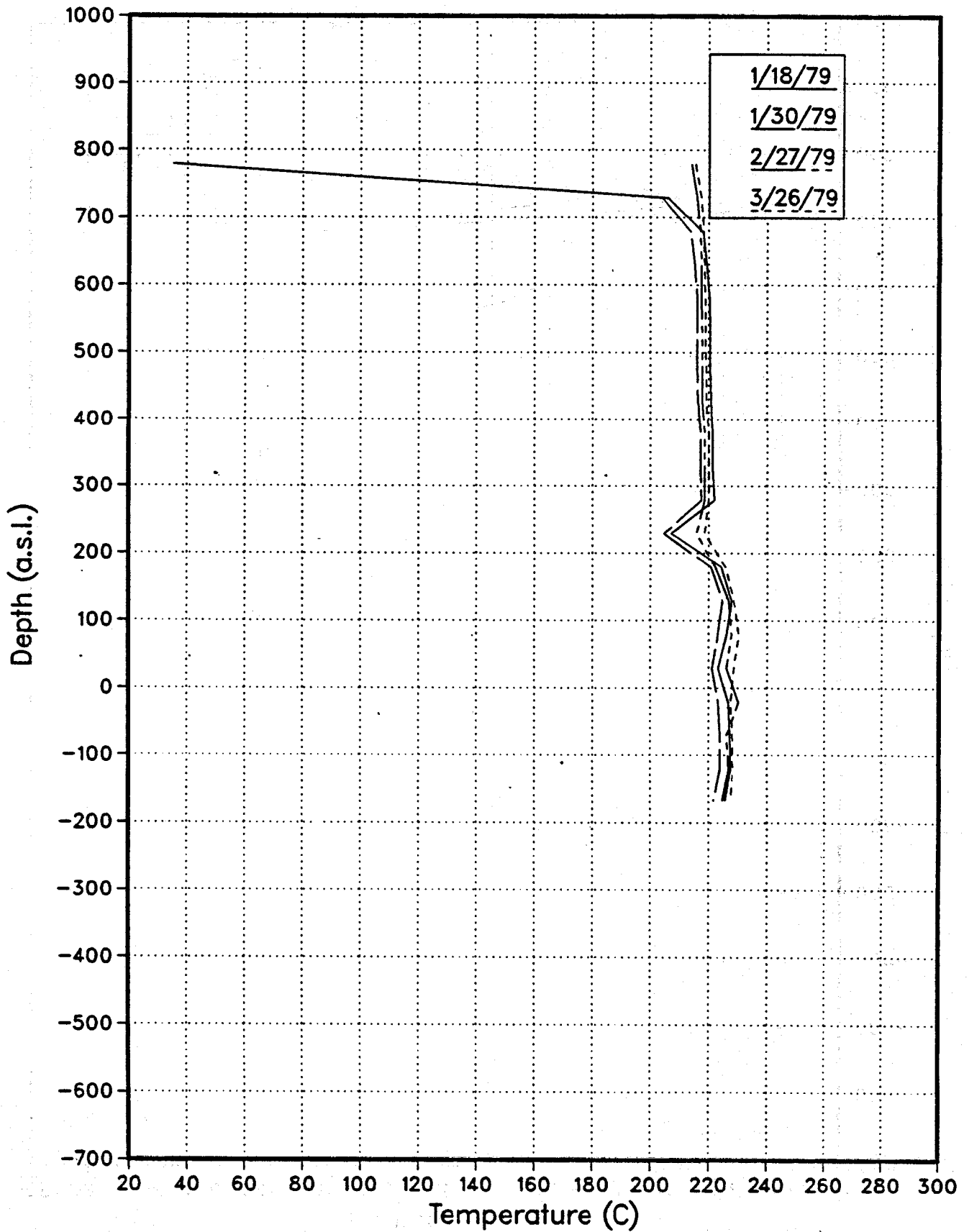
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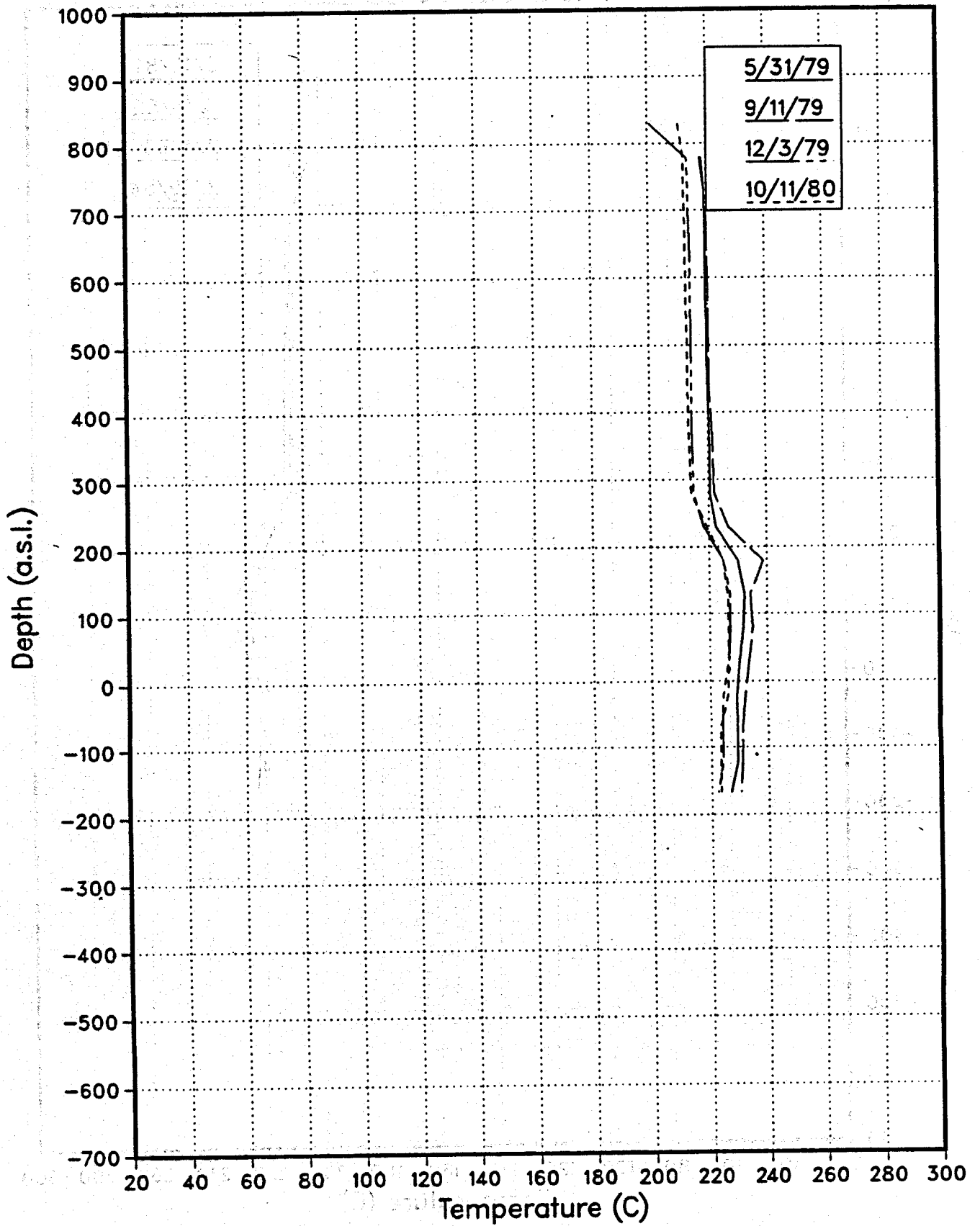
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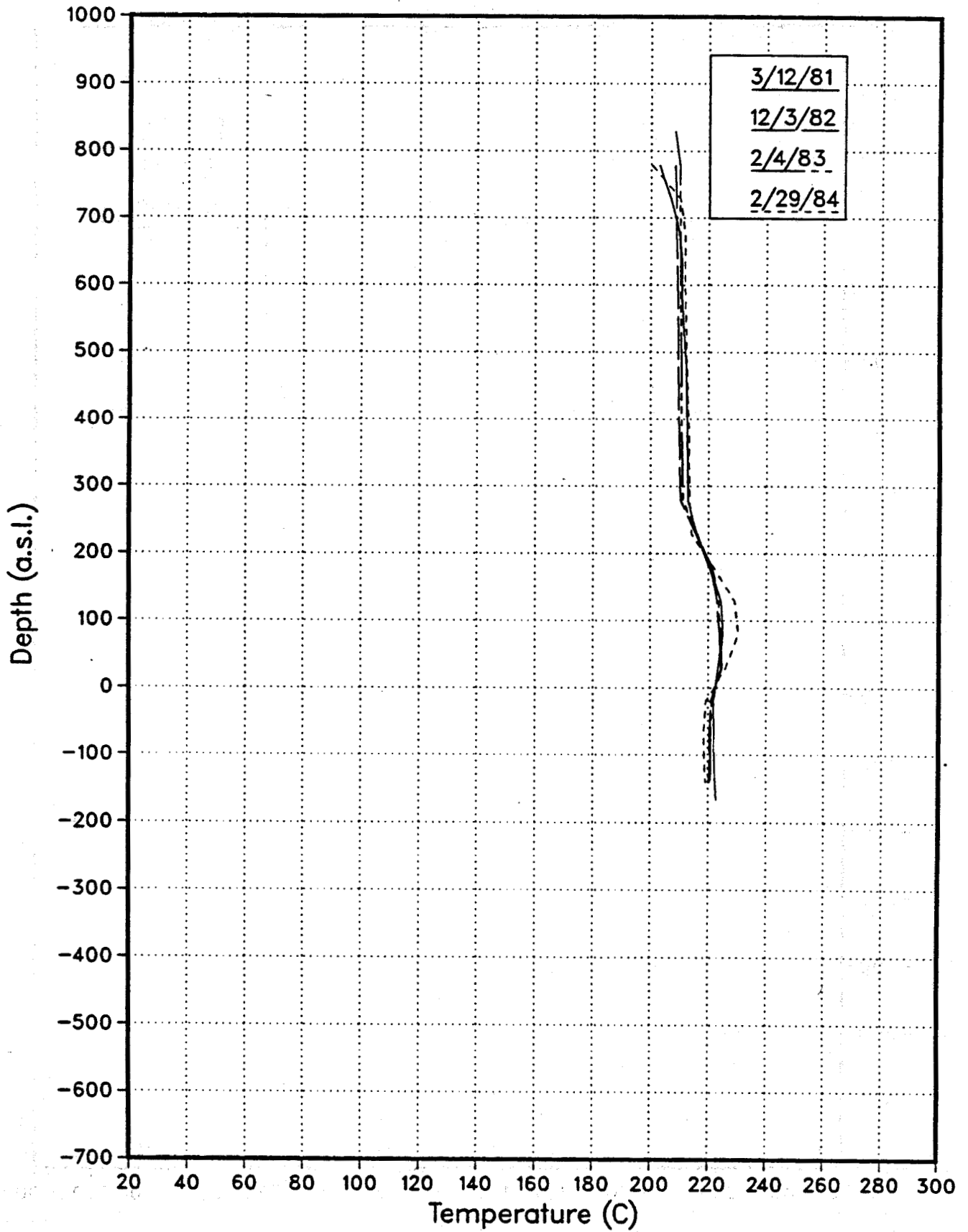
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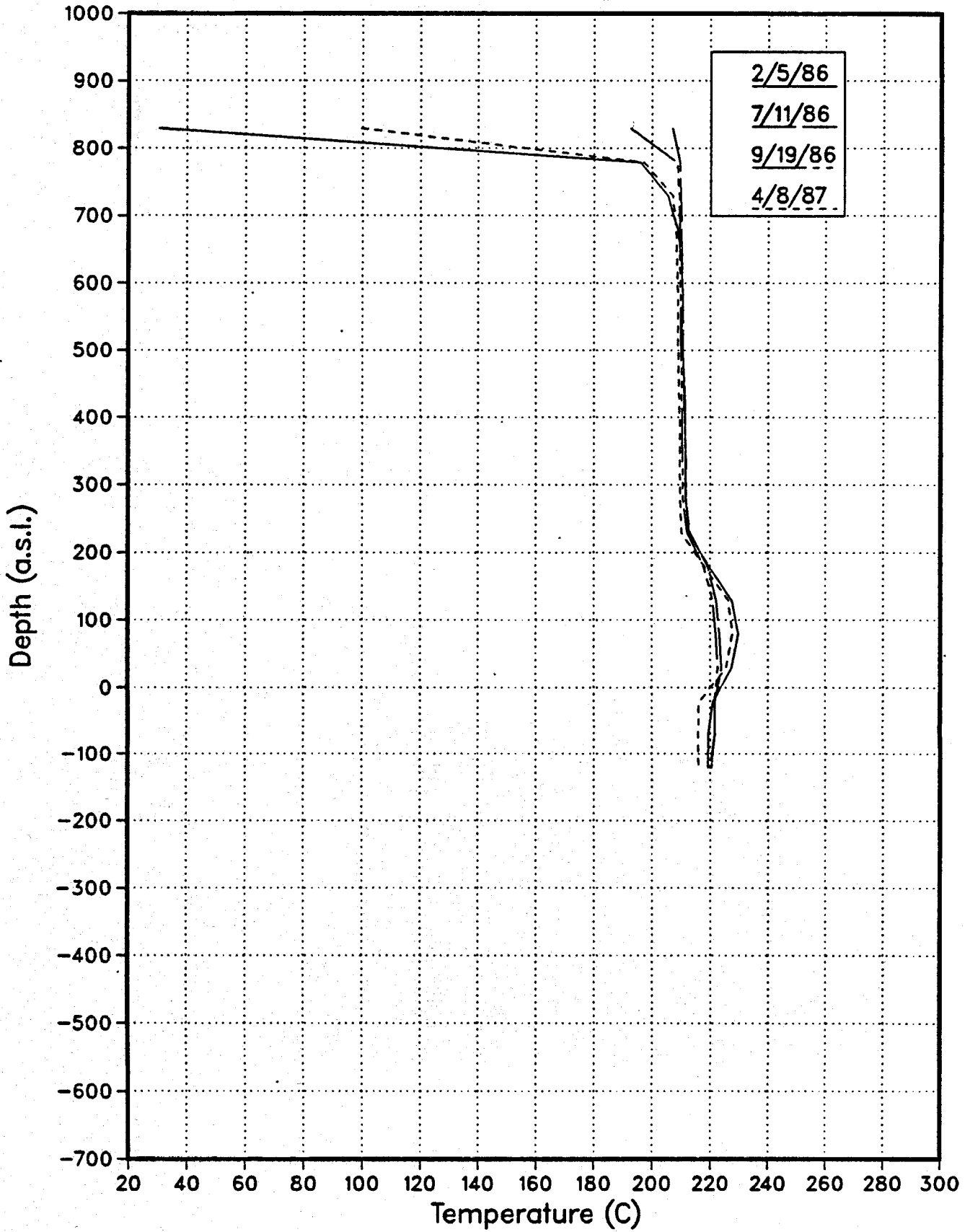
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AH28 Temperature Surveys



AH28 Temperature Surveys



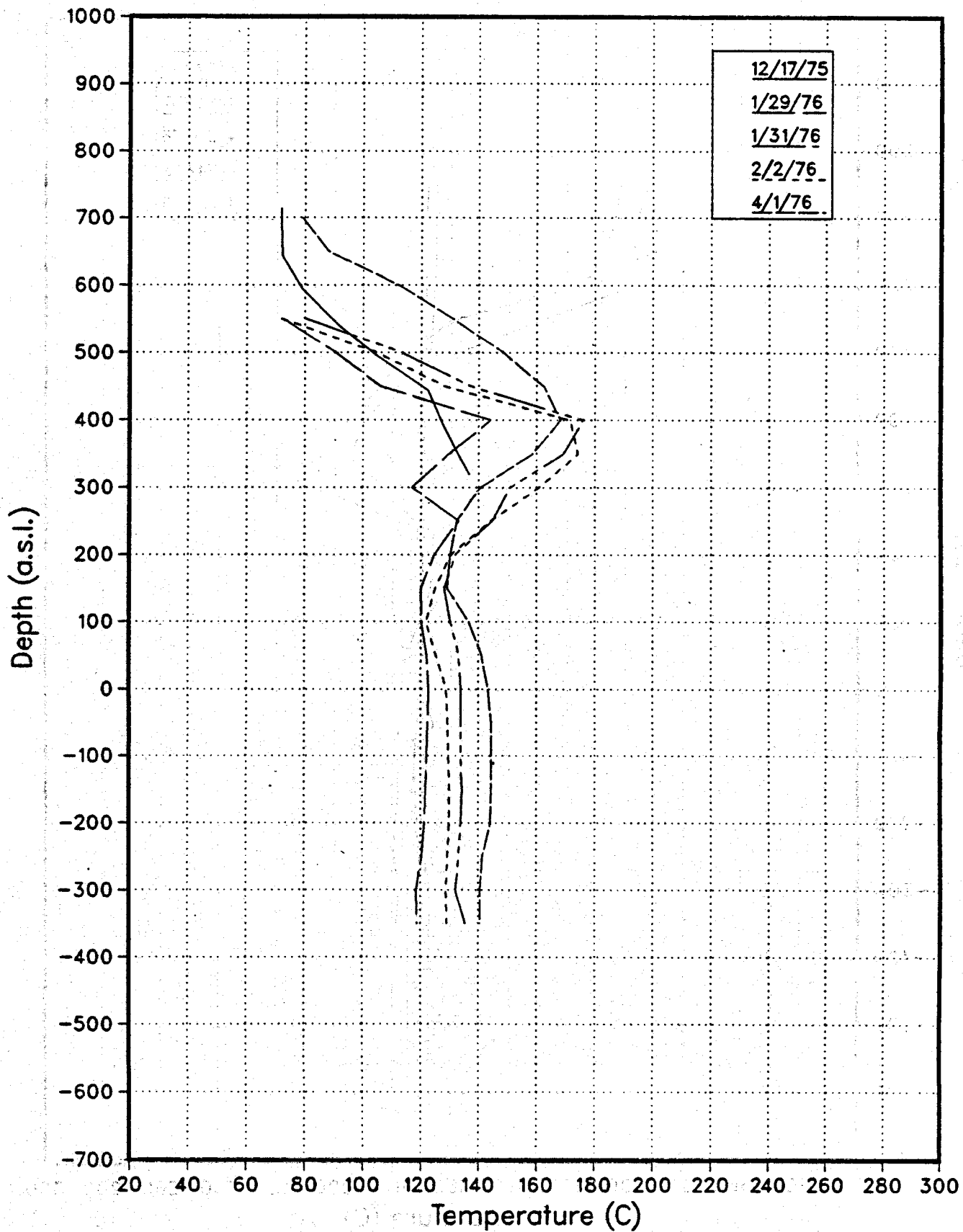
STATE OF CALIFORNIA

I, the undersigned, a duly qualified and acting Notary Public in and for the State of California, do hereby certify that the within and foregoing is a true and correct copy of the original of the same as the same appears from the records of my office.

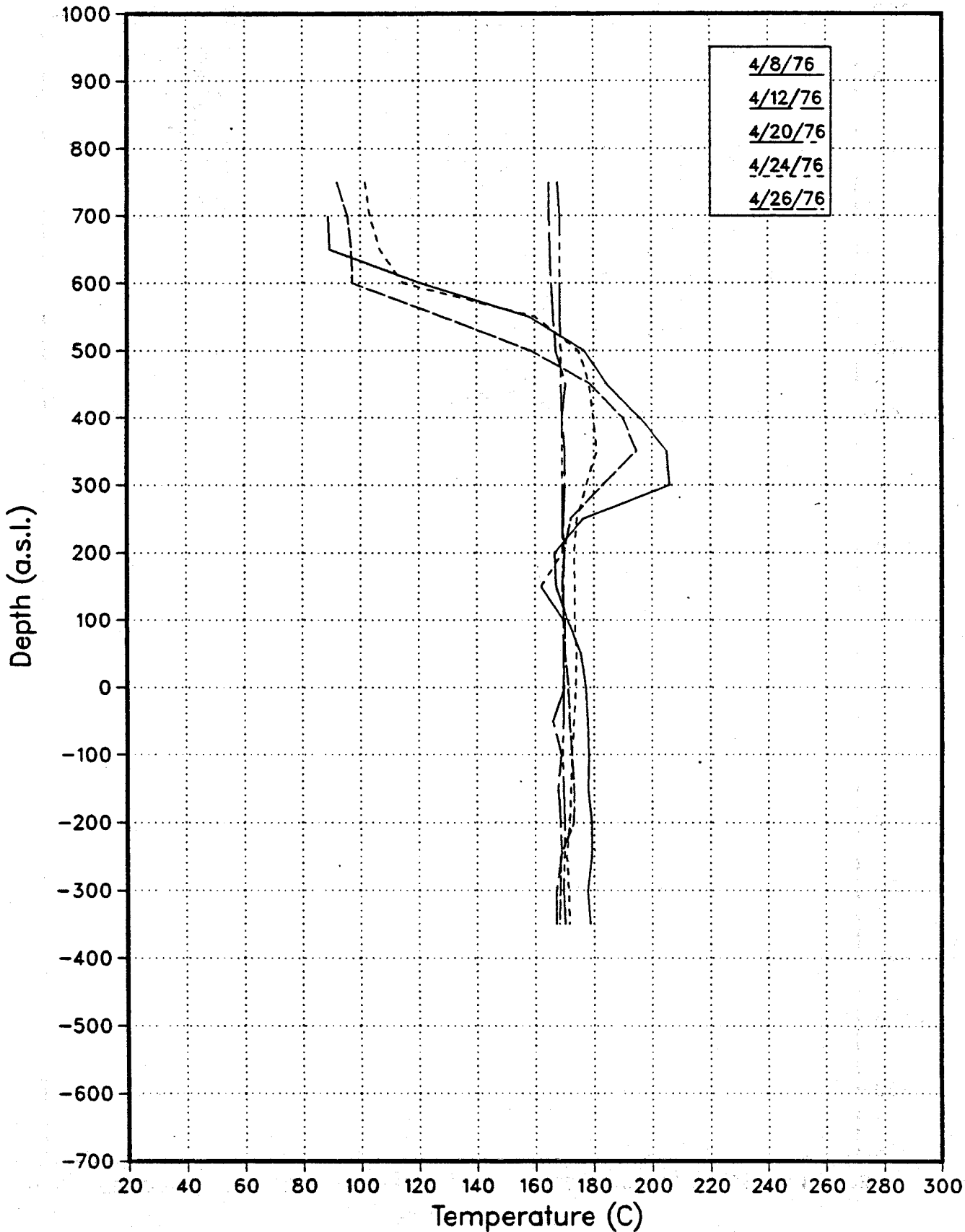
Witness my hand and the seal of my office this _____ day of _____, 19____.

 Notary Public in and for the State of California

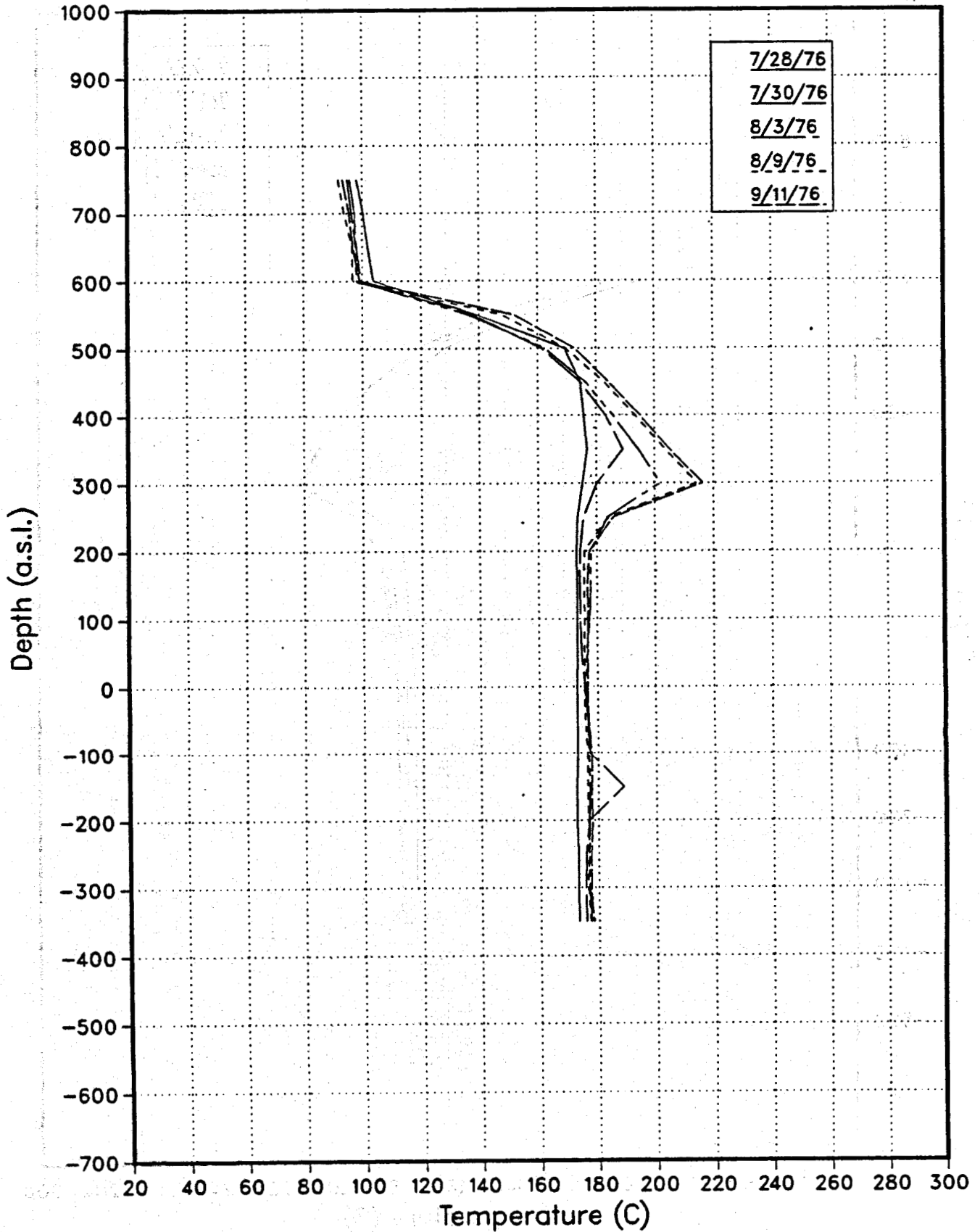
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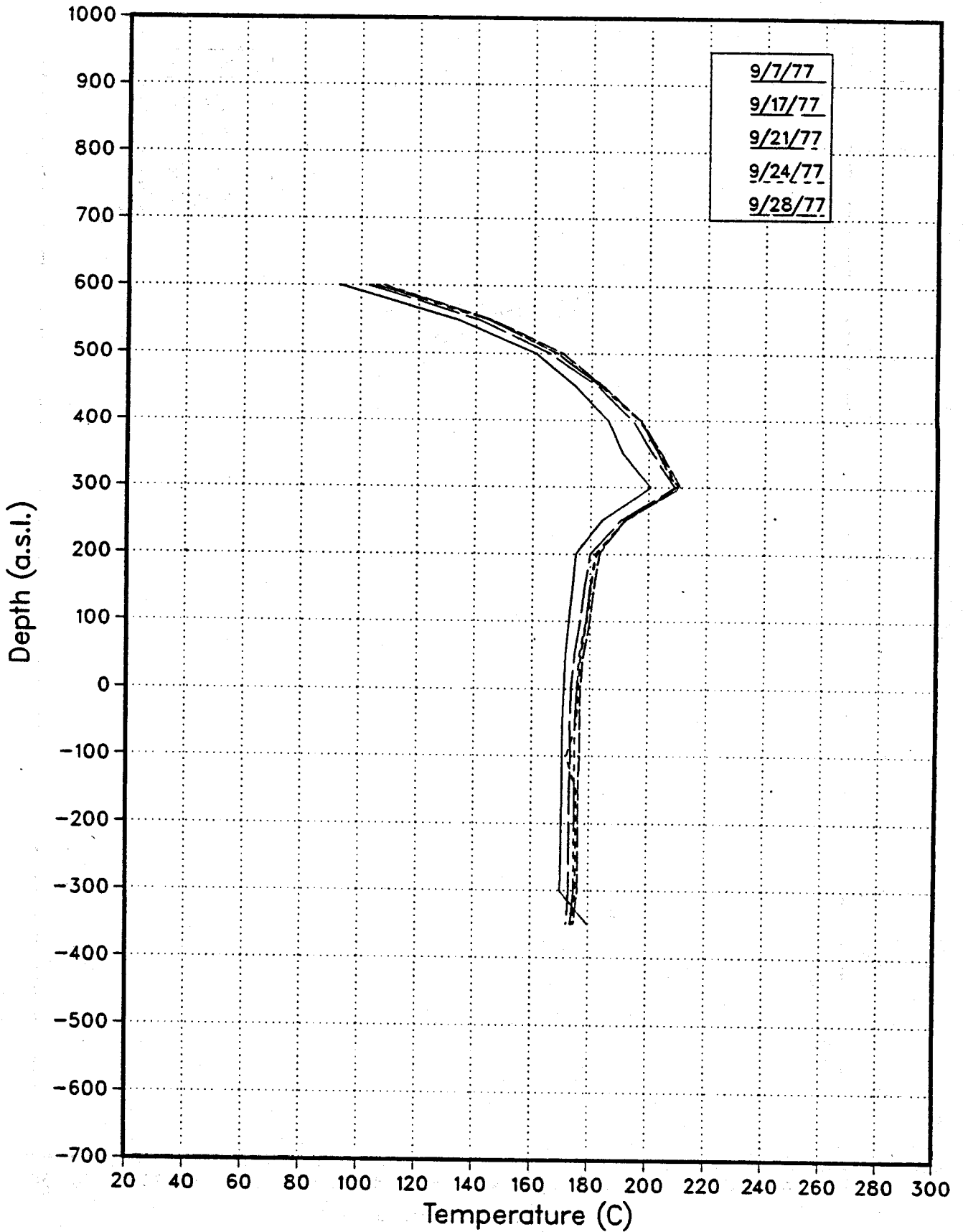
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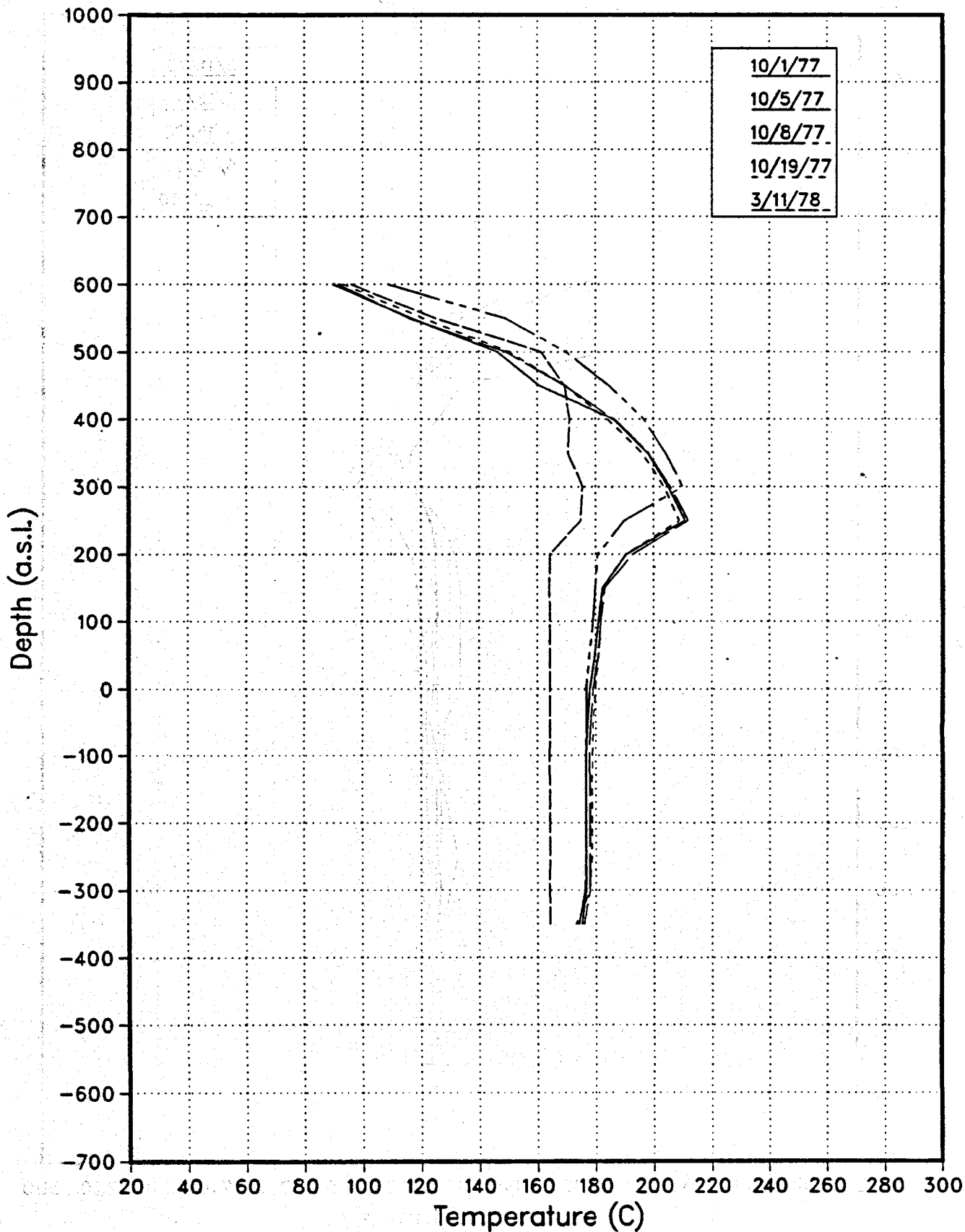
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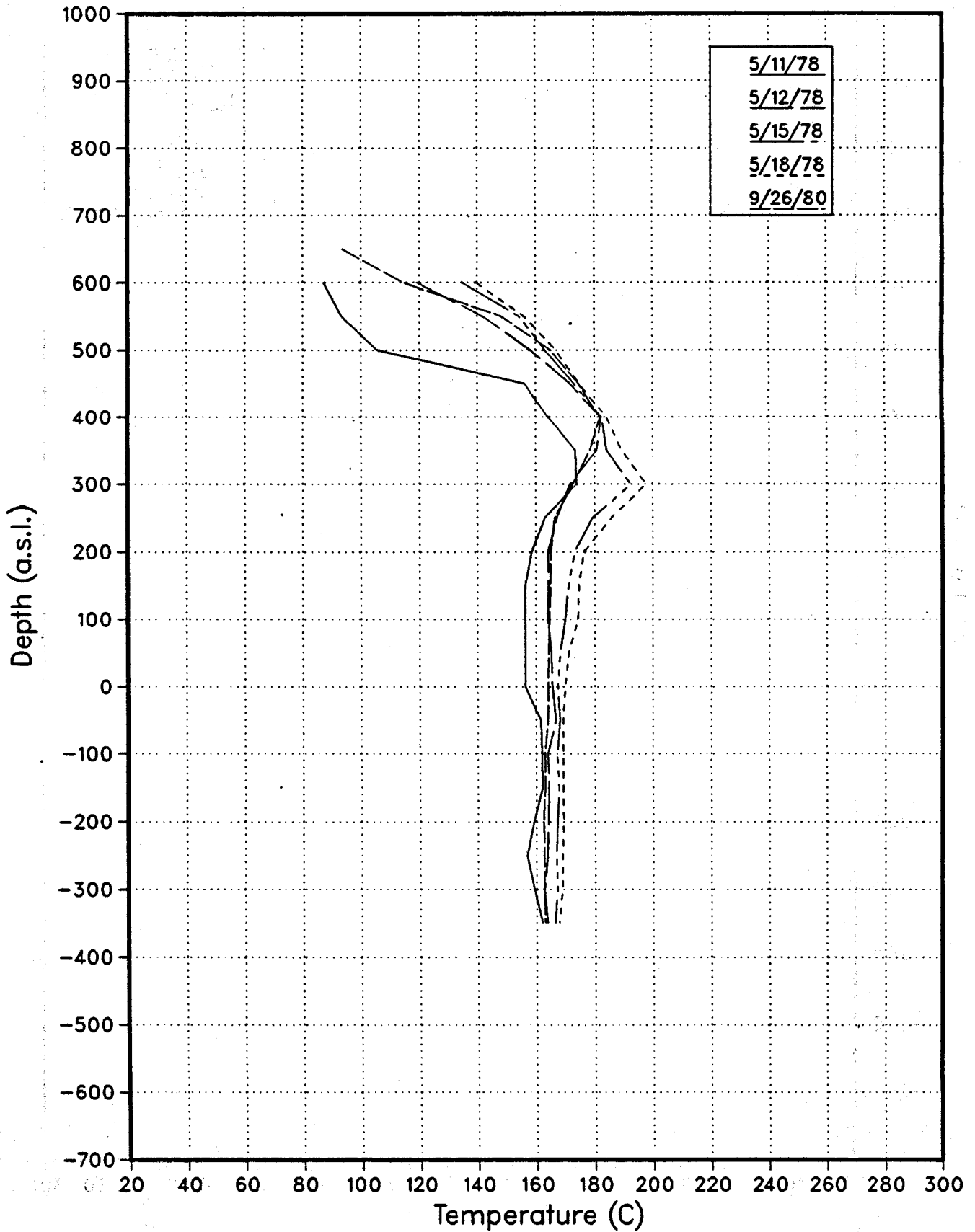
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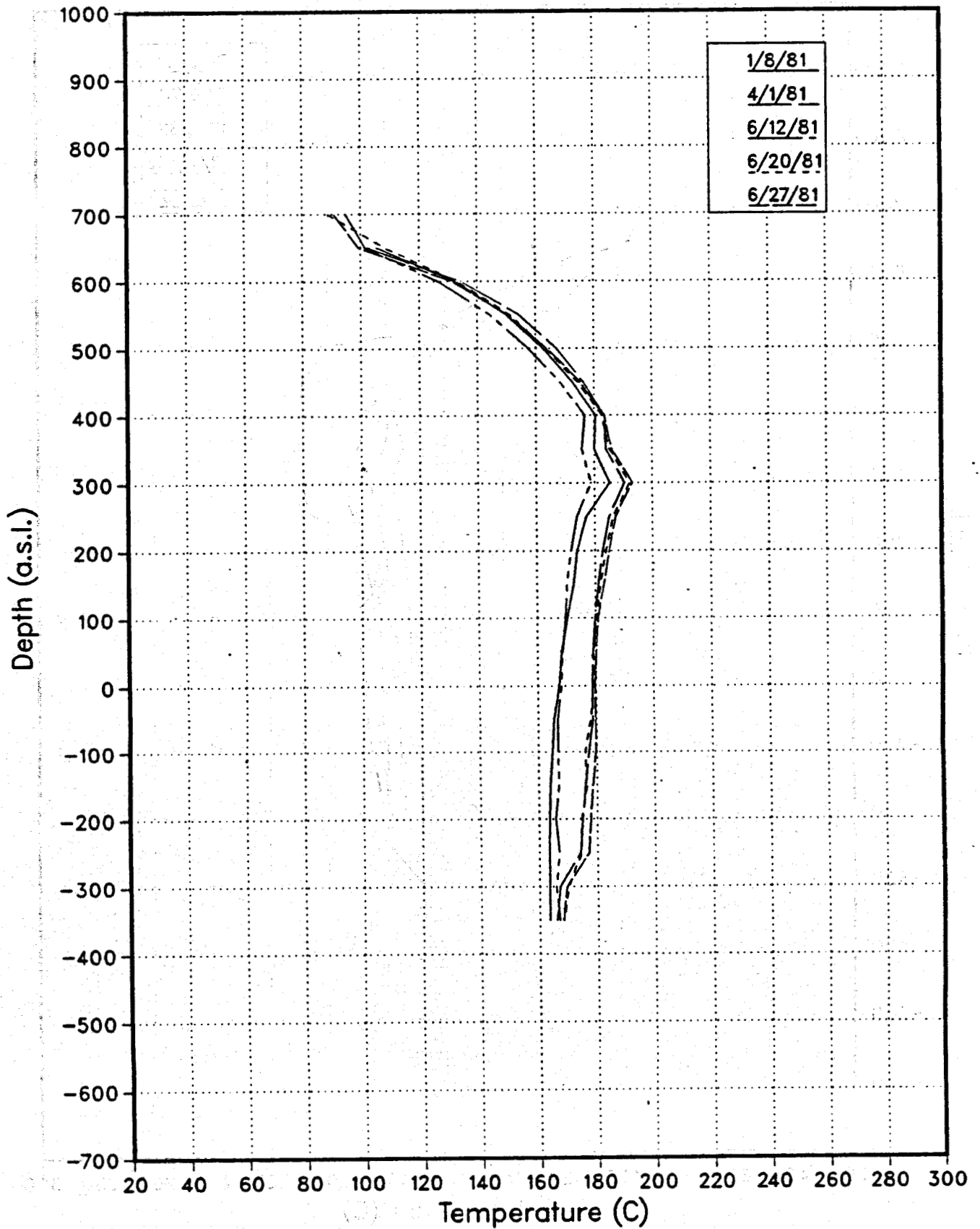
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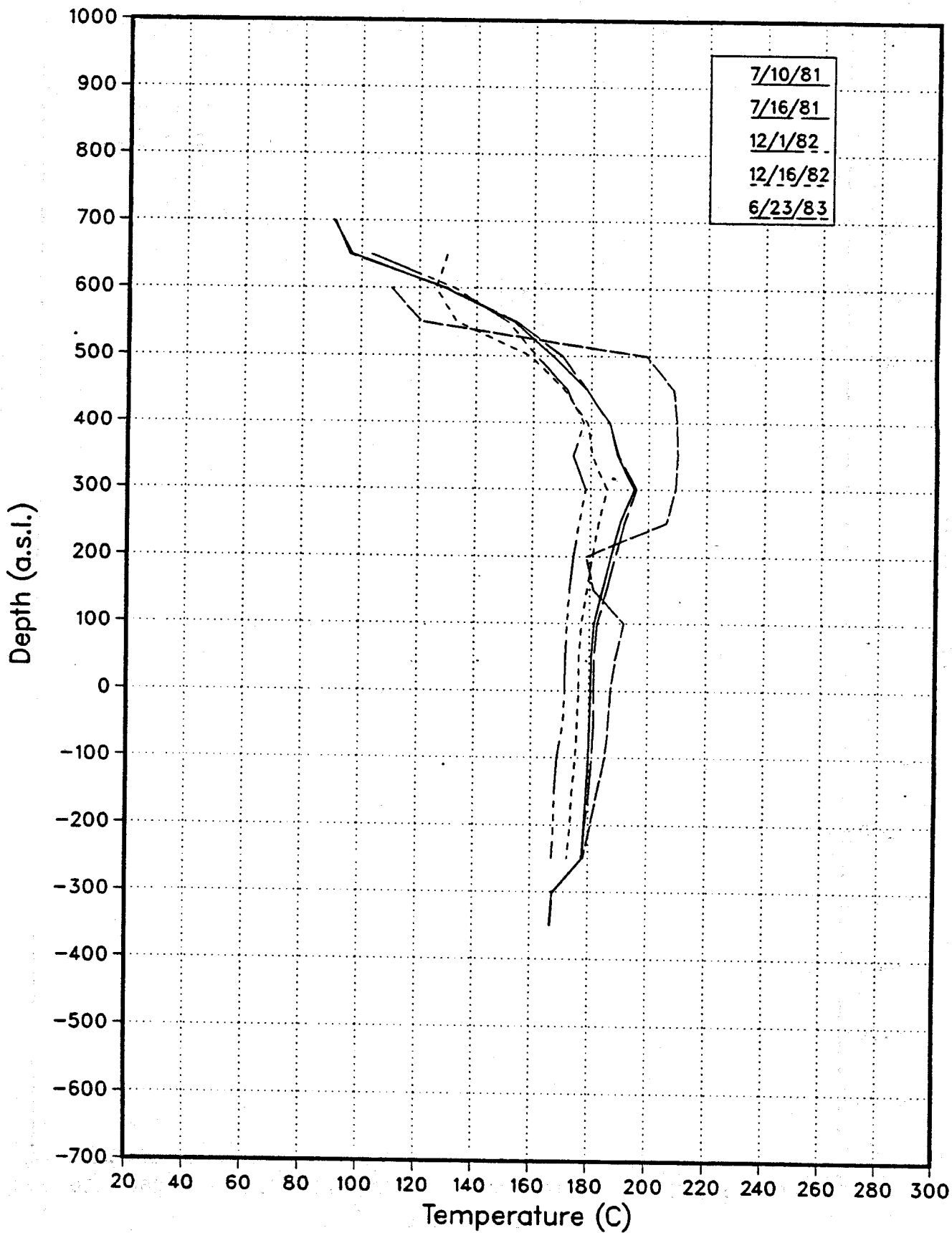
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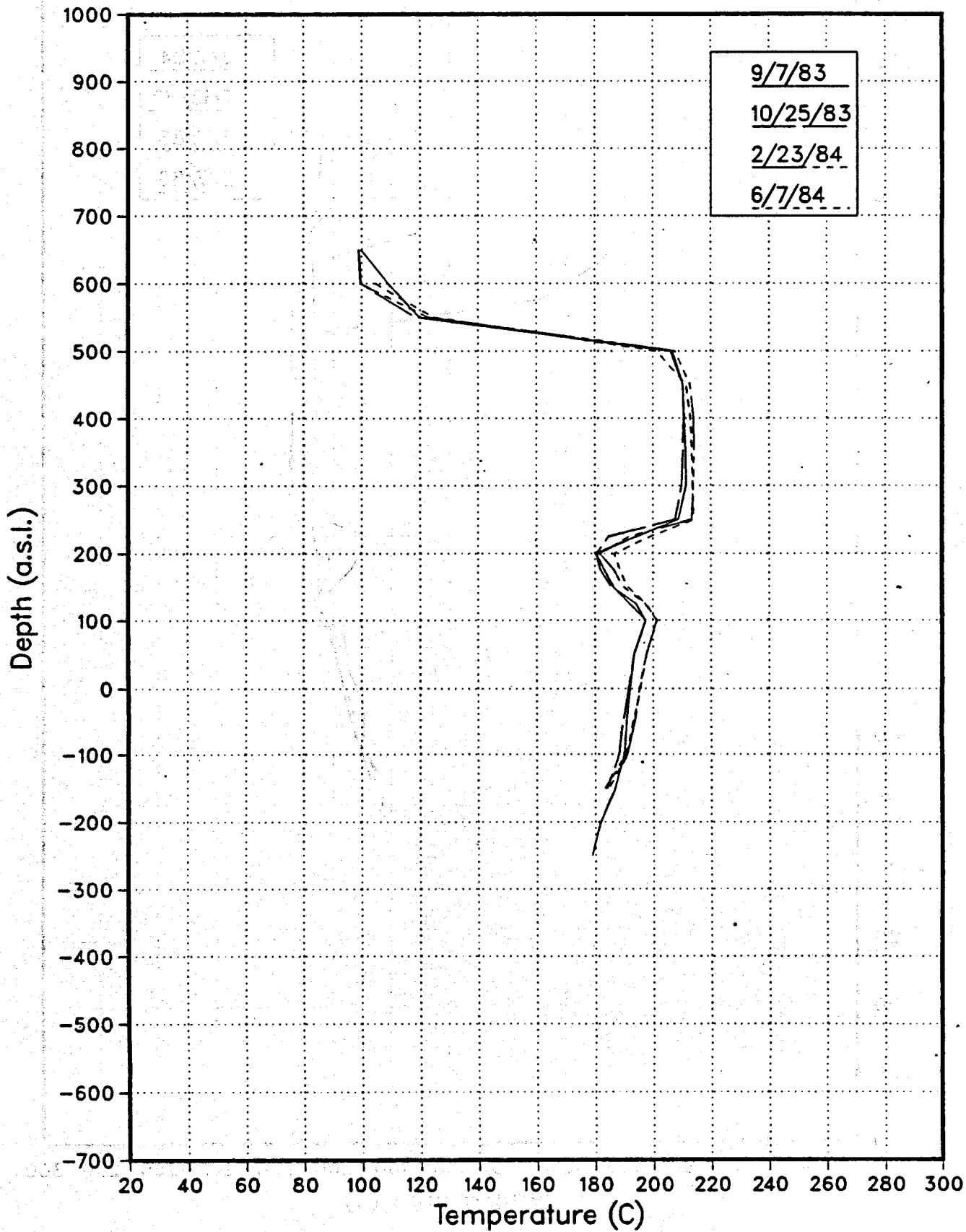
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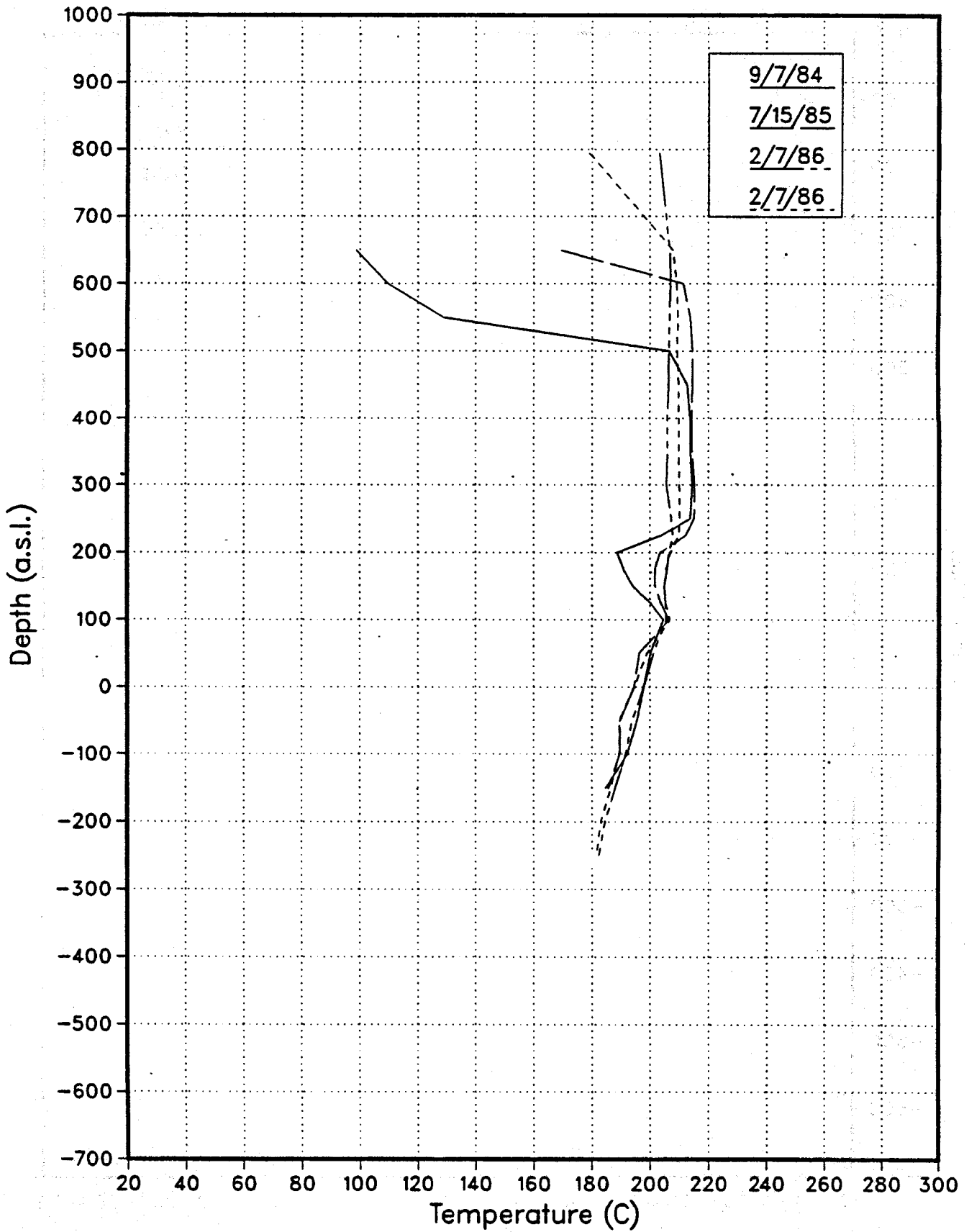
AH29 Temperature Surveys



AH29 Temperature Surveys

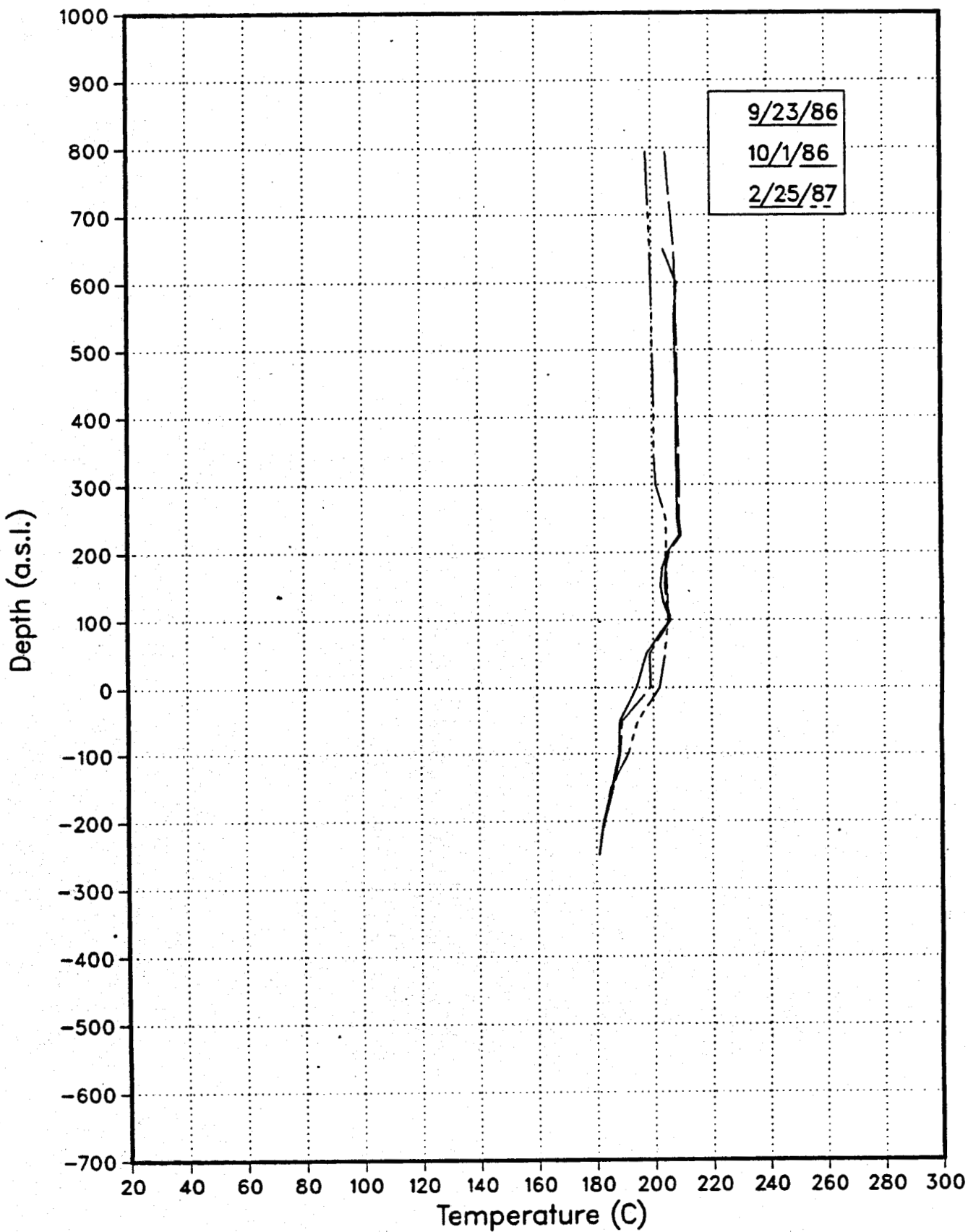


AH29 Temperature Surveys



-D145-/D146

AH29 Temperature Surveys



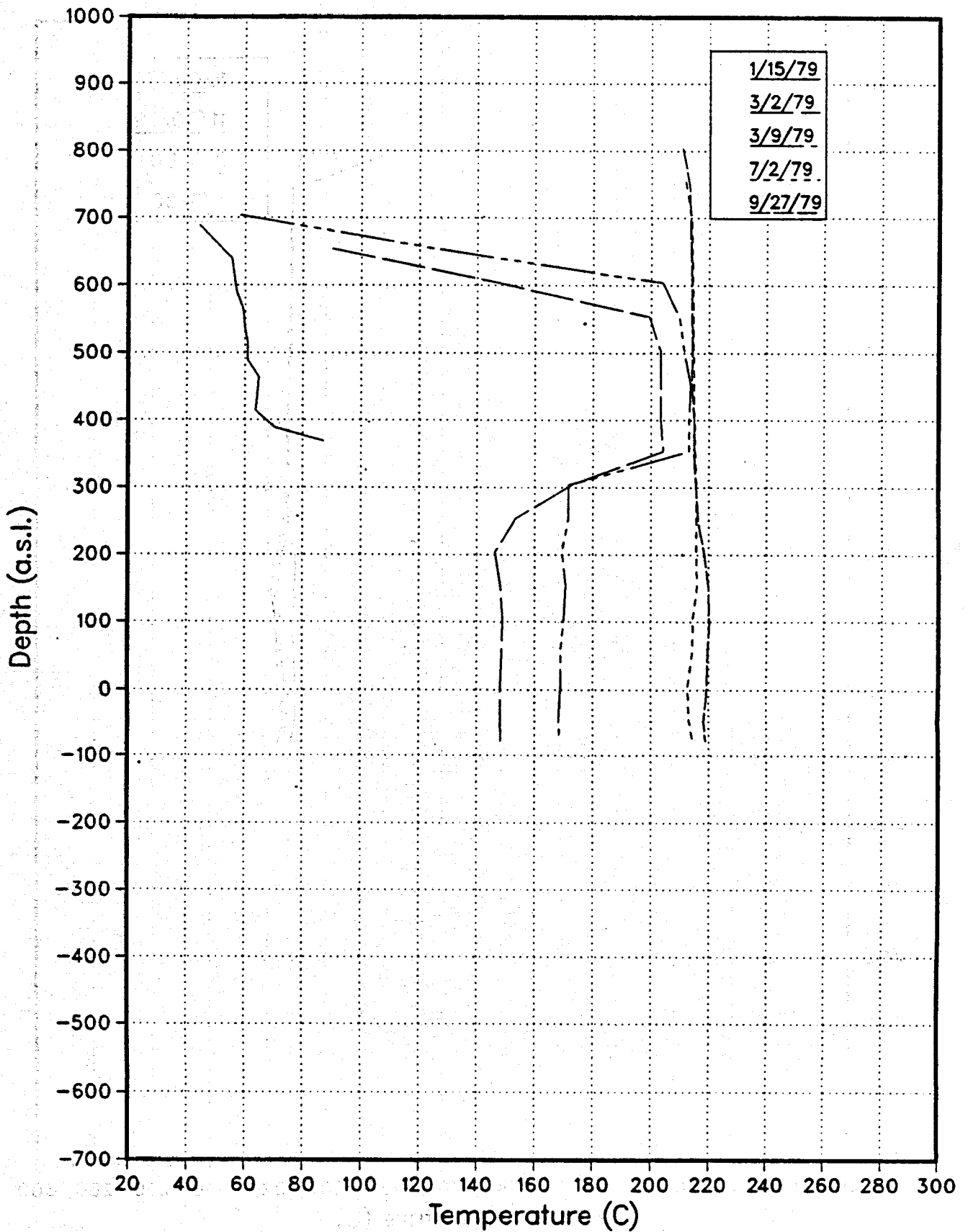
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1947

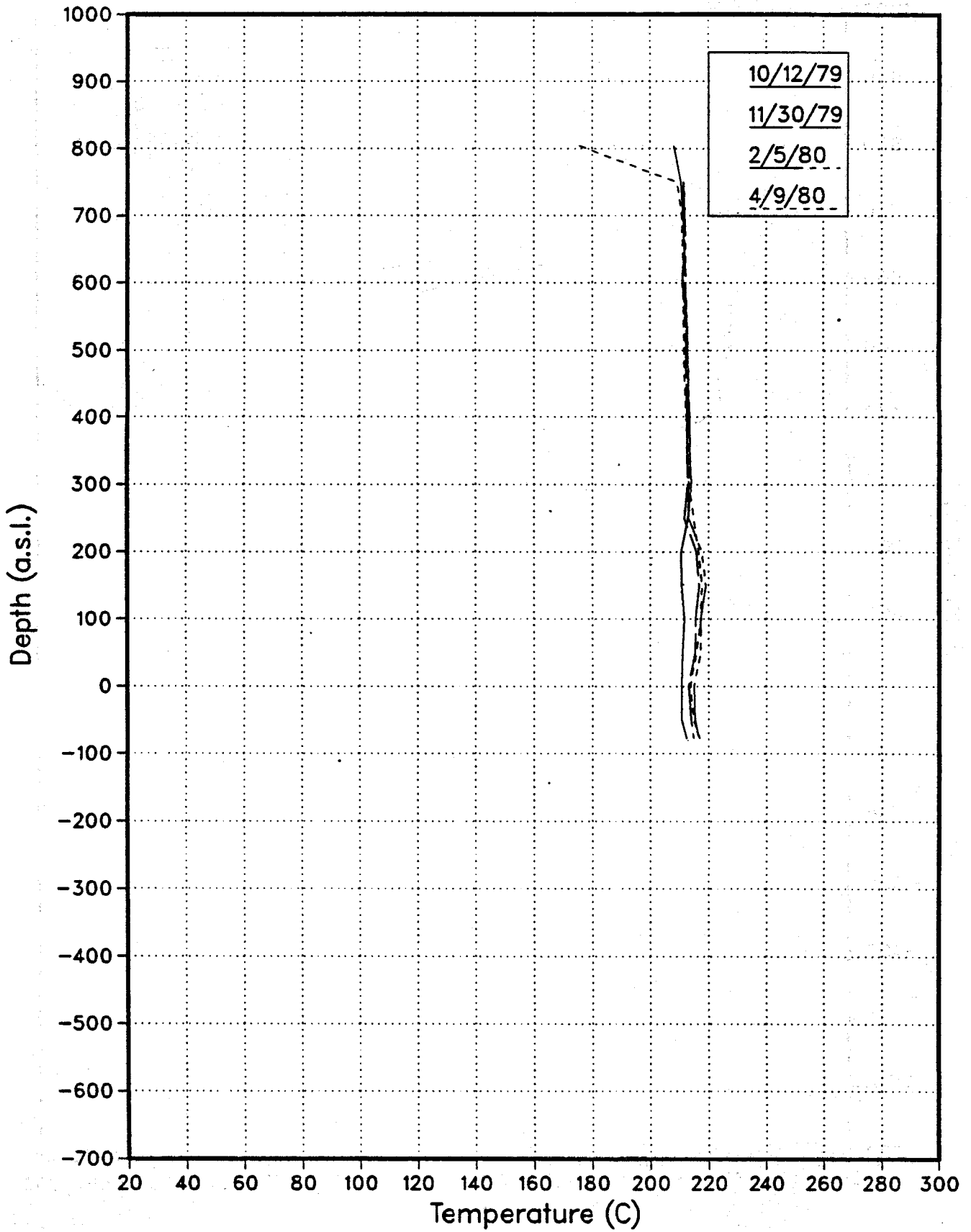
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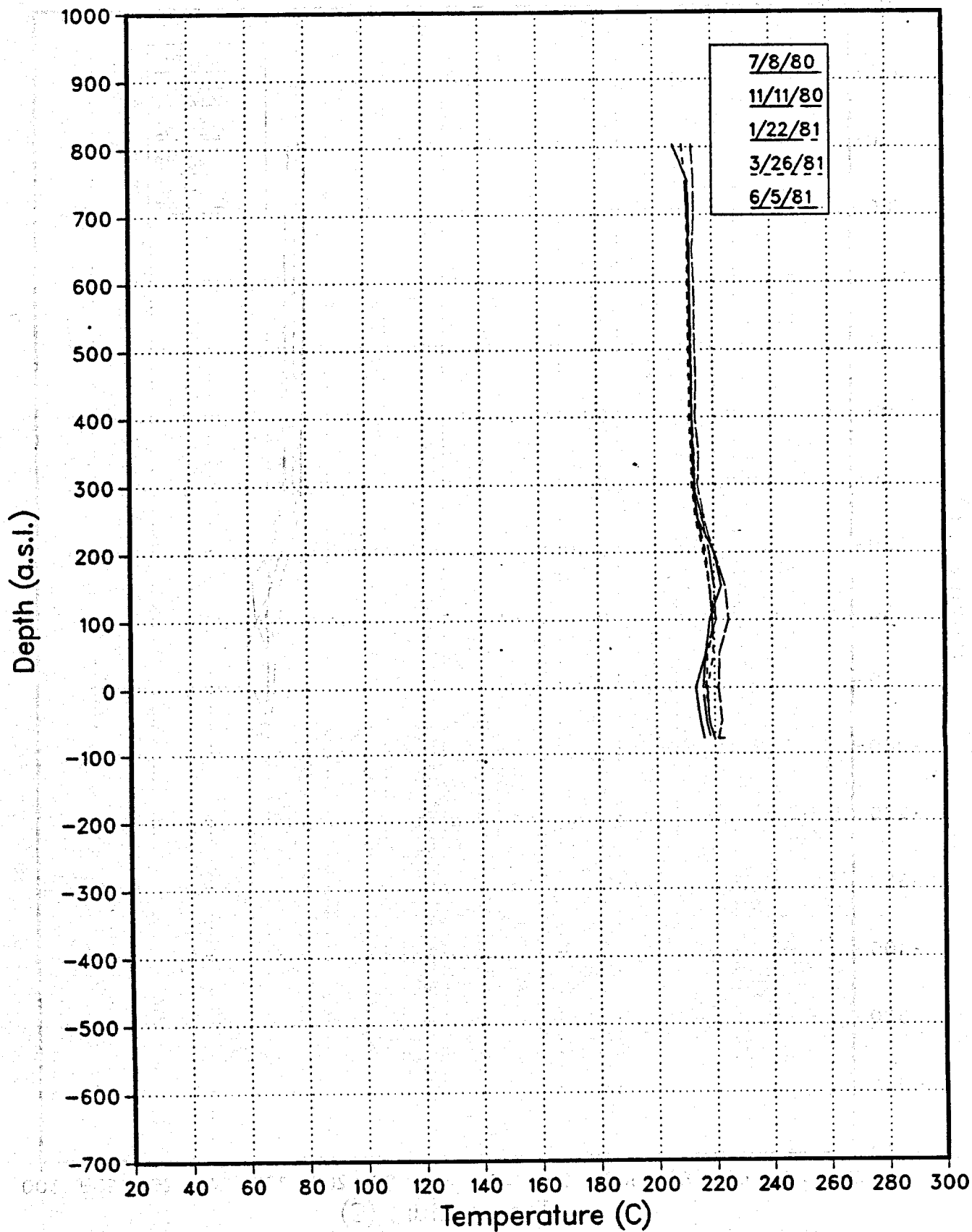
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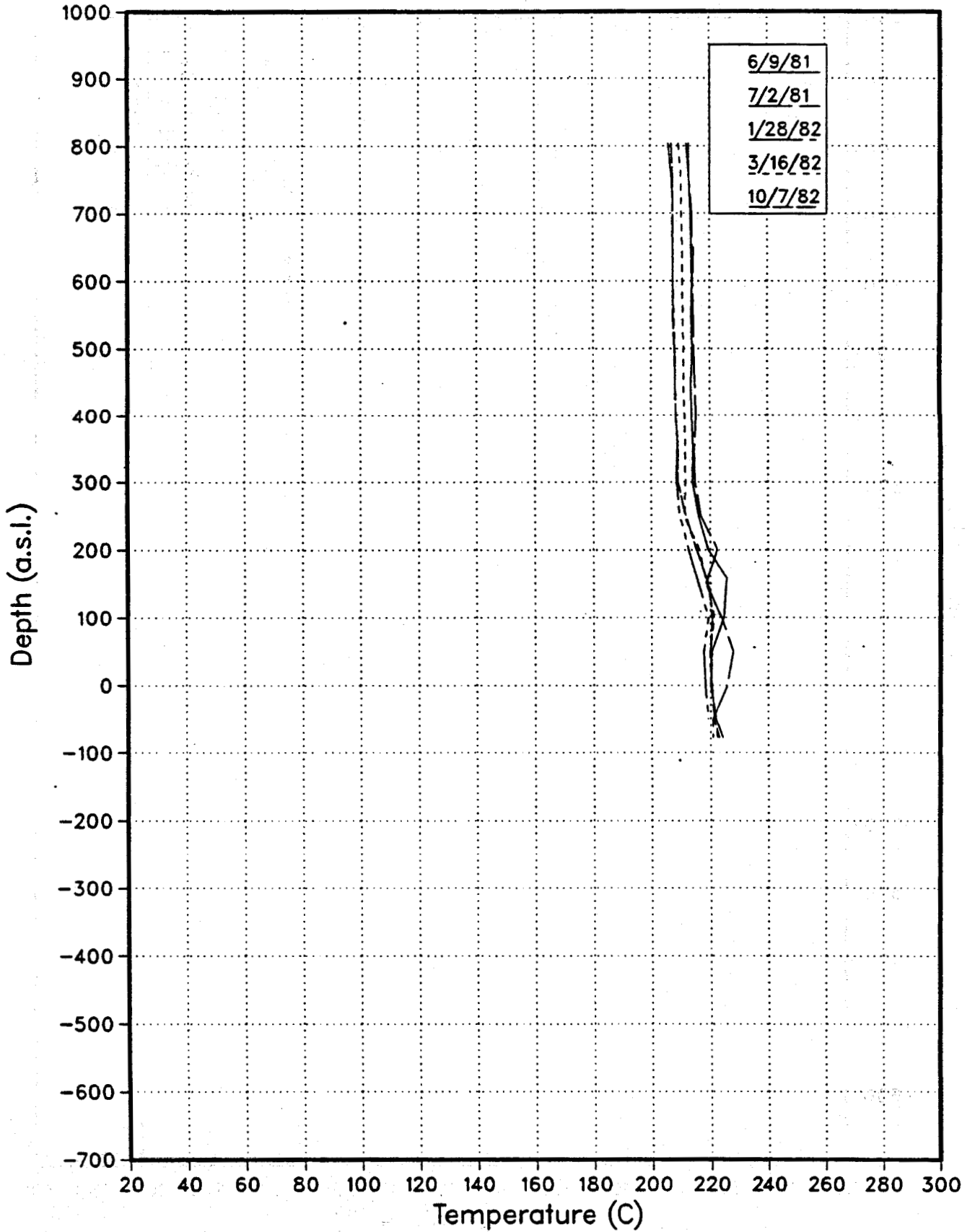
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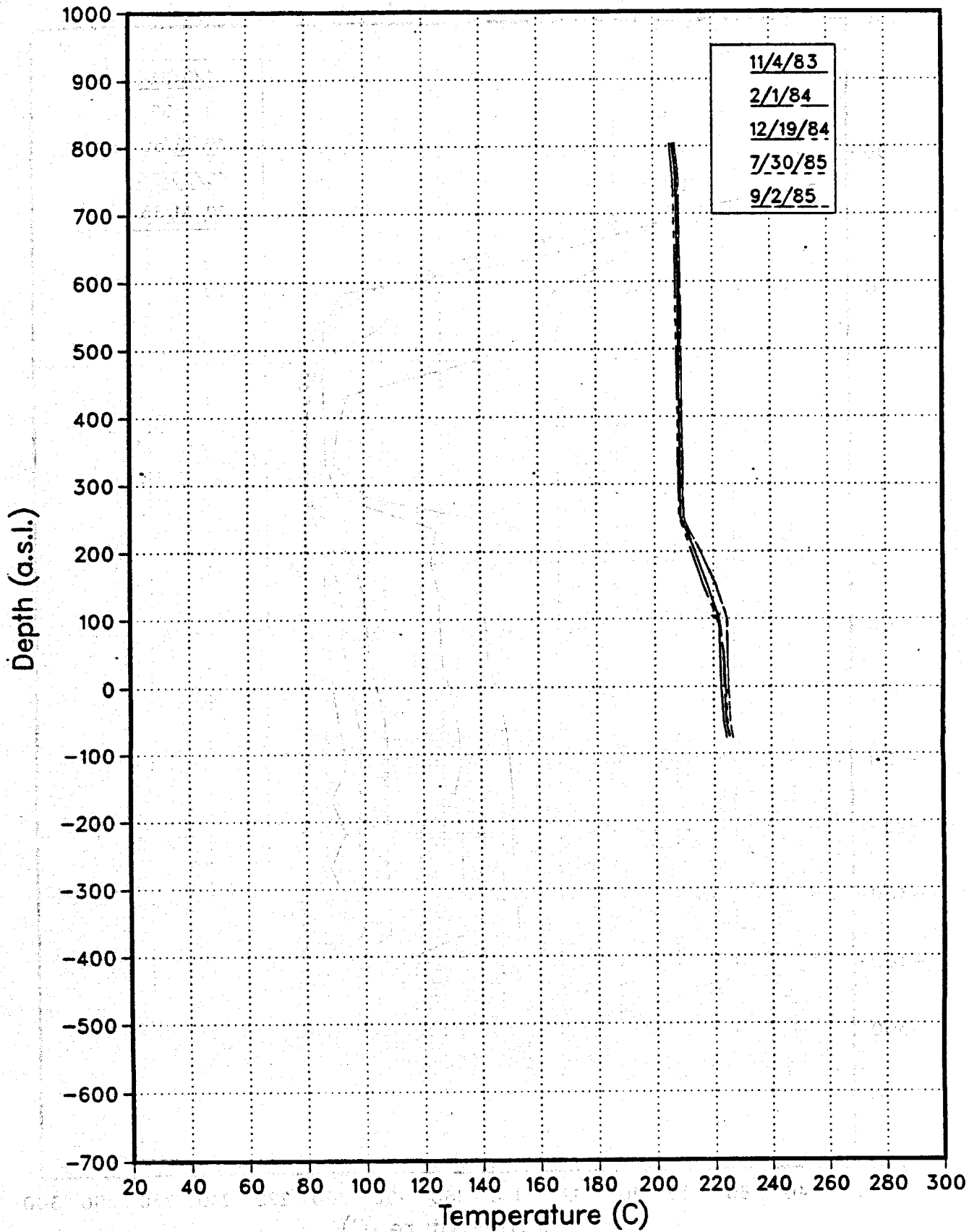
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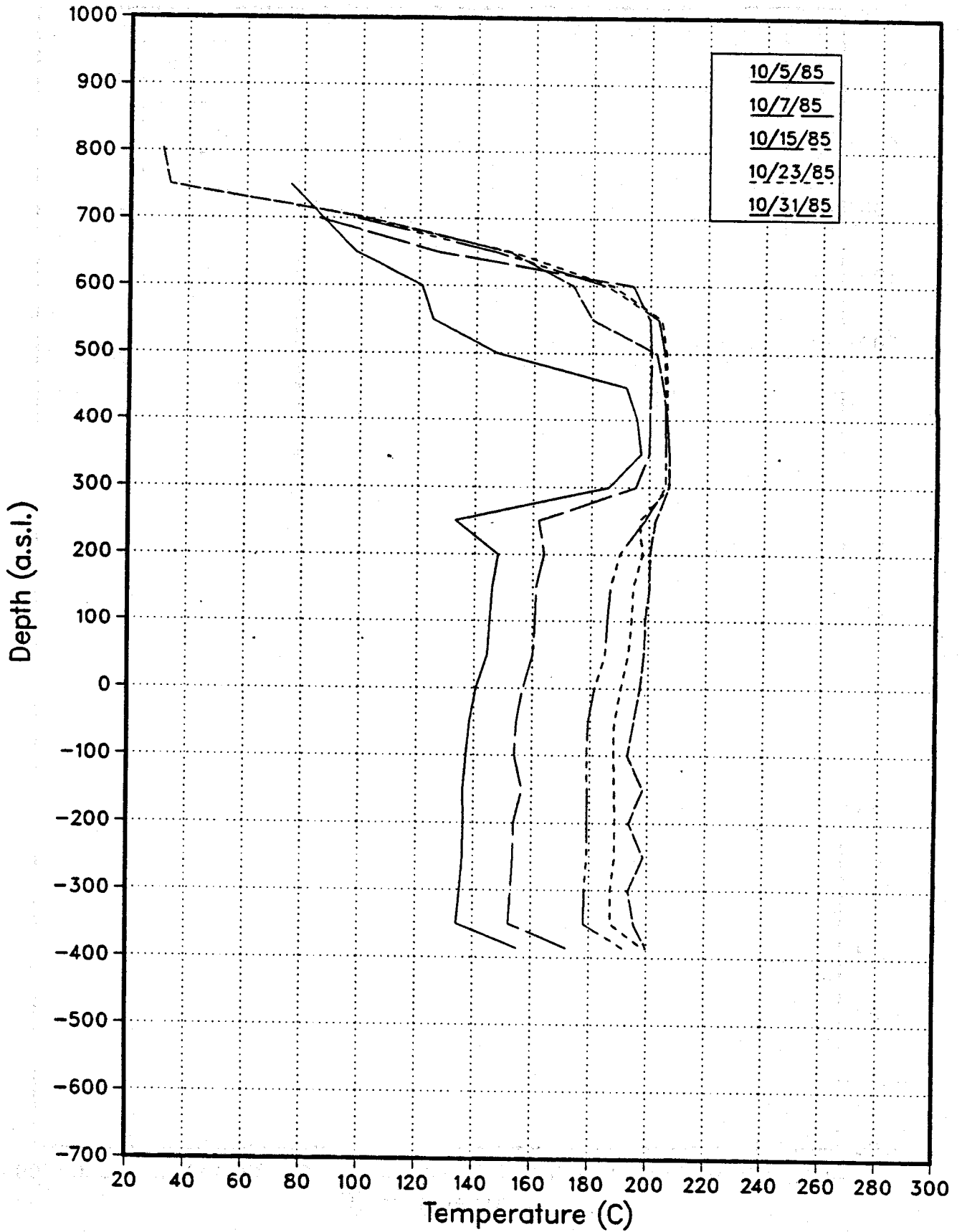
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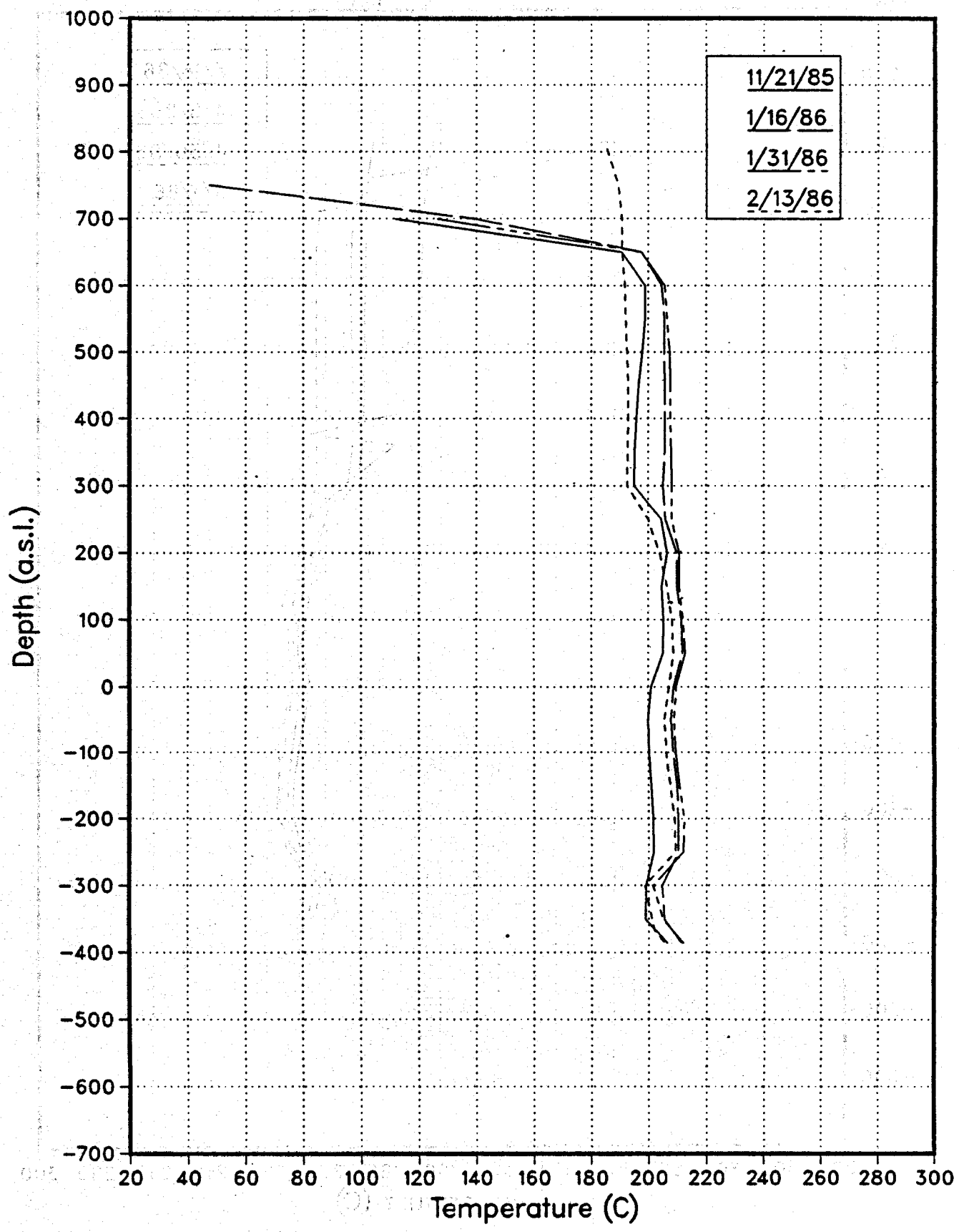
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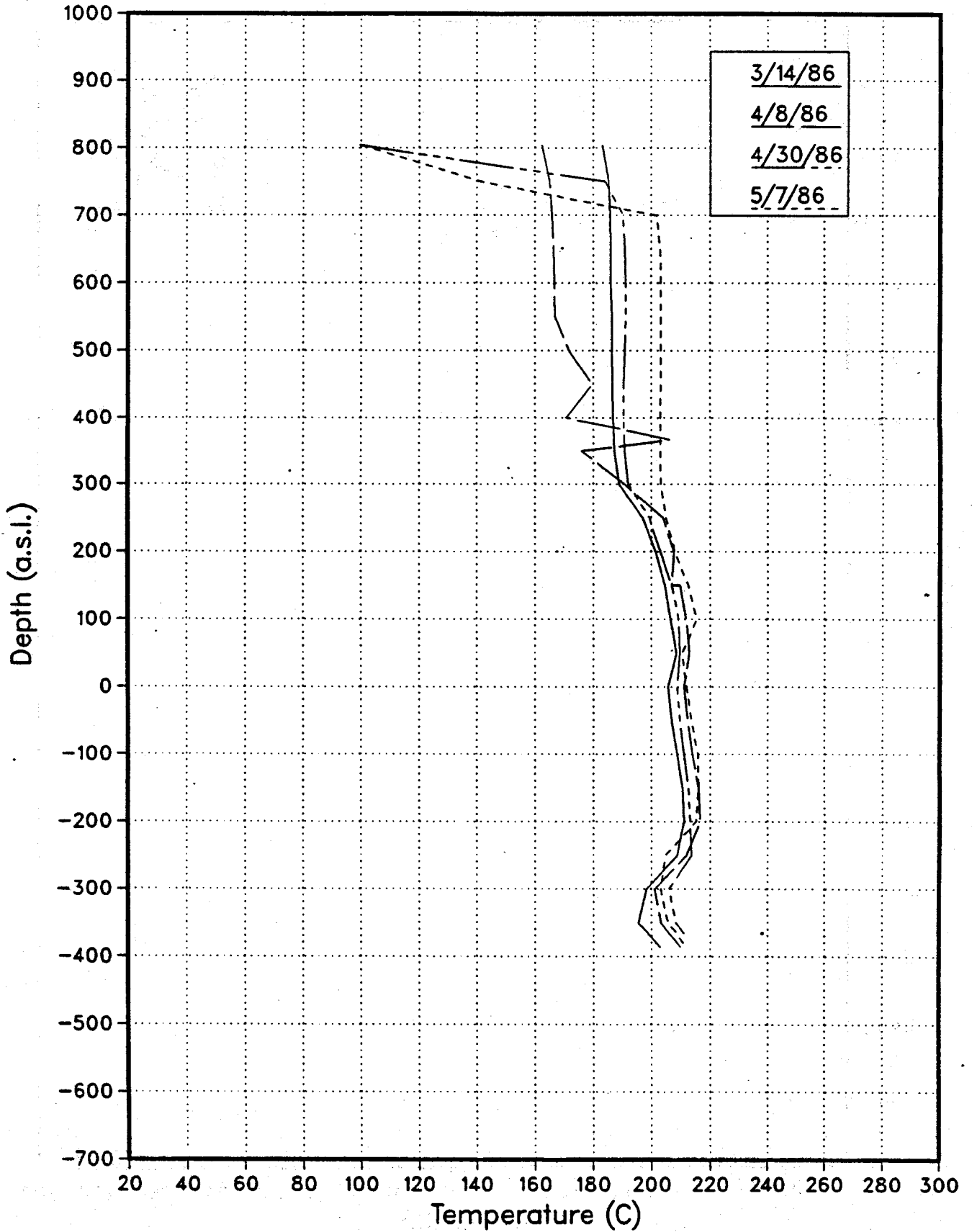
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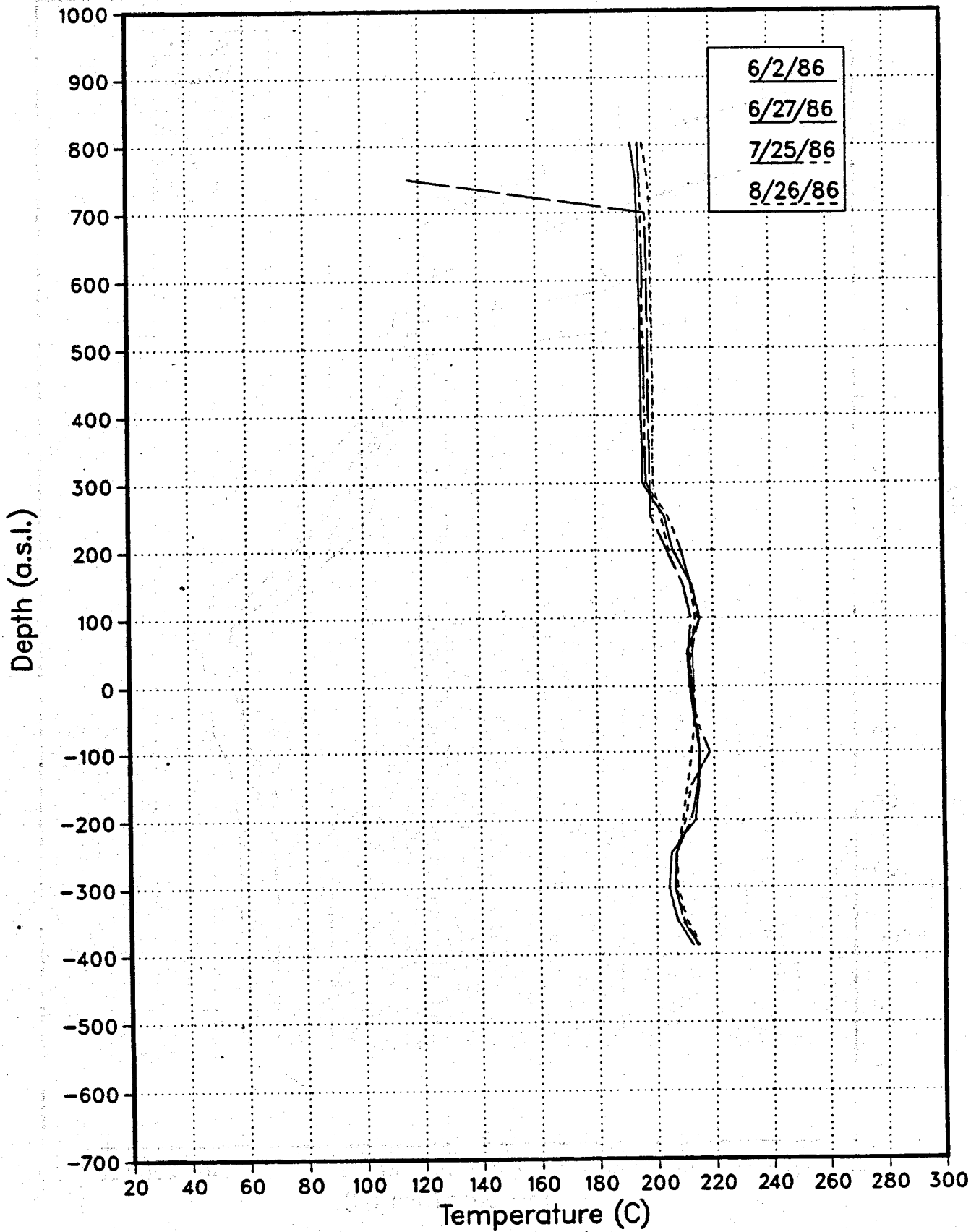
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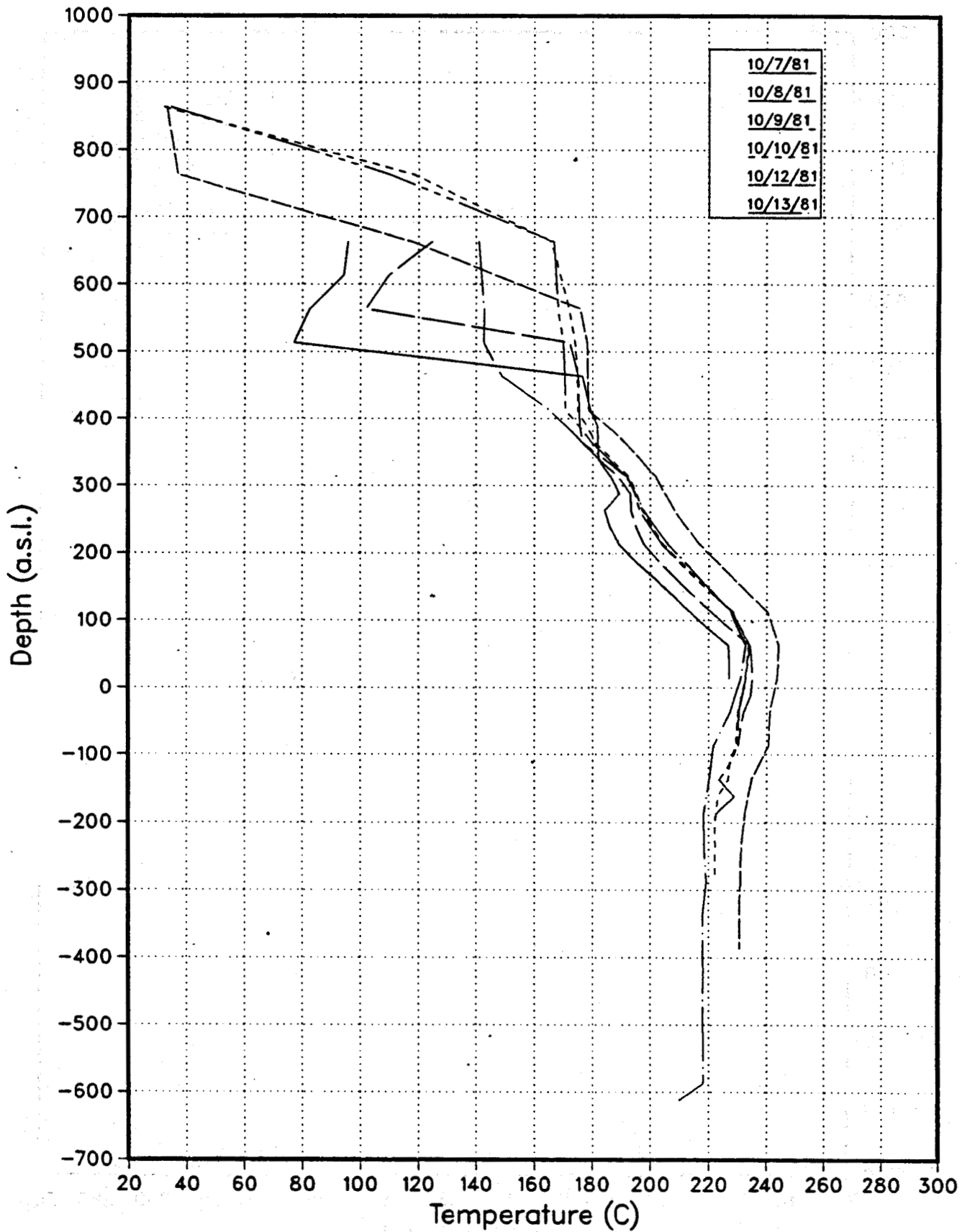
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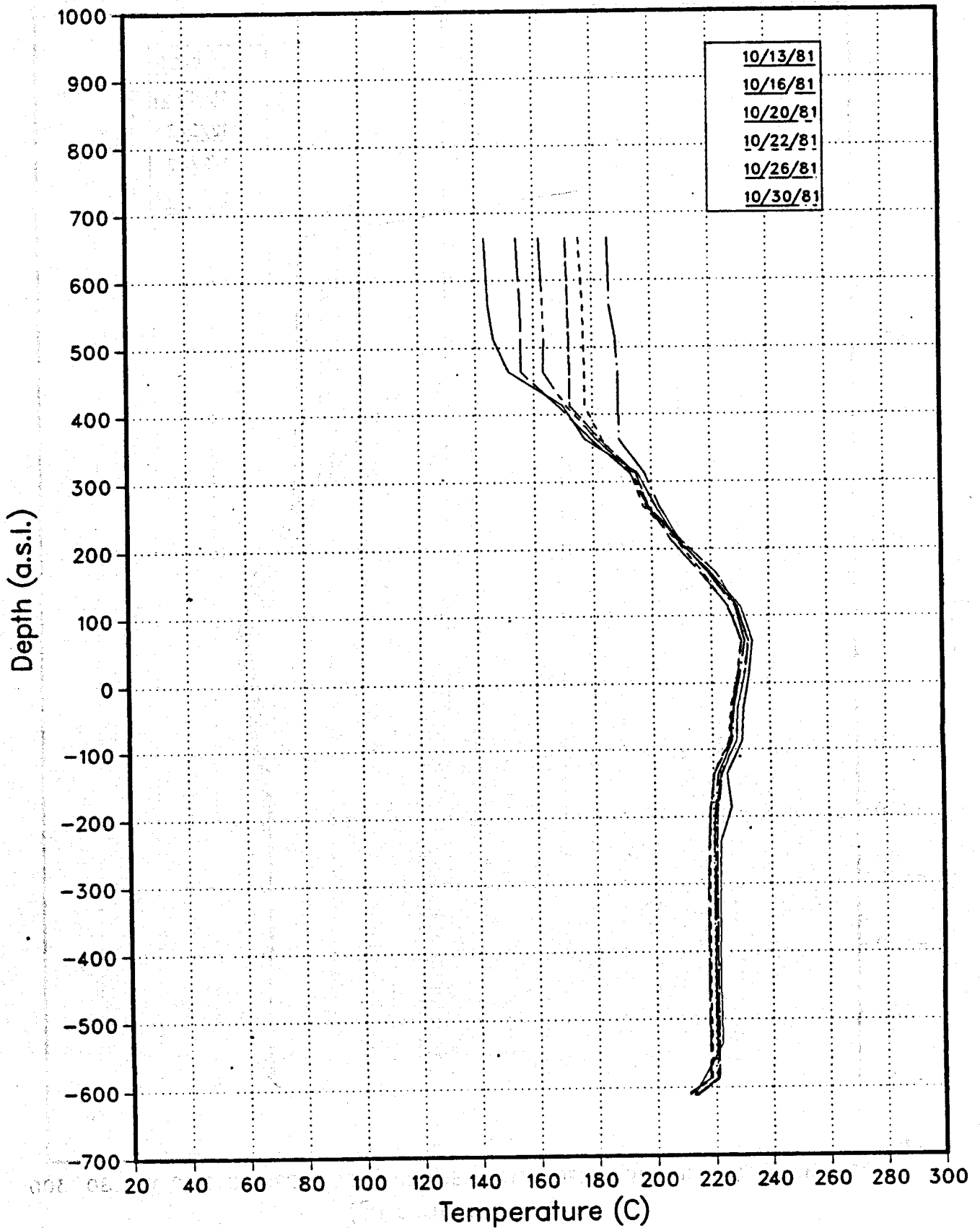
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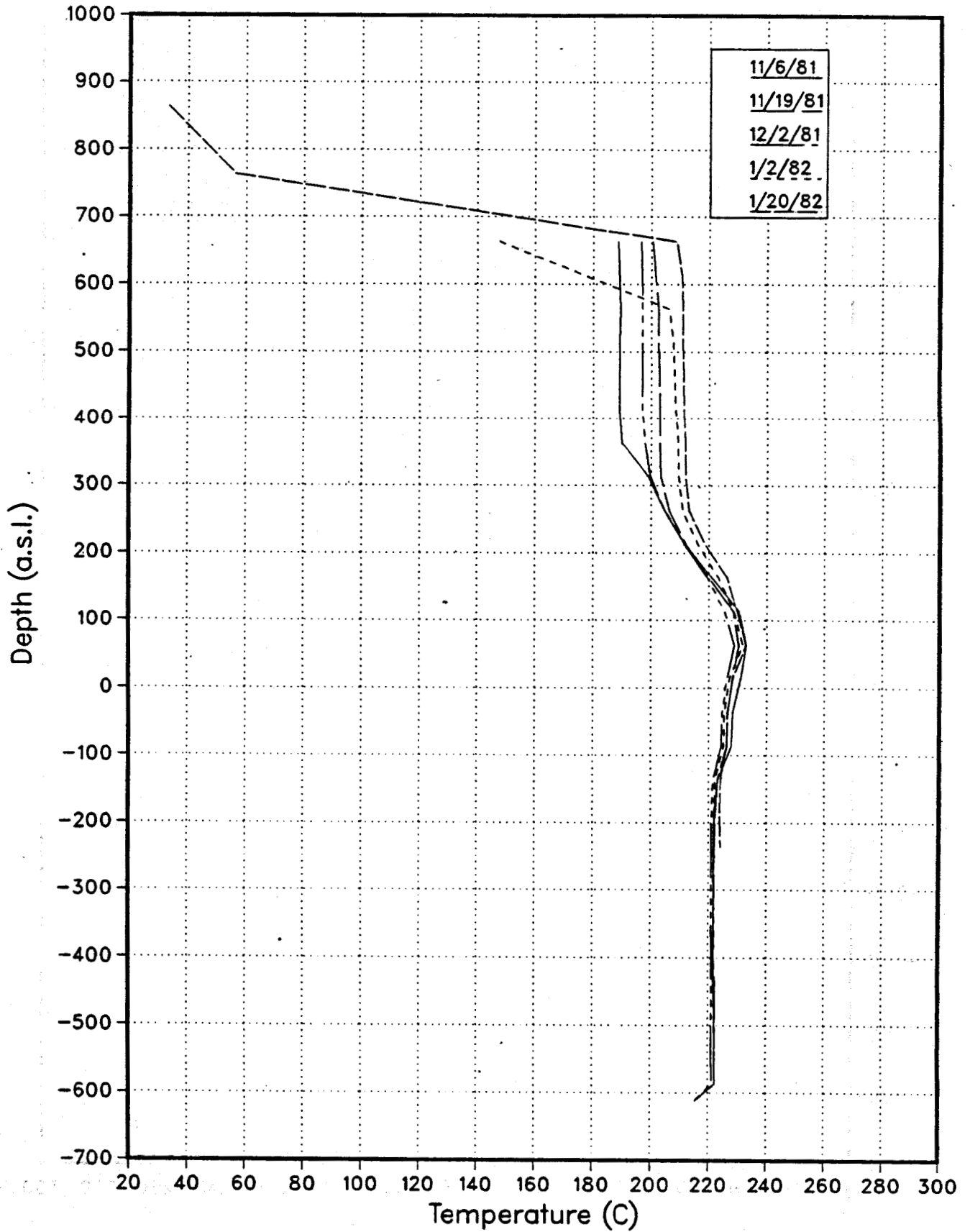
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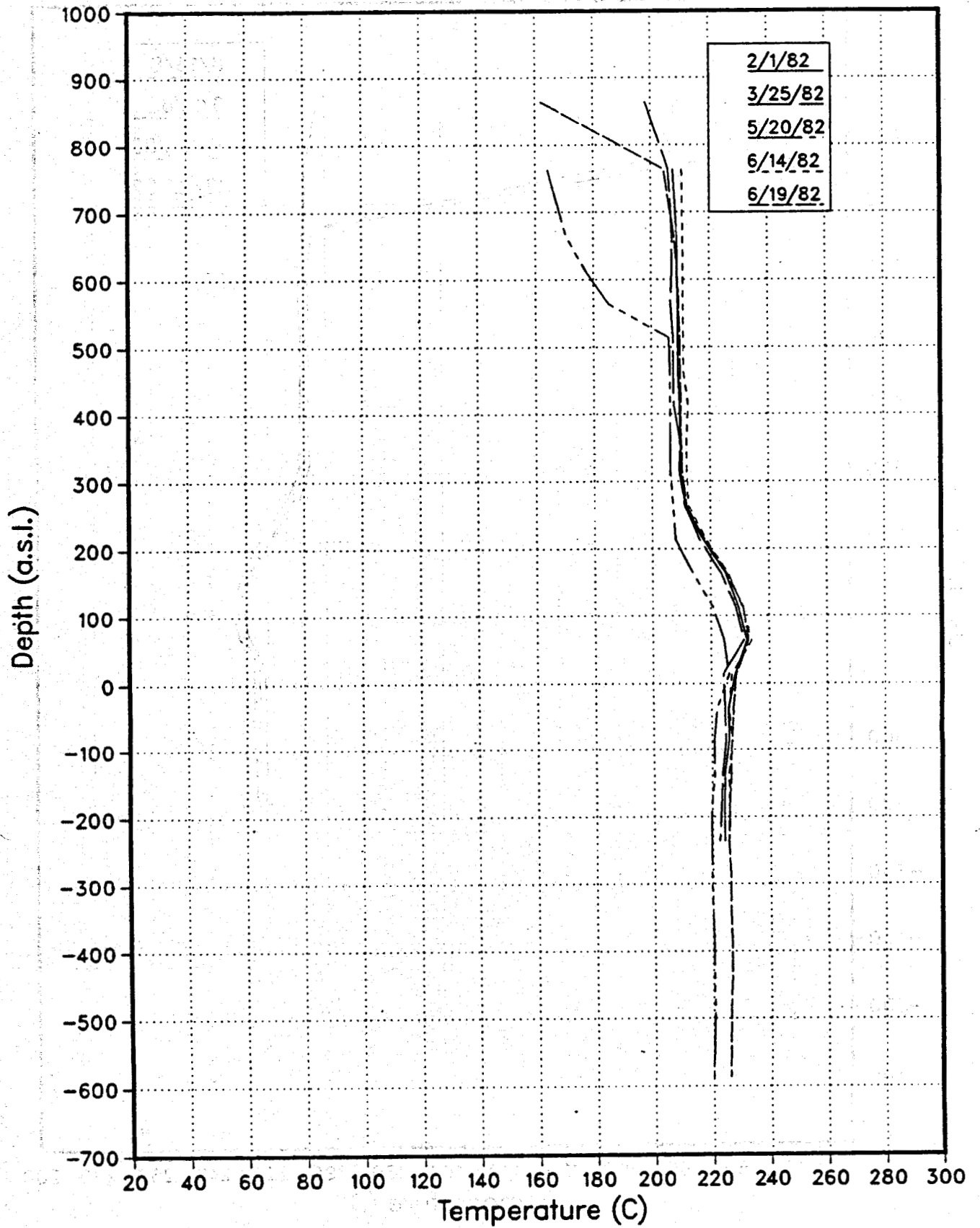
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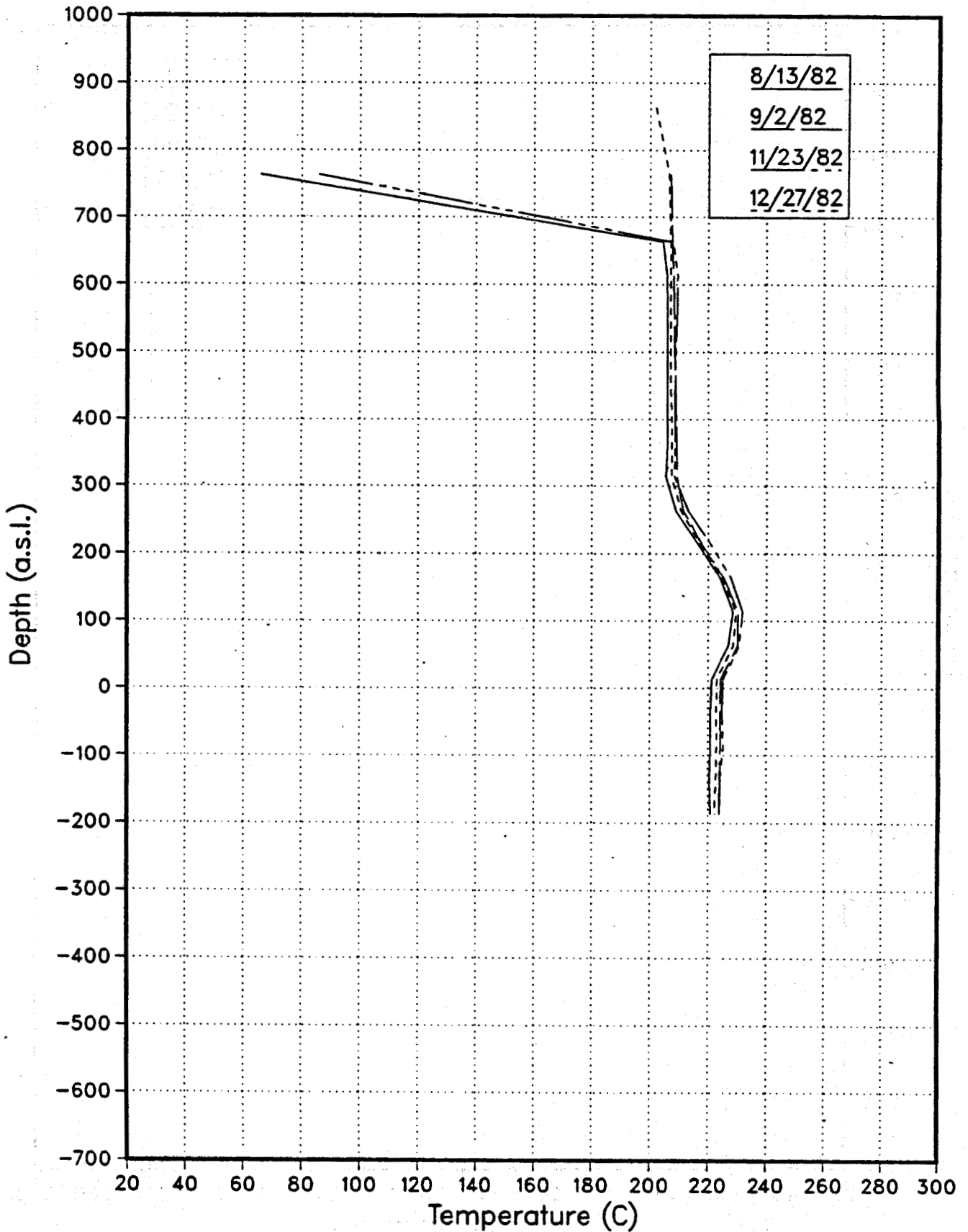
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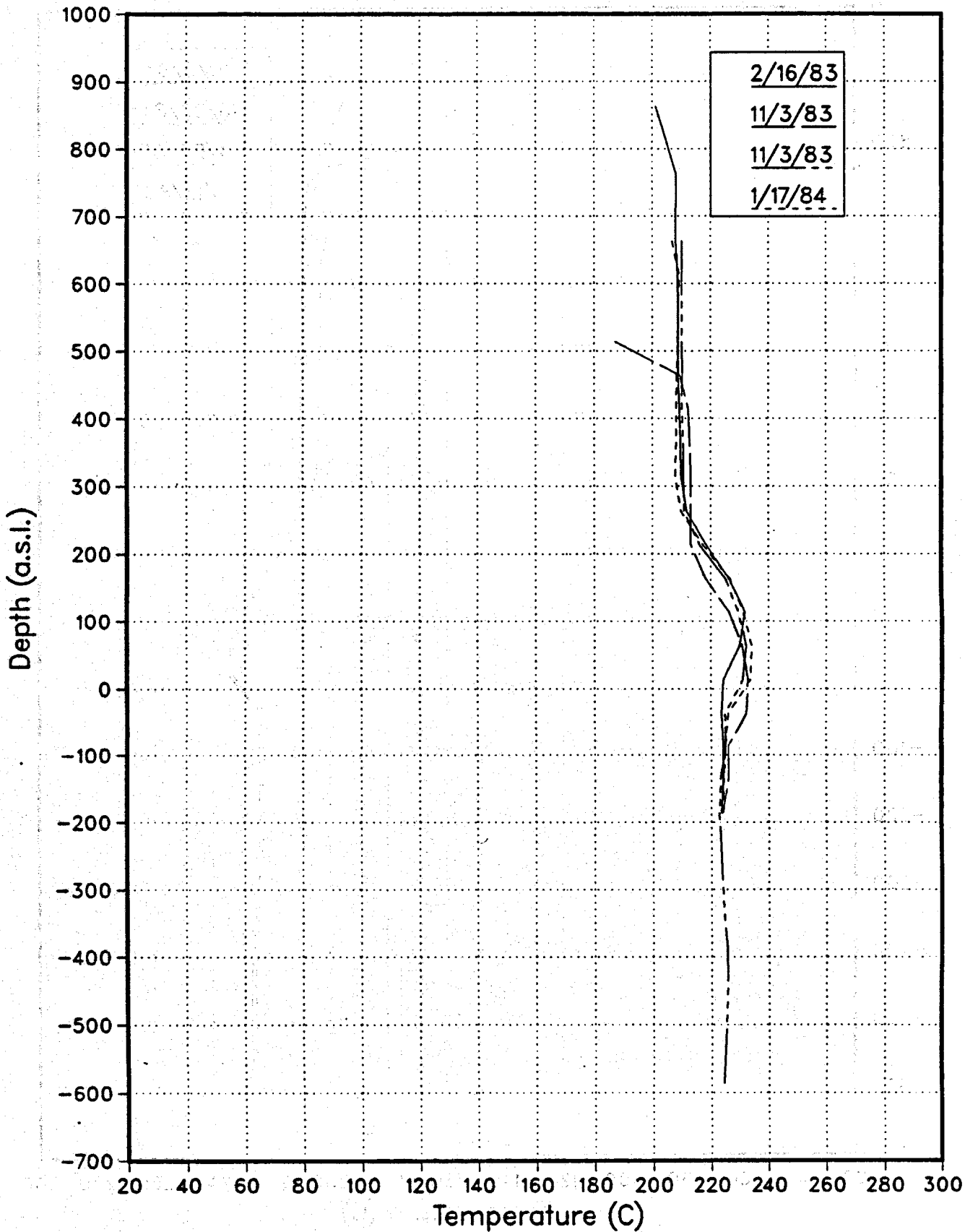
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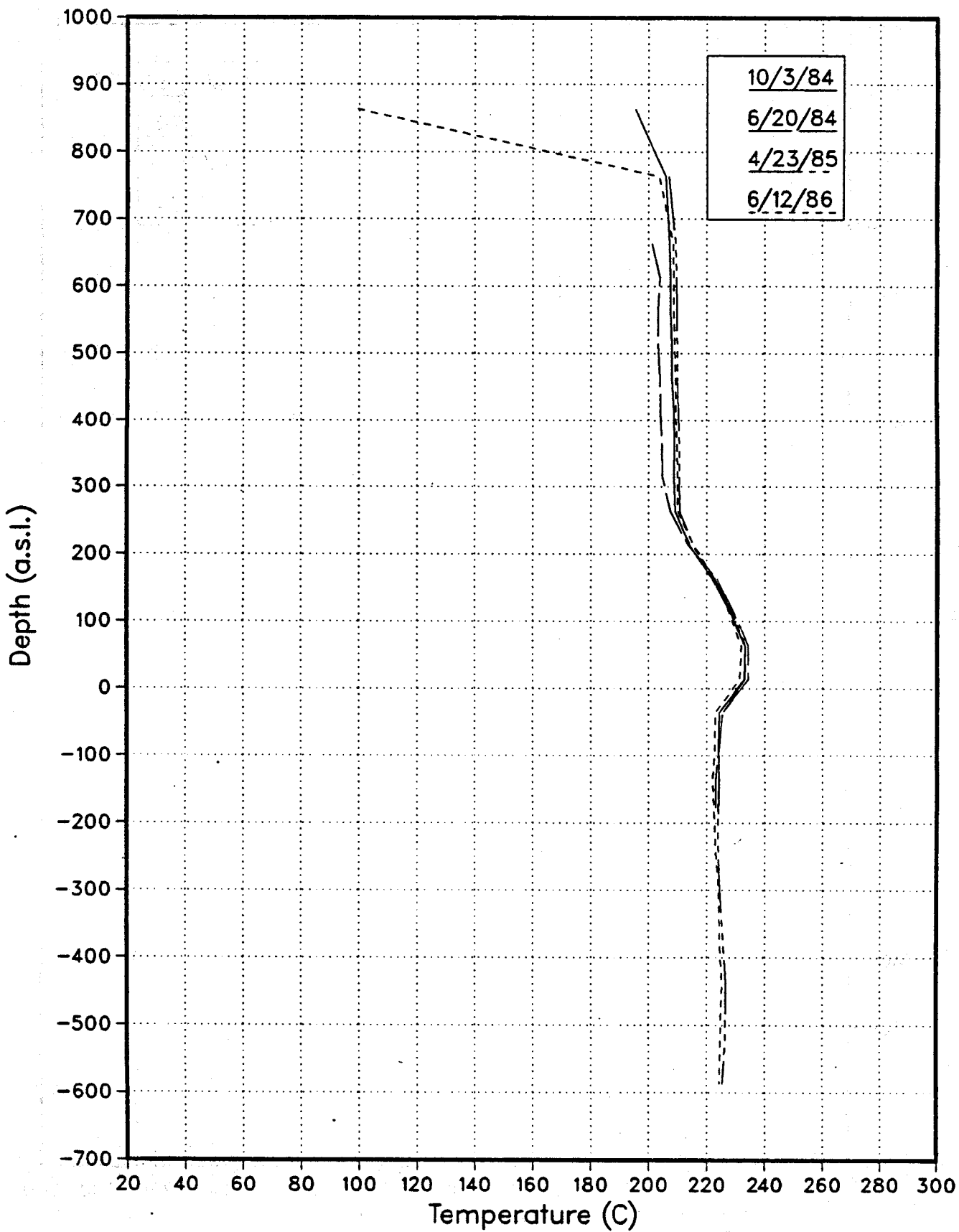
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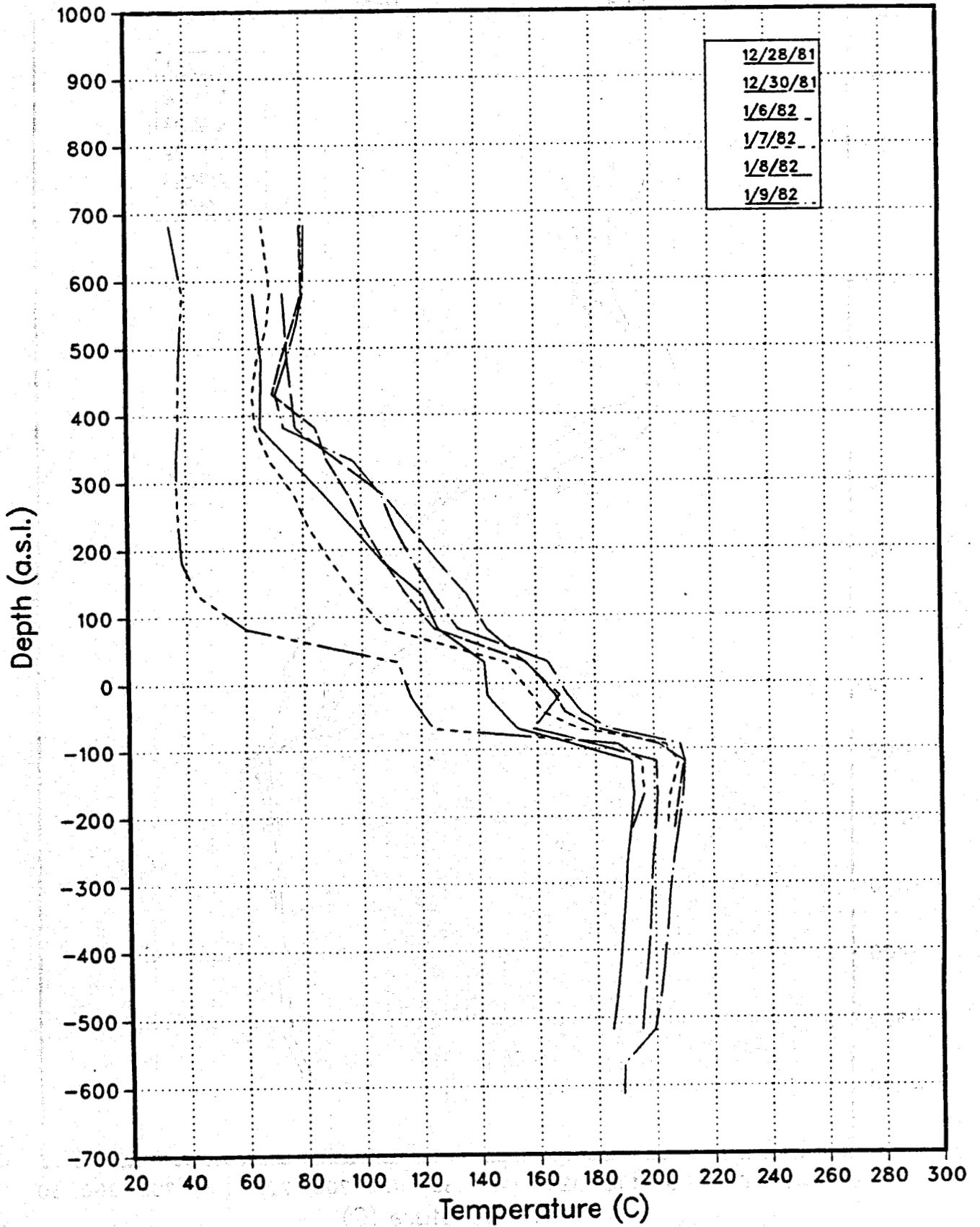
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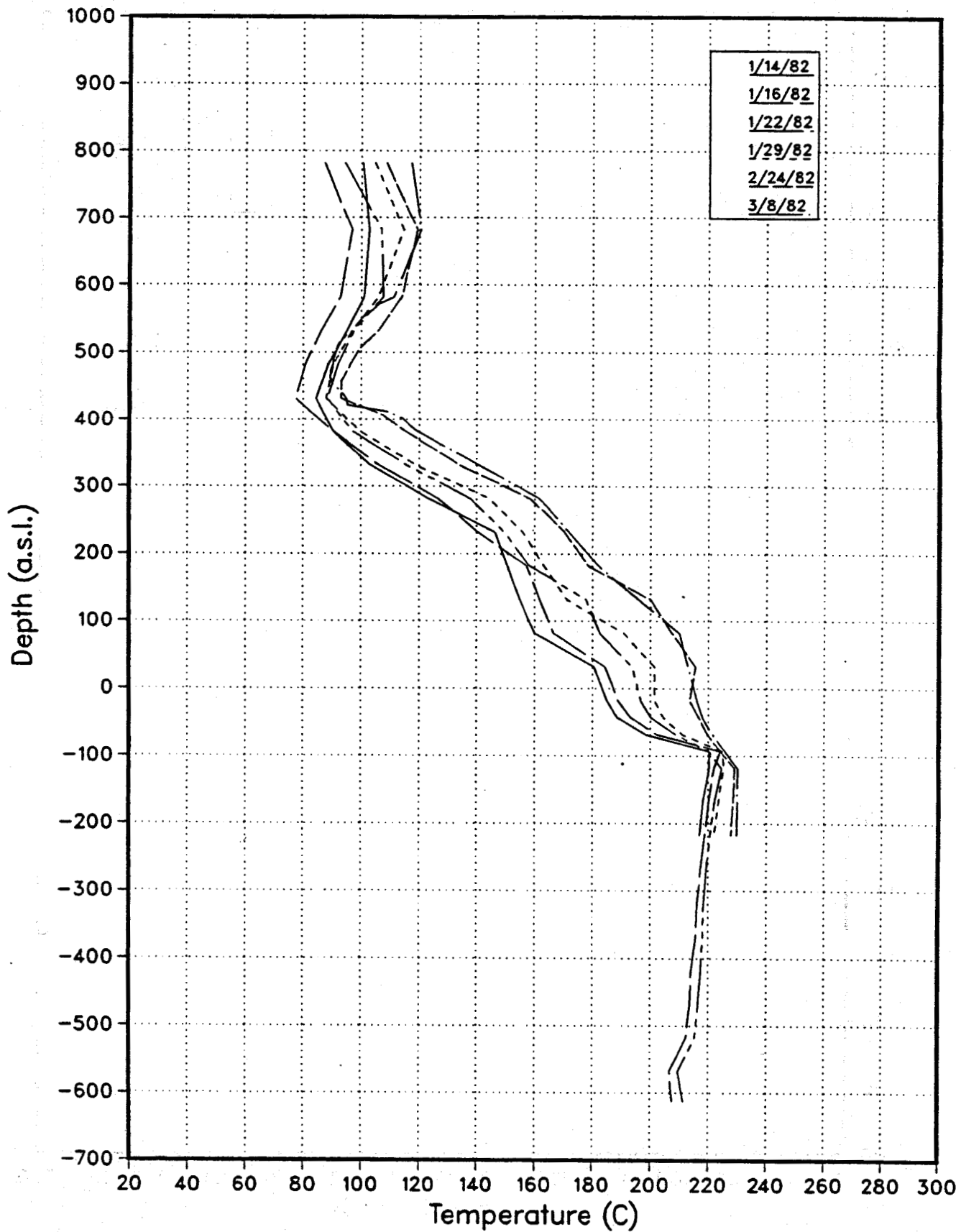
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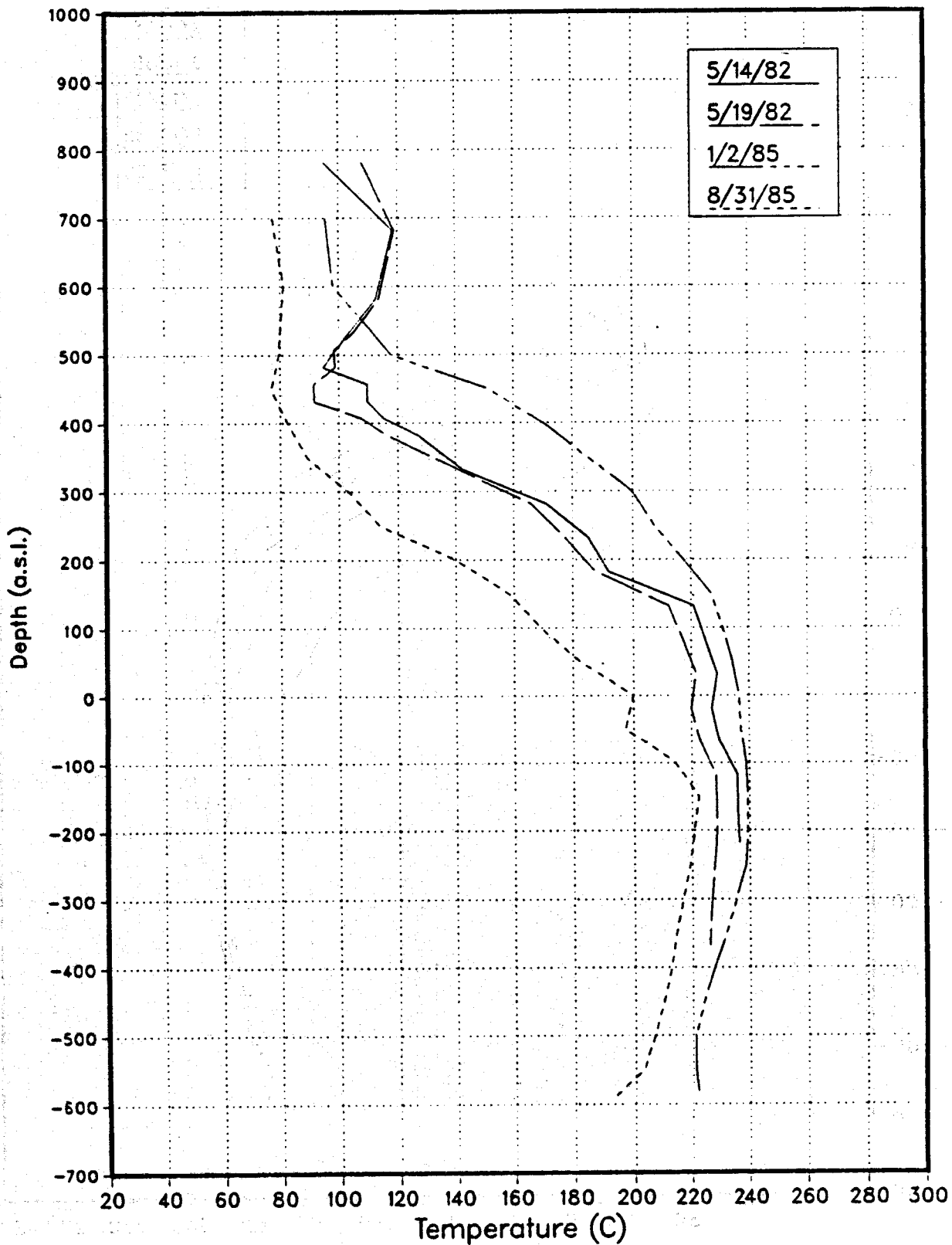
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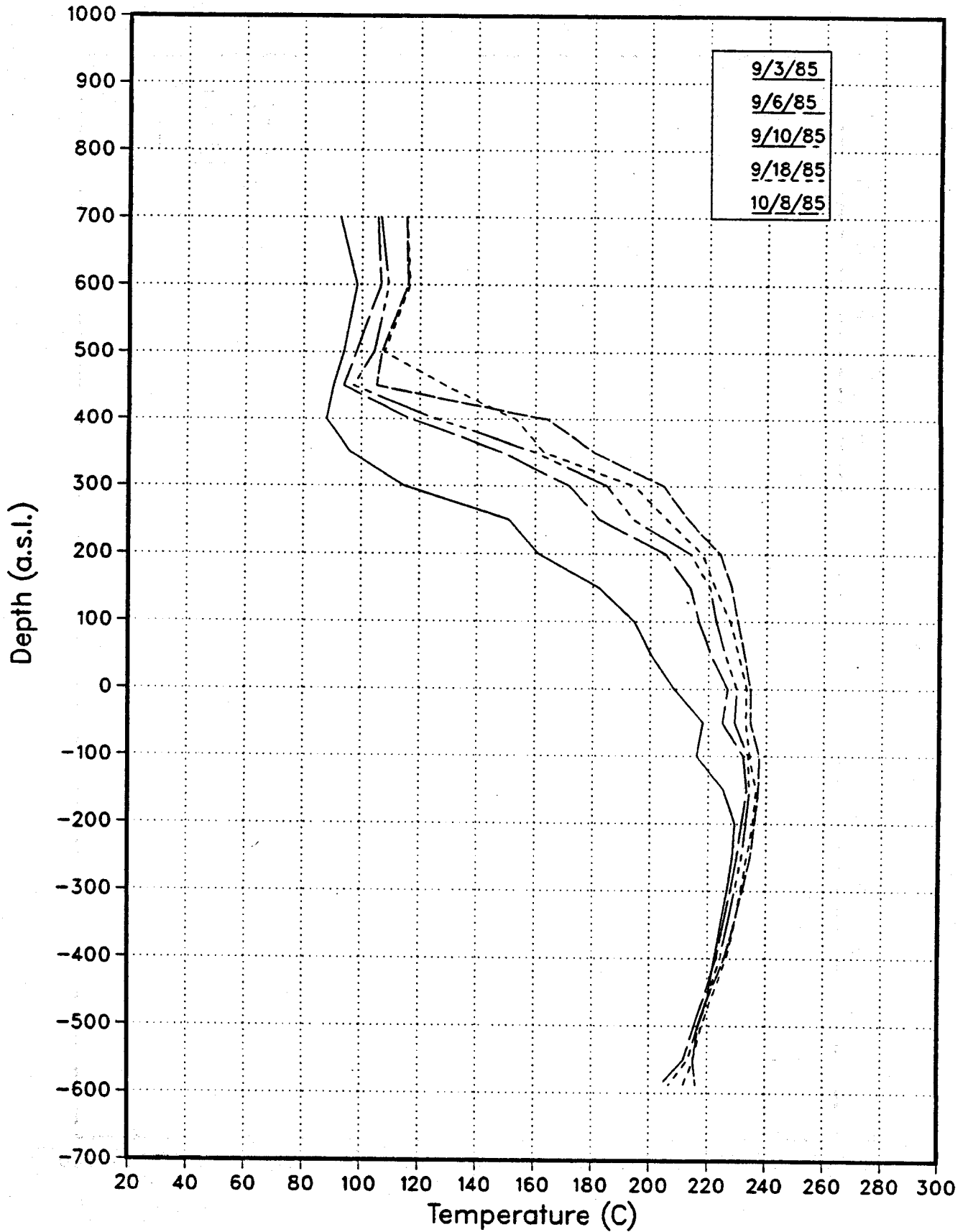
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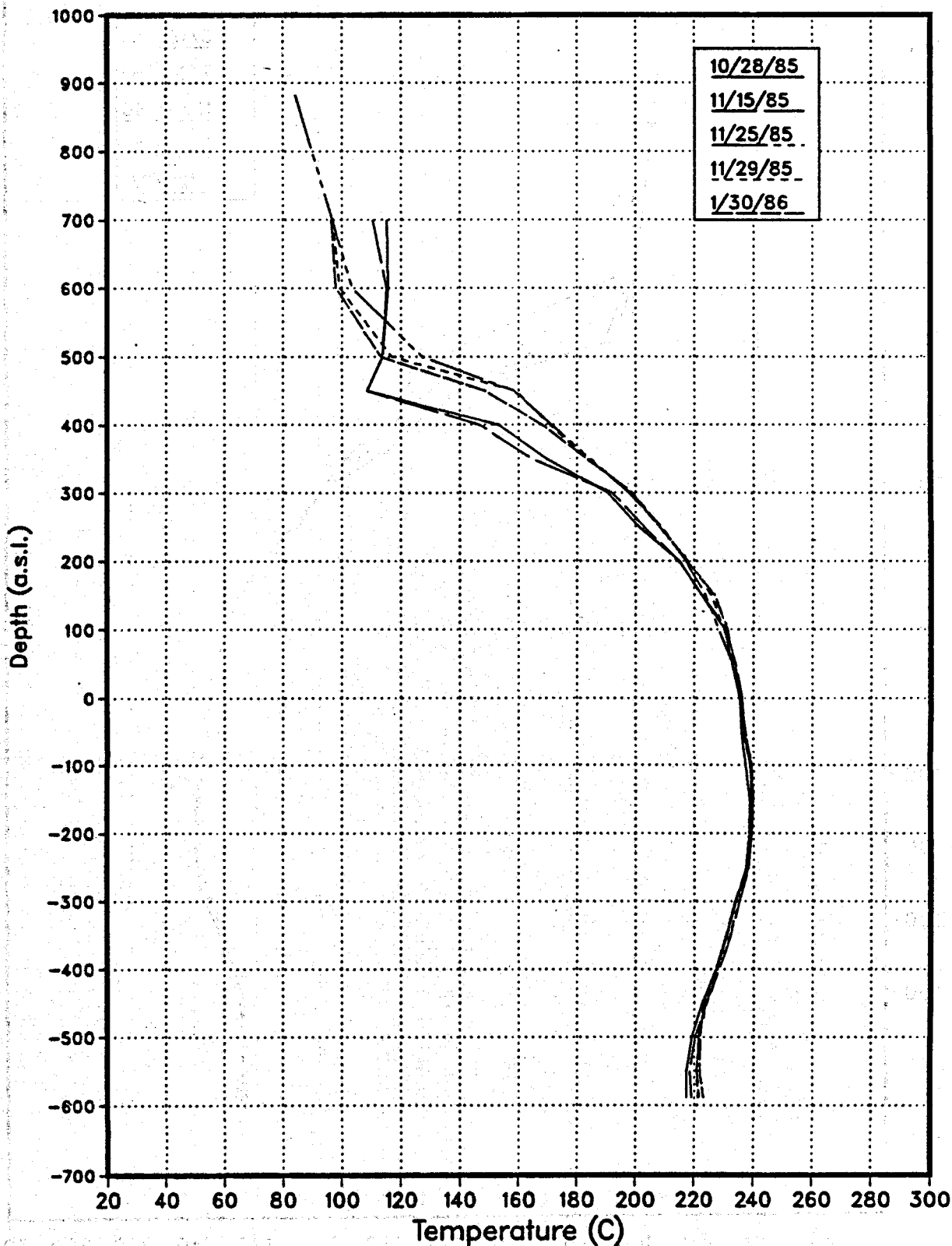
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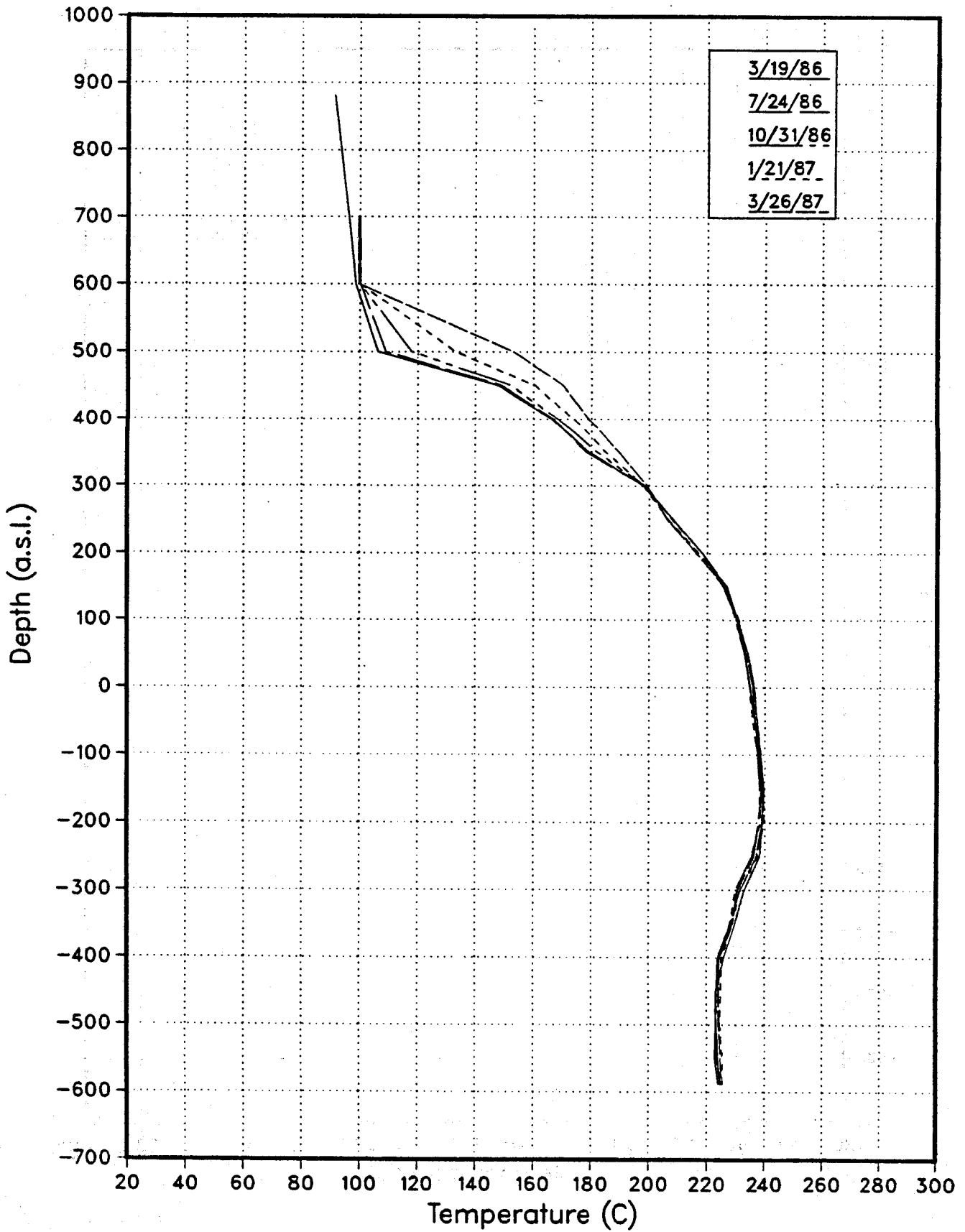
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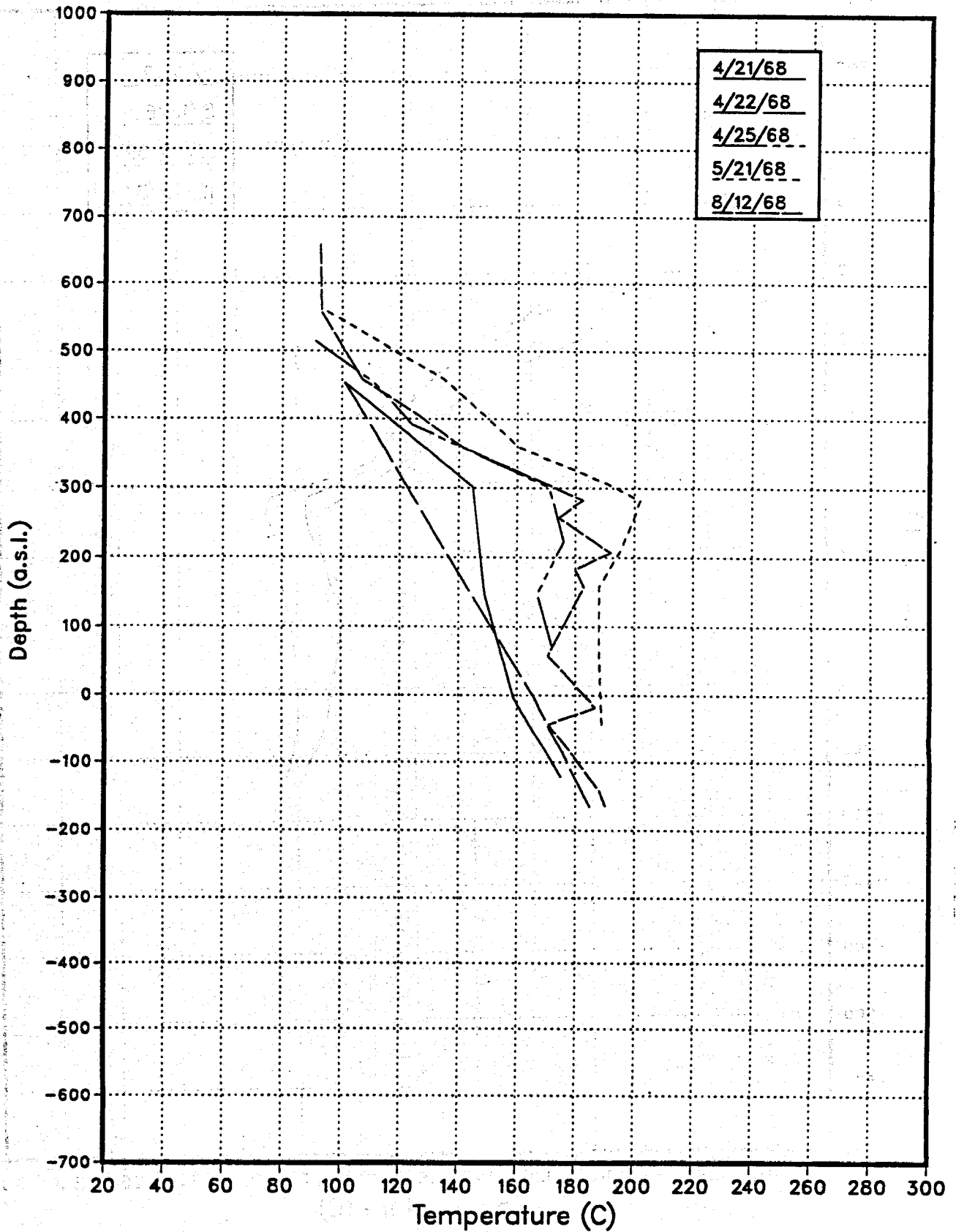
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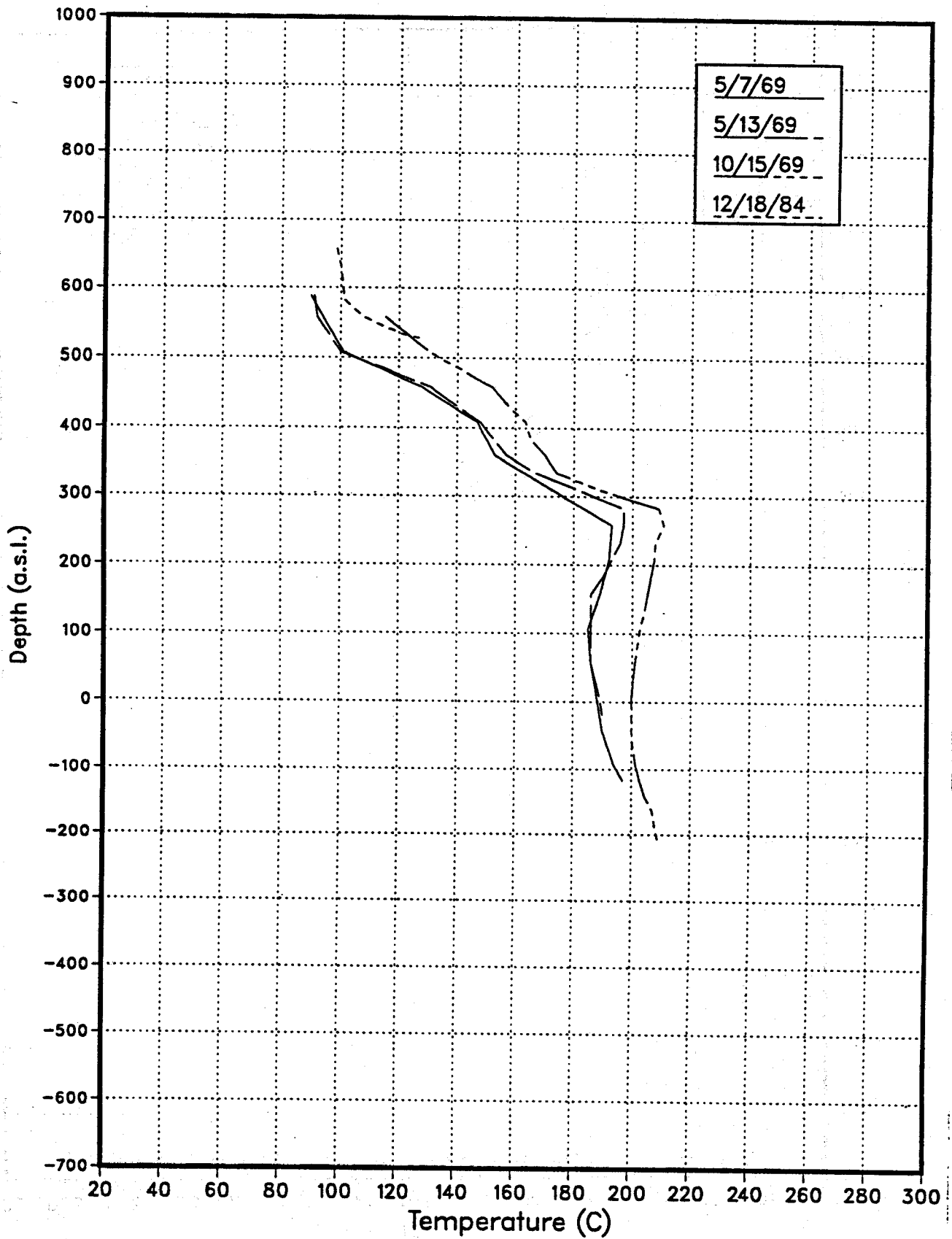
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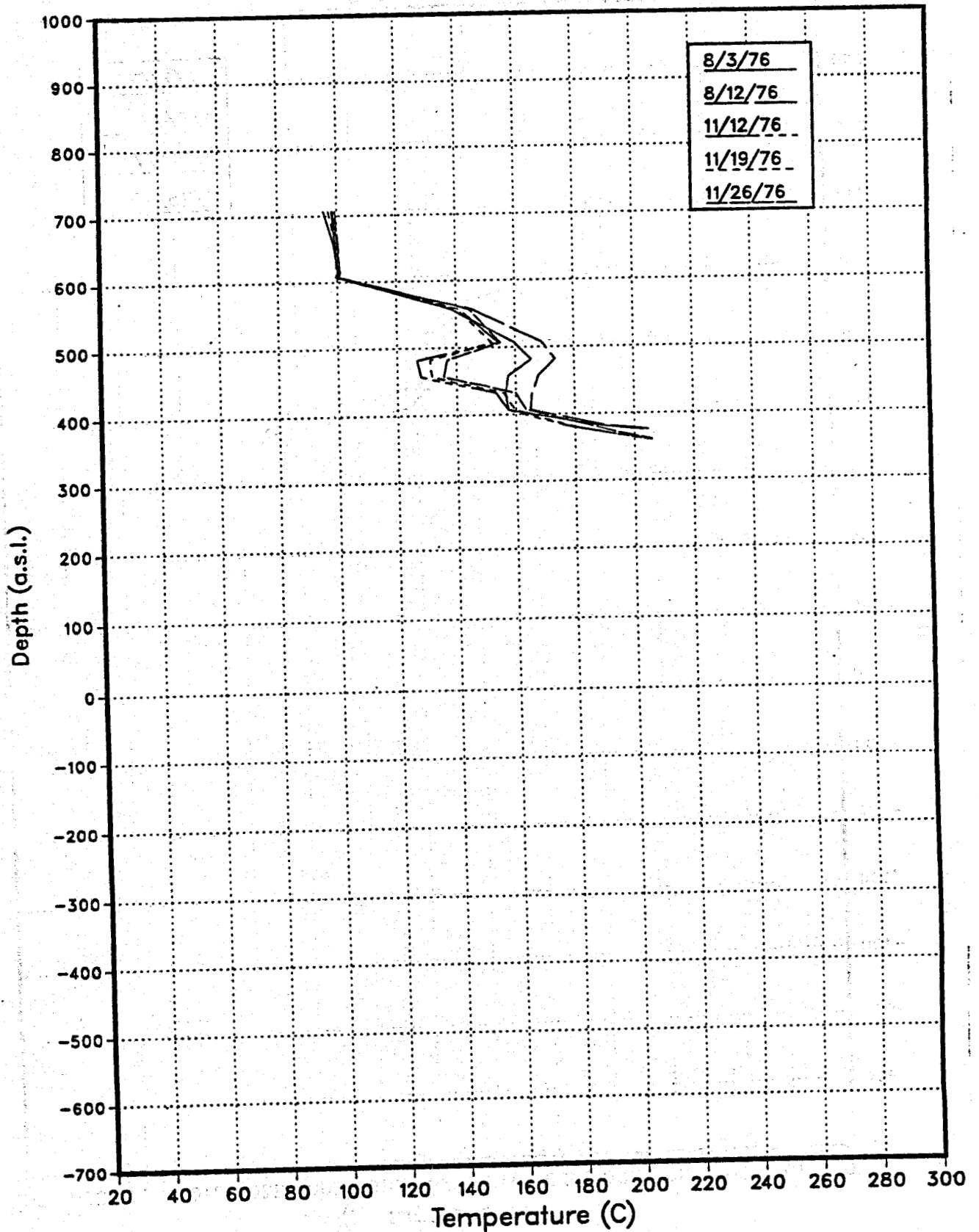
CH 1 Temperature Surveys



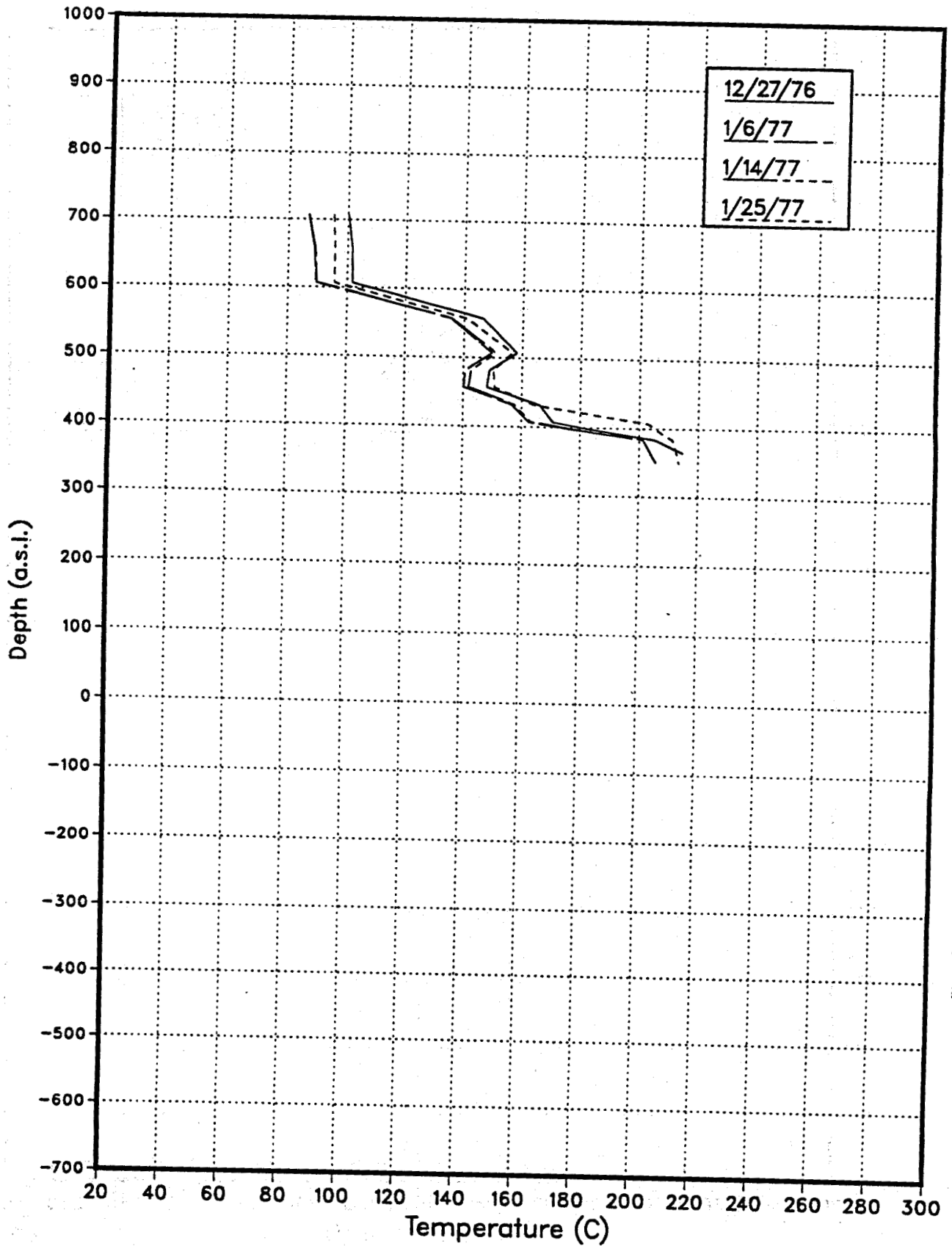
CH 1 Temperature Surveys



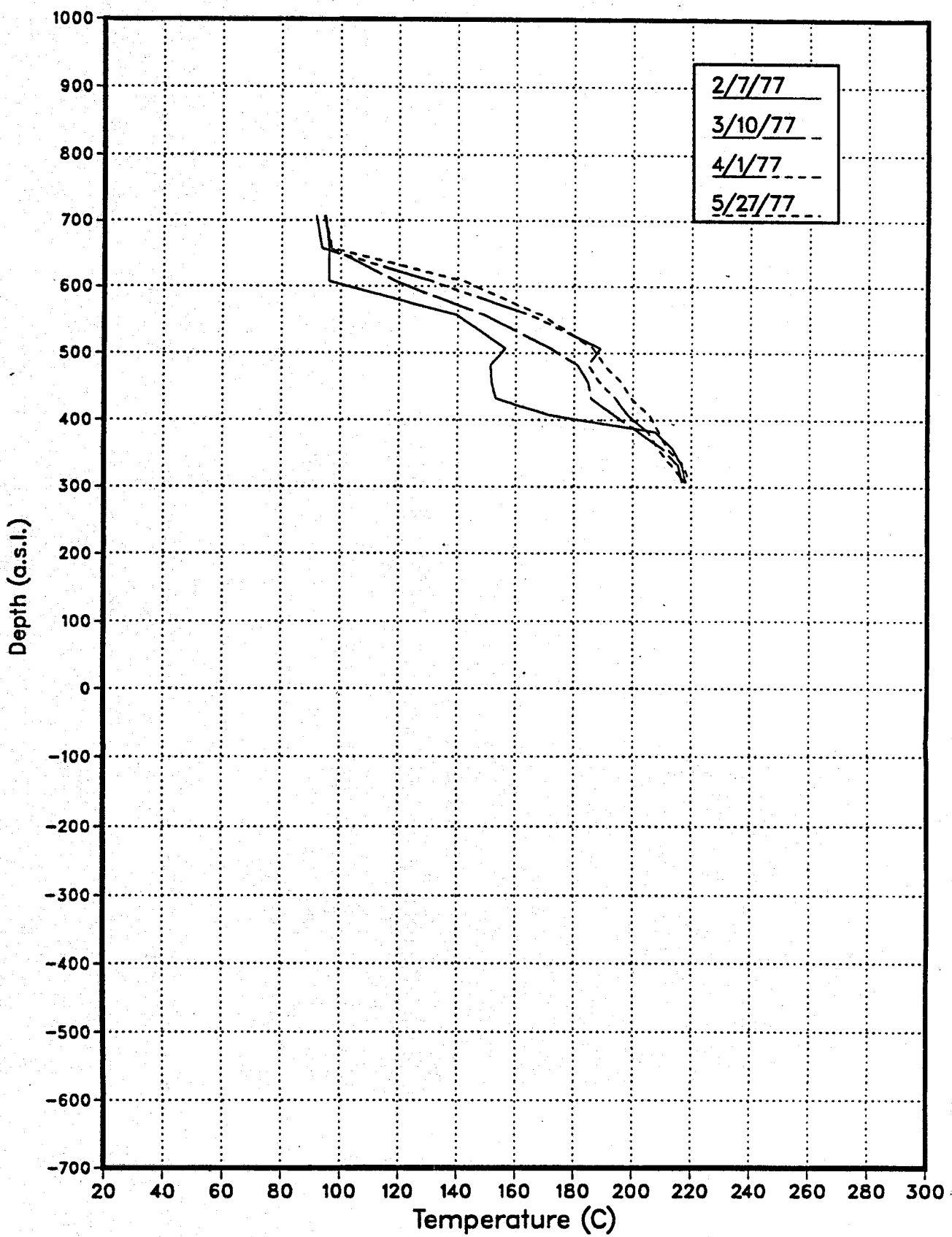
CHE 1 Temperature Surveys



CHE 1 Temperature Surveys

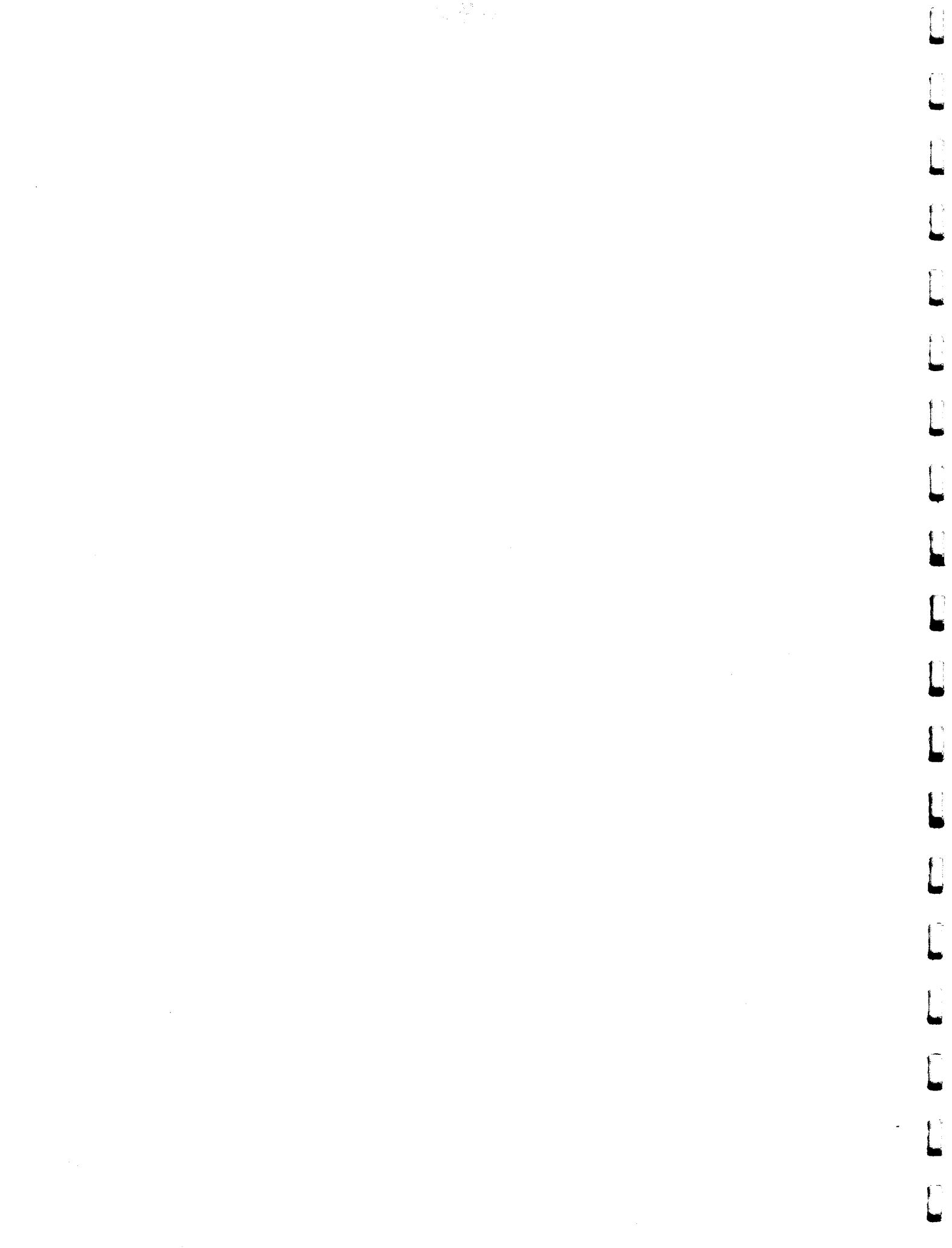


CHE 1 Temperature Surveys

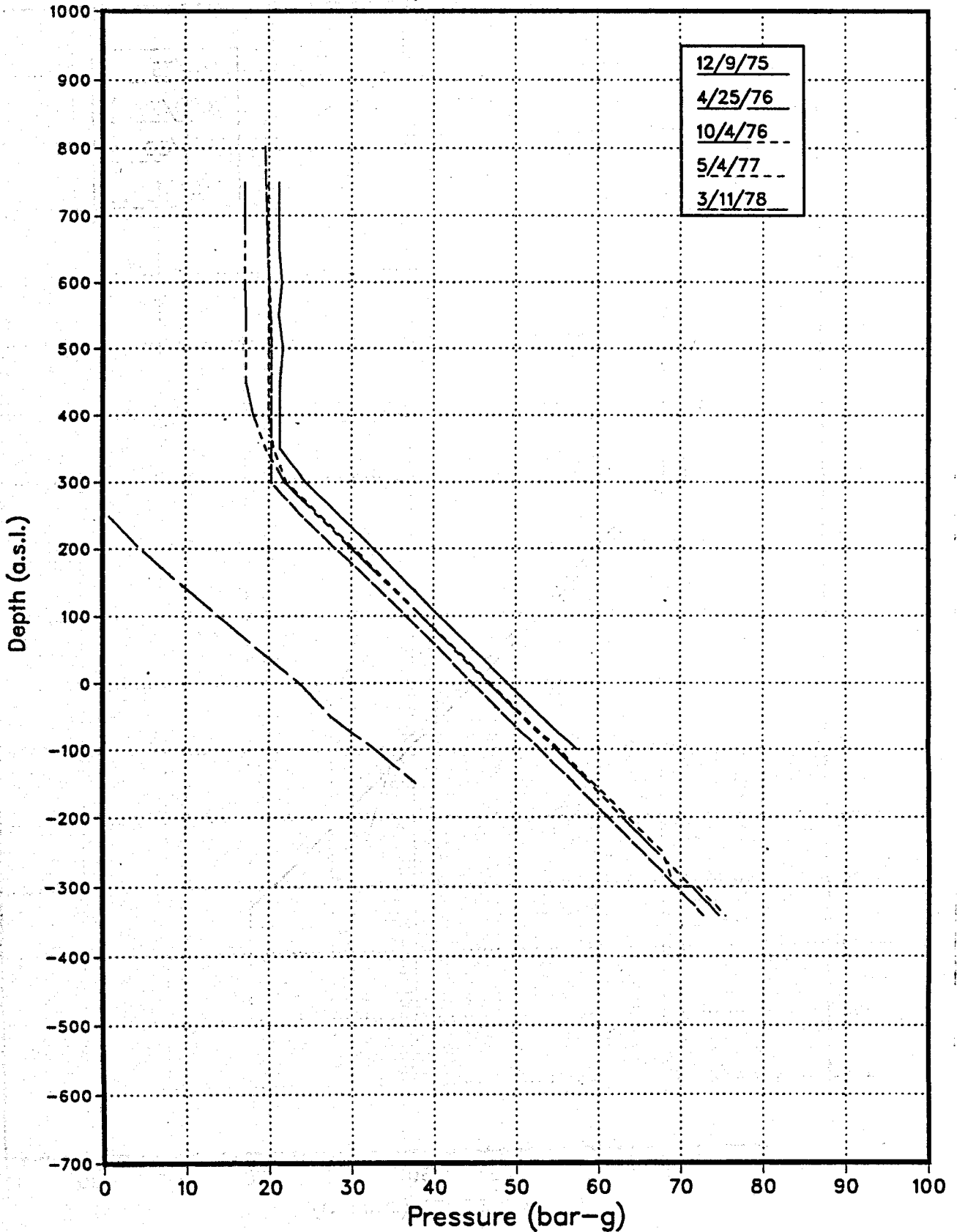


APPENDIX E

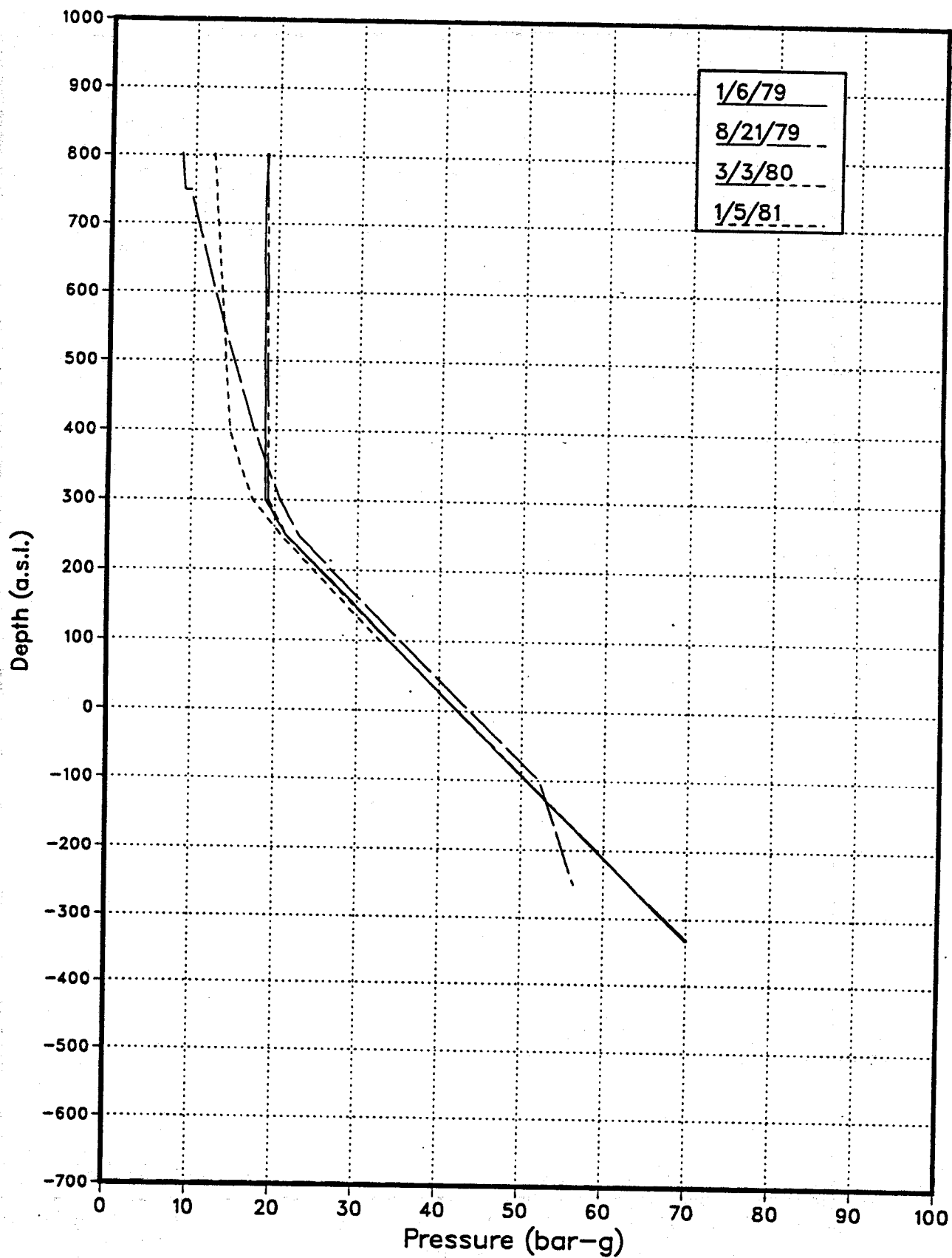
(Pressure Logs)



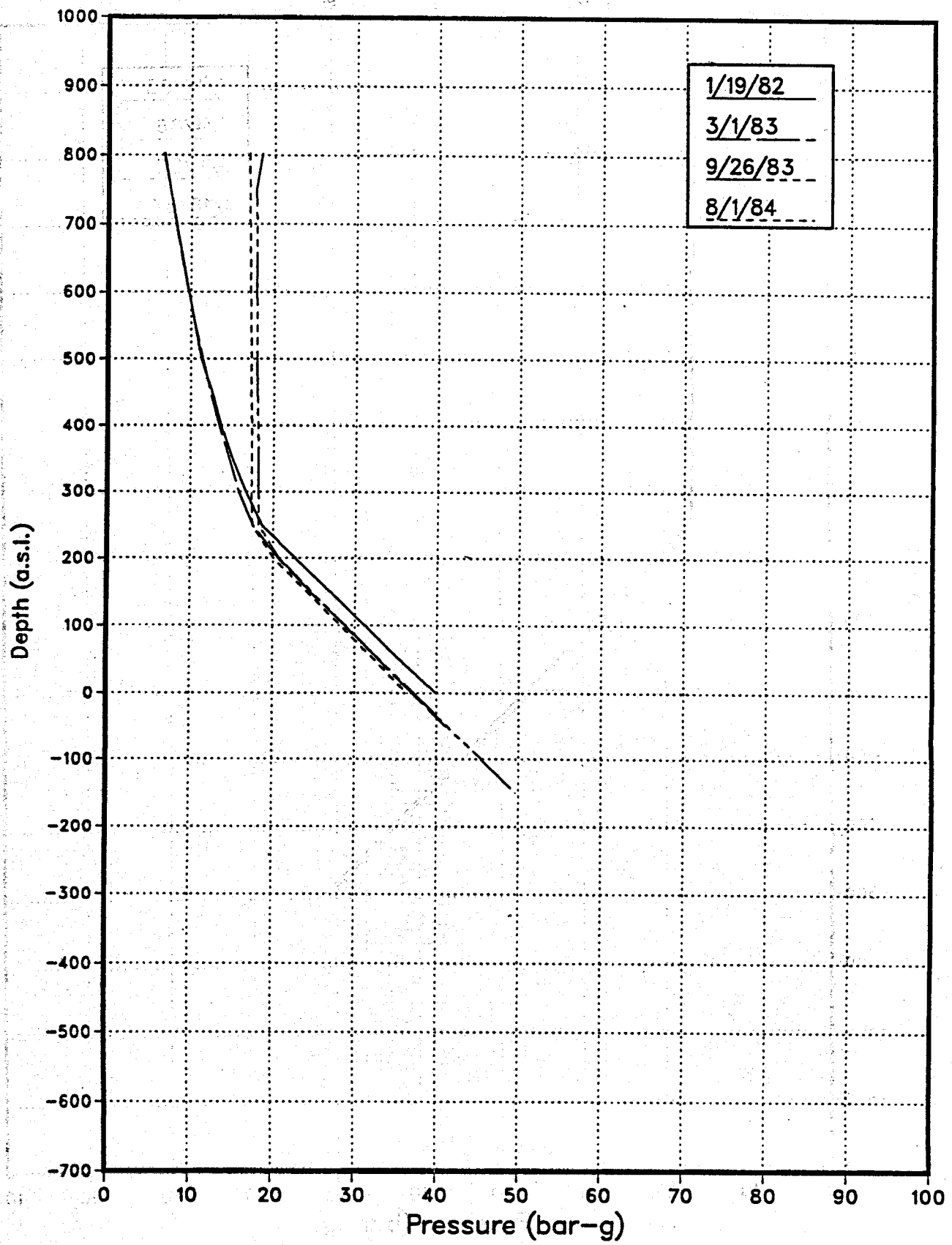
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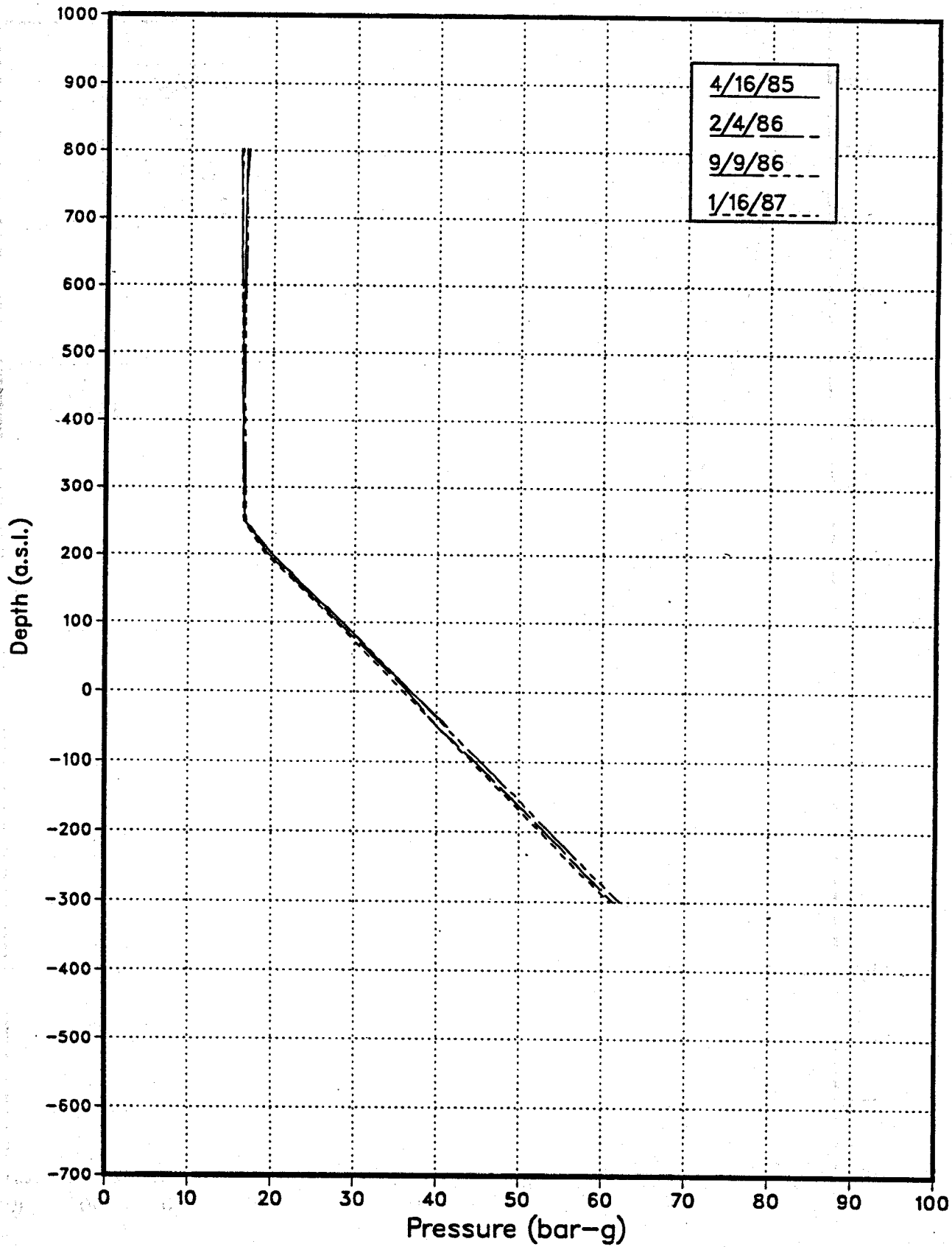
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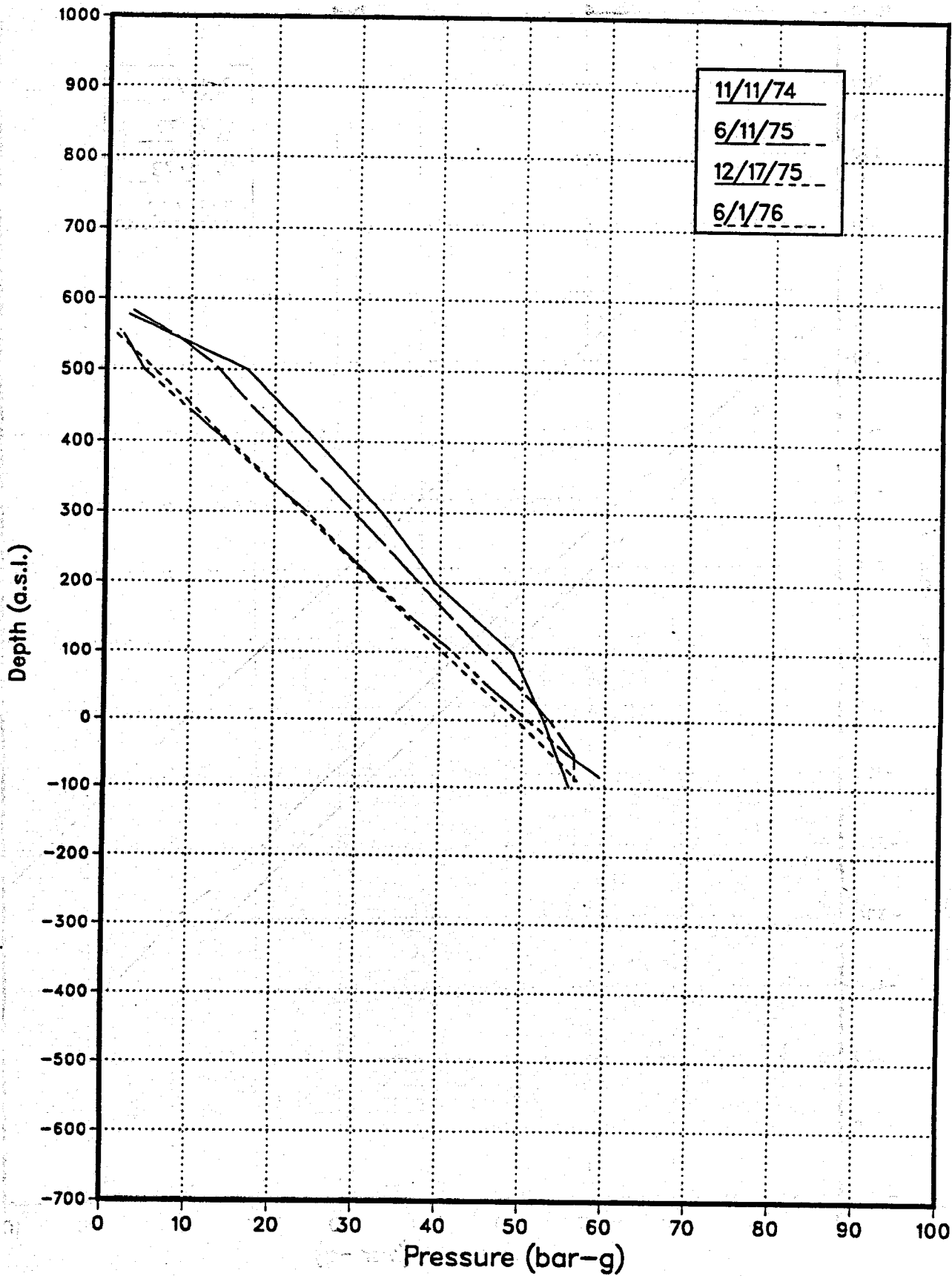
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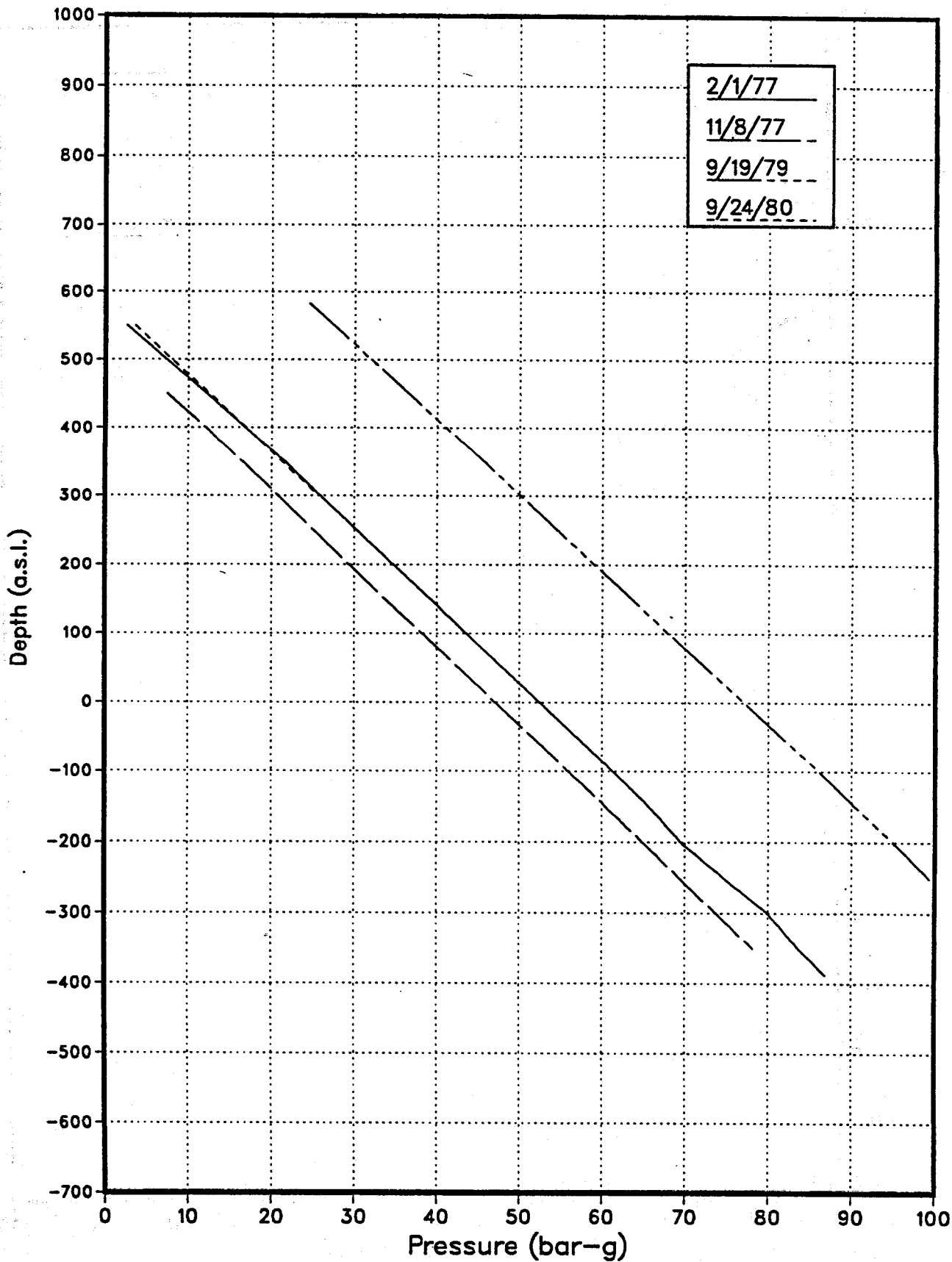
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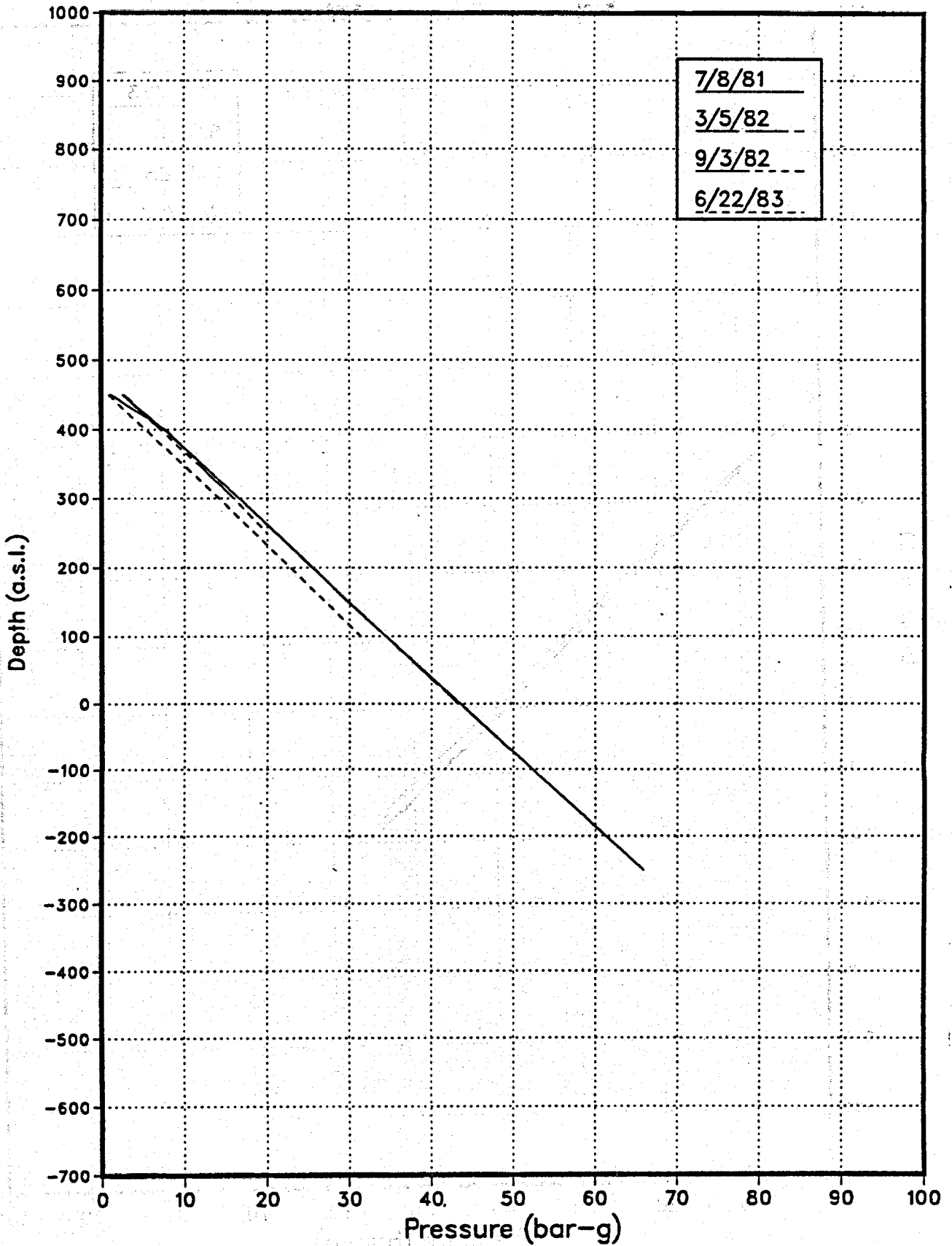
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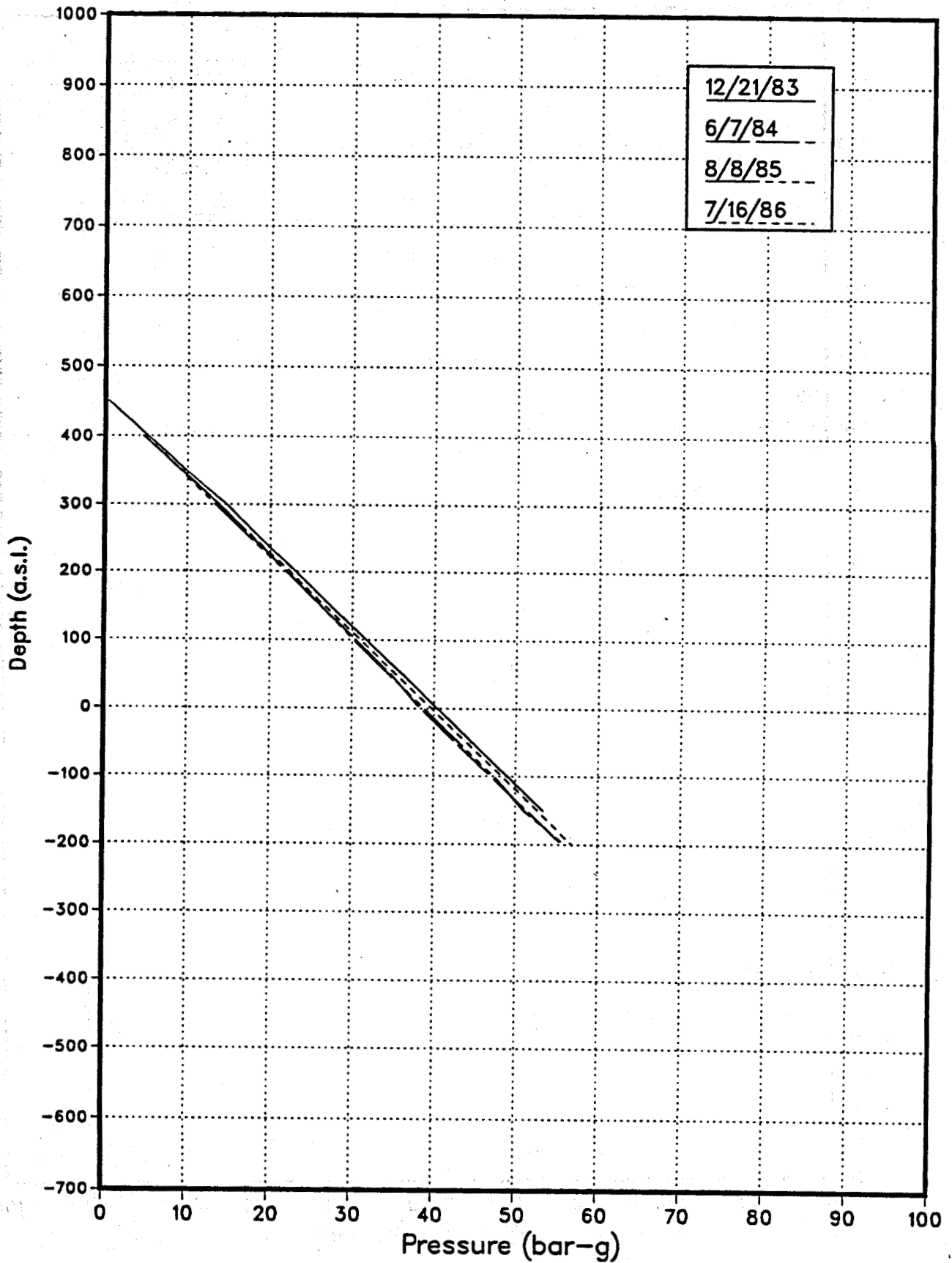
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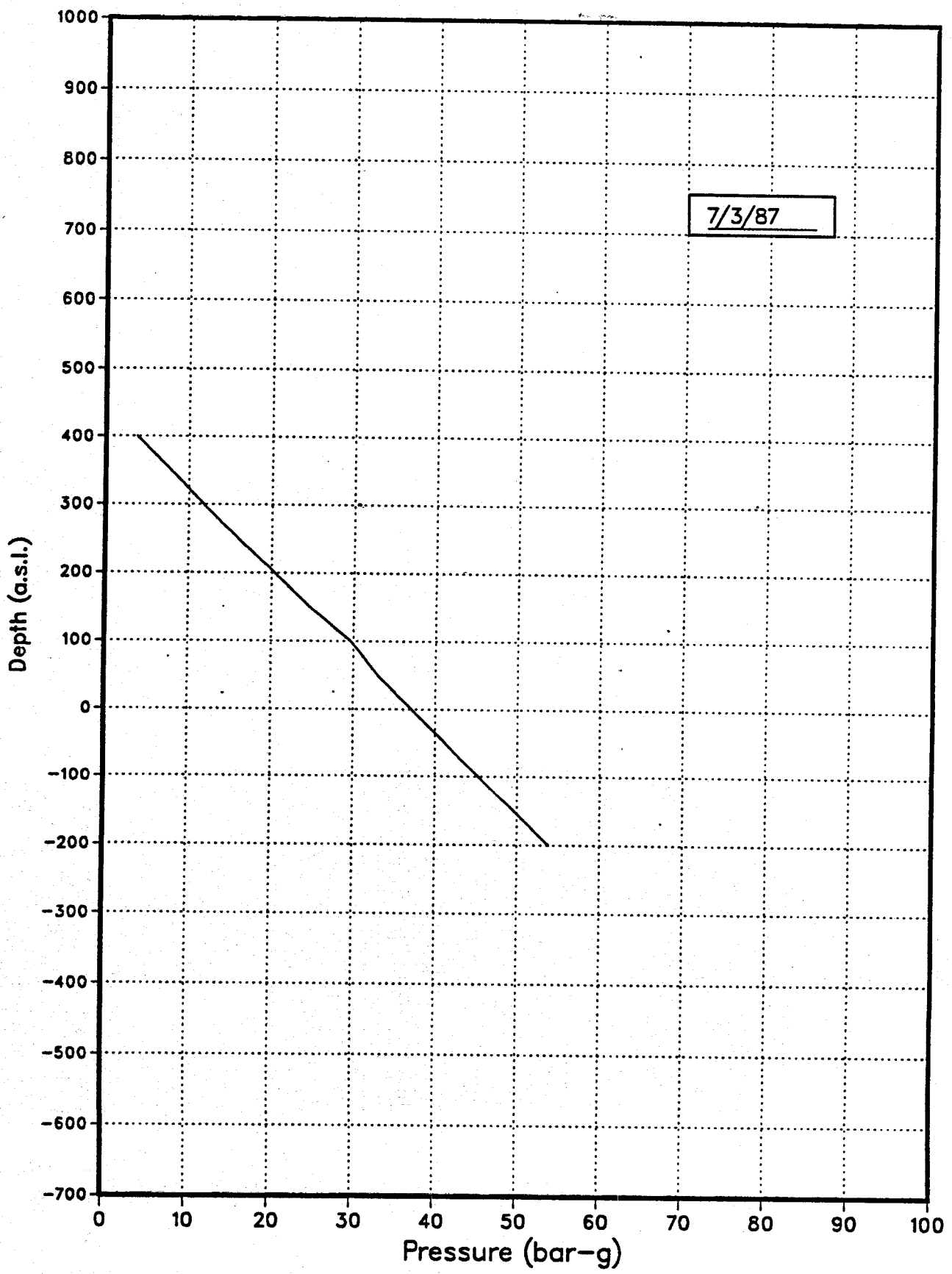
AH2 Pressure Surveys



AH2 Pressure Surveys



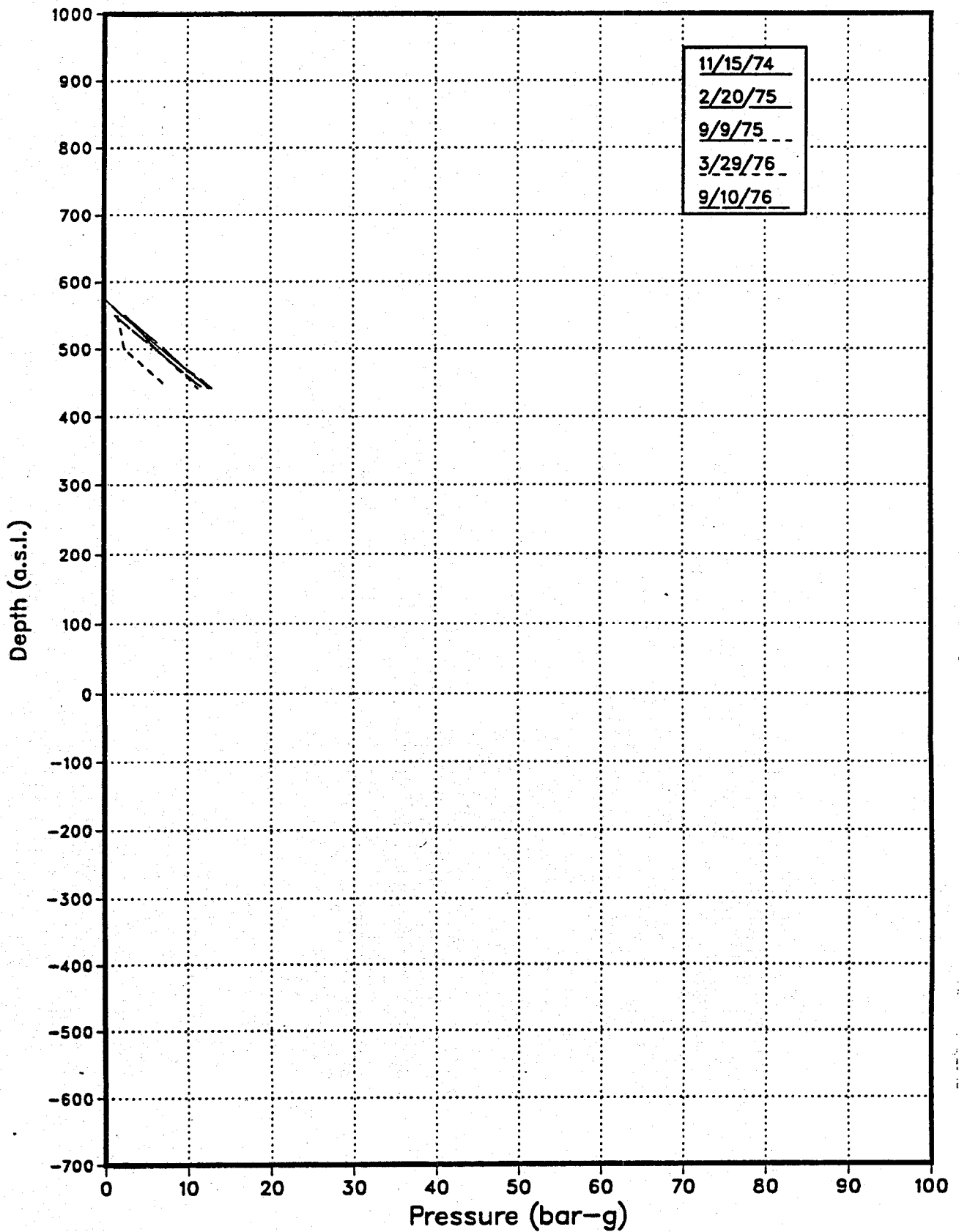
AH2 Pressure Surveys



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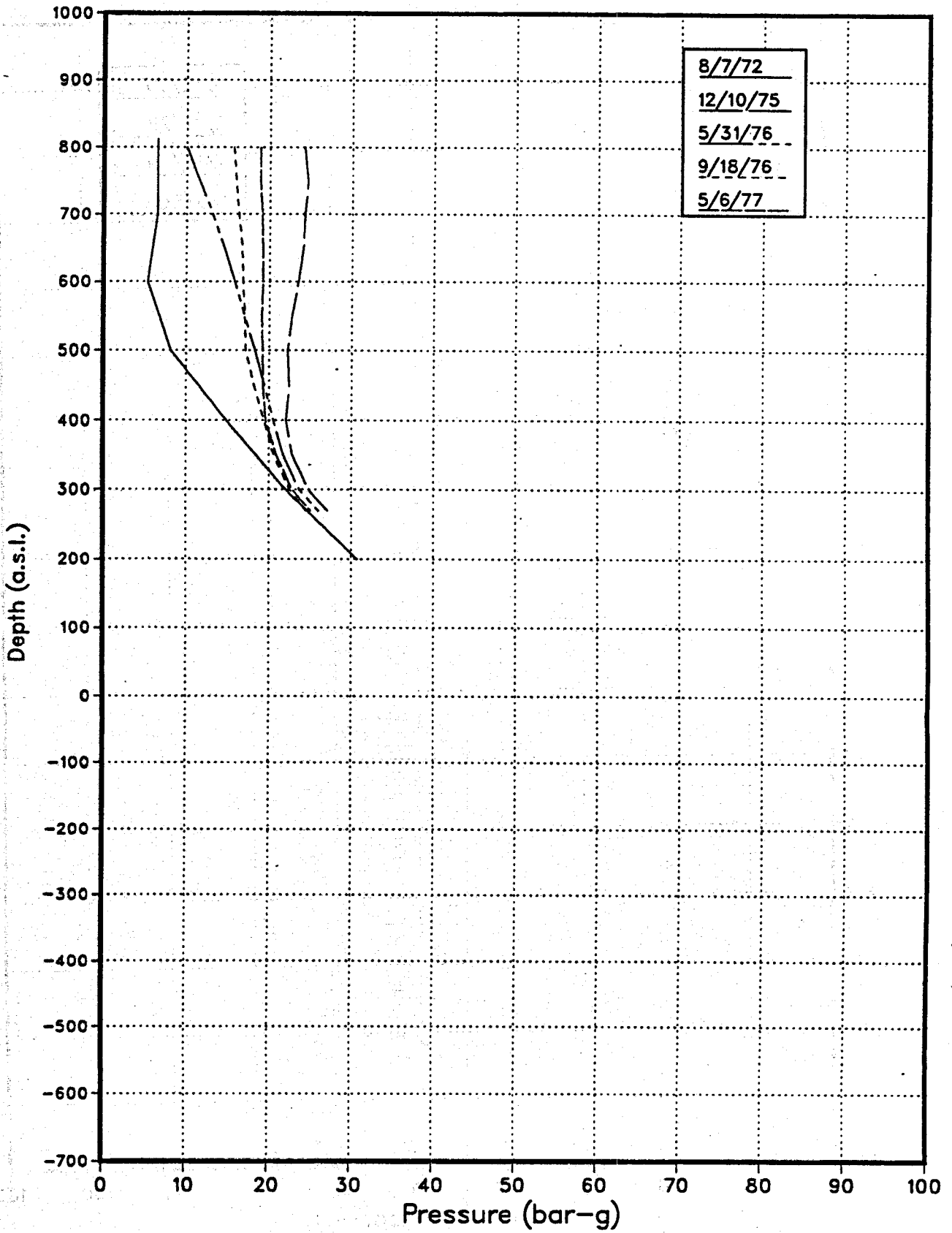
AH3 Pressure Surveys



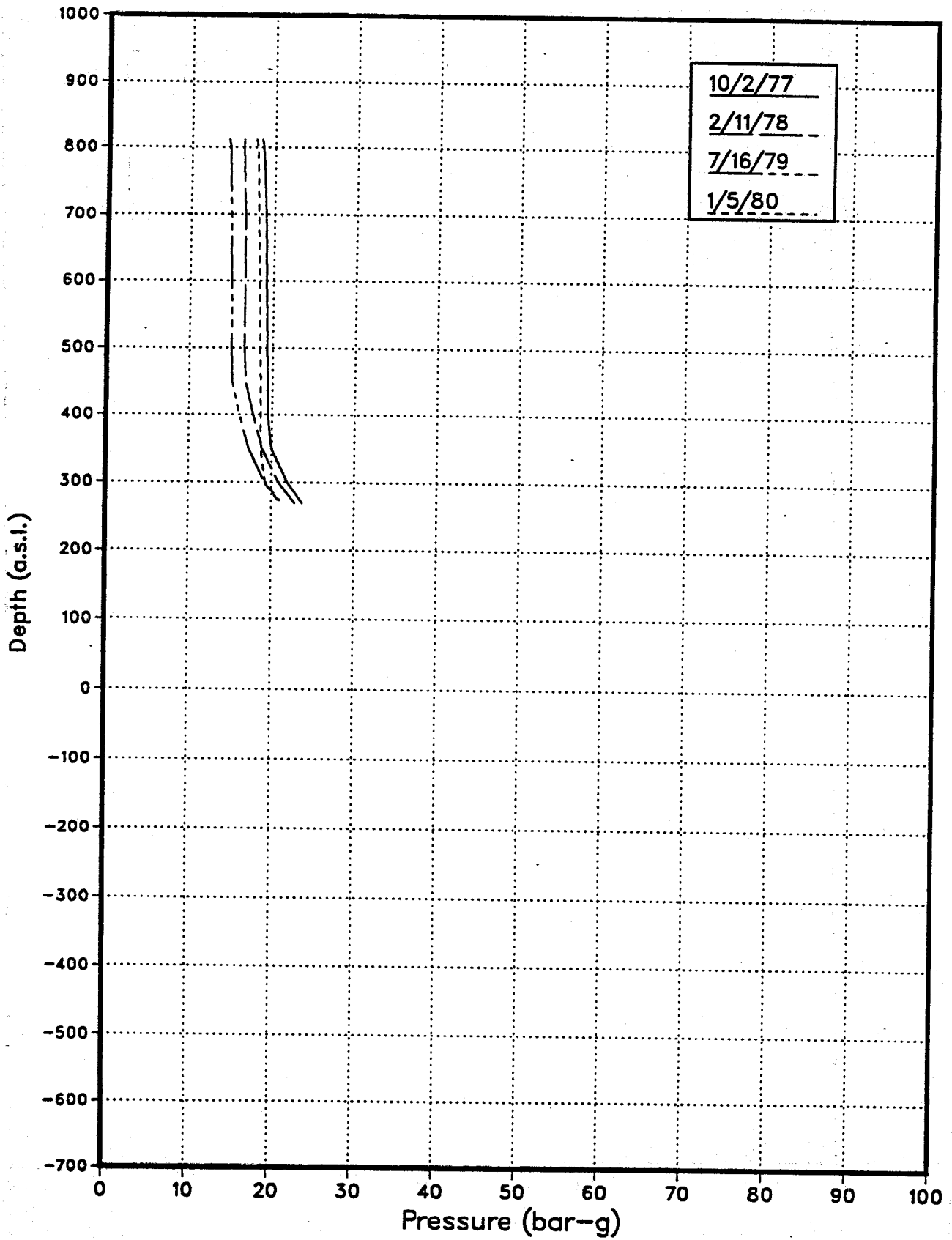
THE HISTORY OF THE

The history of the world is a vast and complex subject, encompassing the lives and actions of countless individuals and the evolution of societies over time. It is a story of triumph and adversity, of discovery and exploration, of war and peace. The ancient world, with its empires and civilizations, laid the foundations for the modern world. The Middle Ages, with its religious fervor and chivalry, shaped the cultural and political landscape of Europe. The Renaissance, with its emphasis on humanism and individualism, marked a turning point in Western history. The Enlightenment, with its focus on reason and progress, paved the way for the modern era. The Industrial Revolution, with its technological advances and social changes, transformed the world into a globalized society. The 20th century, with its two world wars and the Cold War, was a period of unprecedented conflict and change. Today, we live in a world of global interconnectedness, where the actions of one nation can have far-reaching consequences for the rest of the world. The history of the world is a testament to the resilience and ingenuity of the human spirit, and a source of inspiration and guidance for the future.

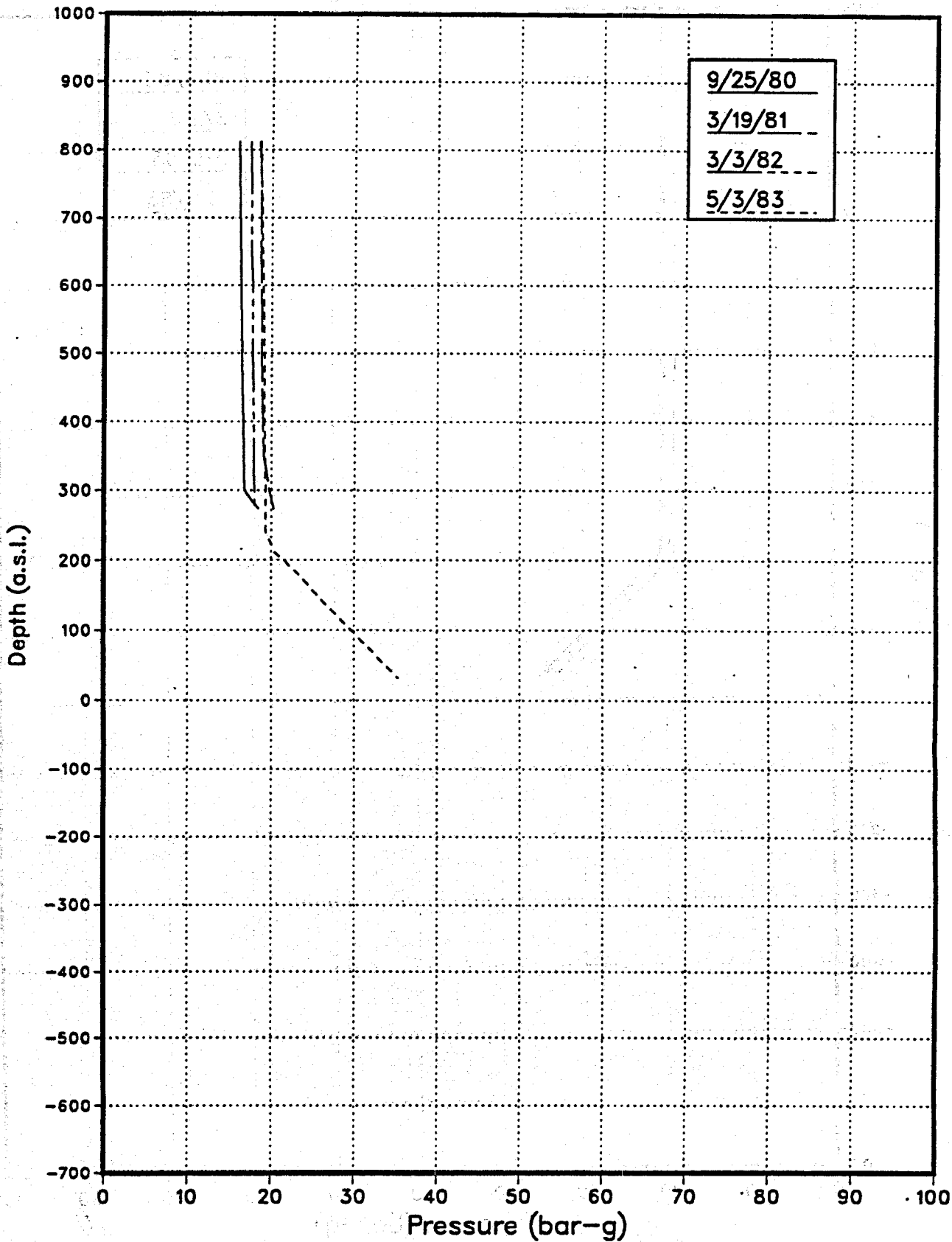
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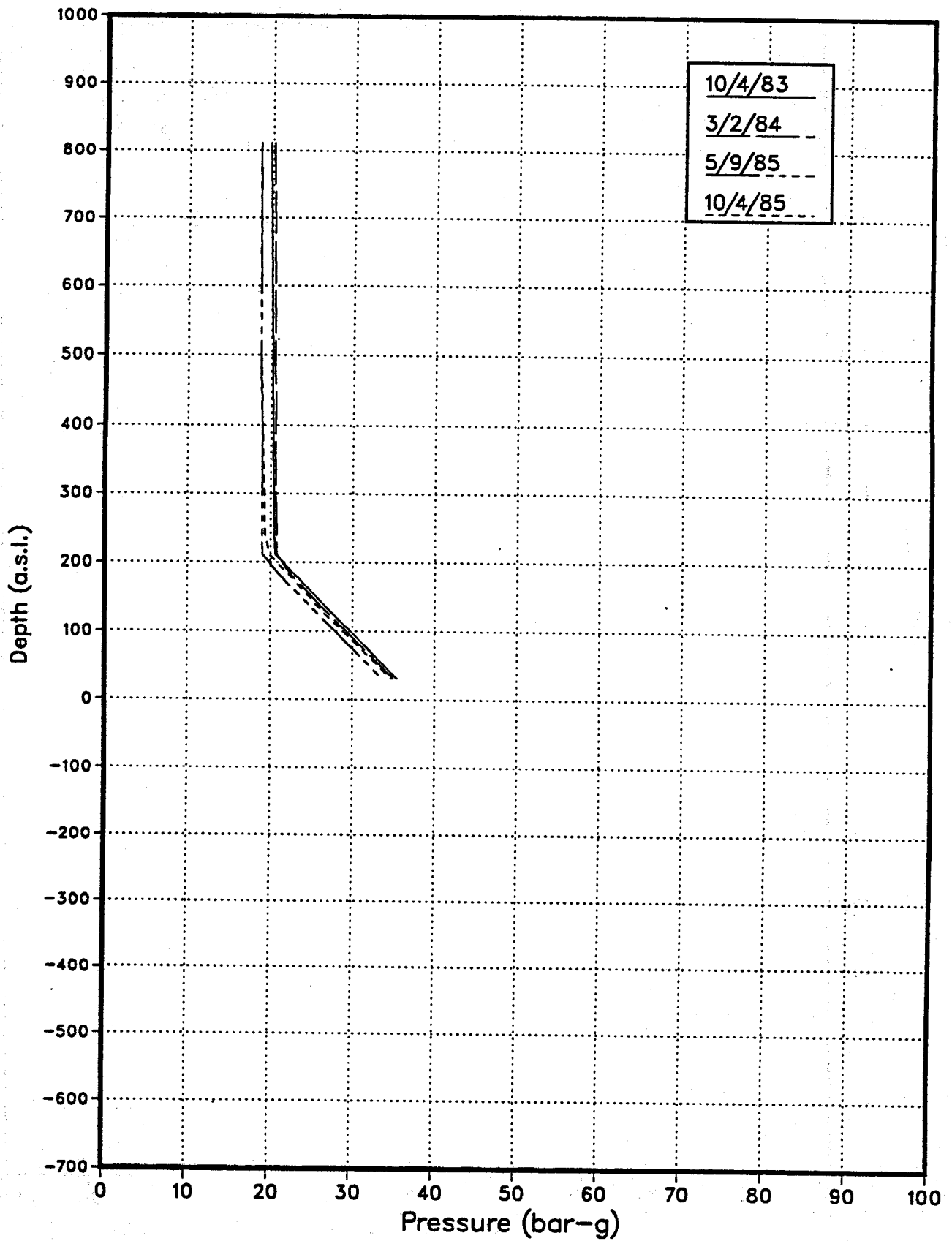
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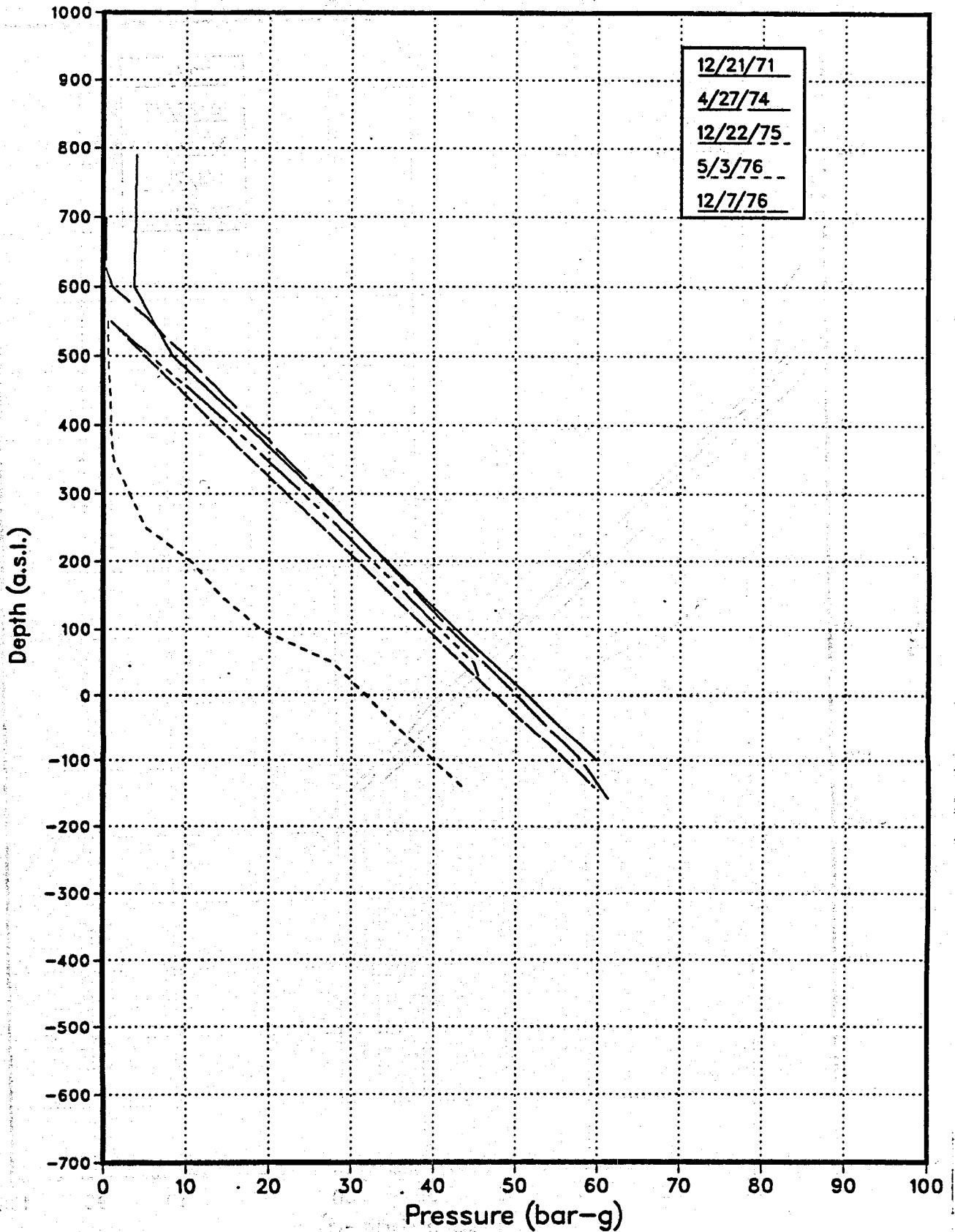
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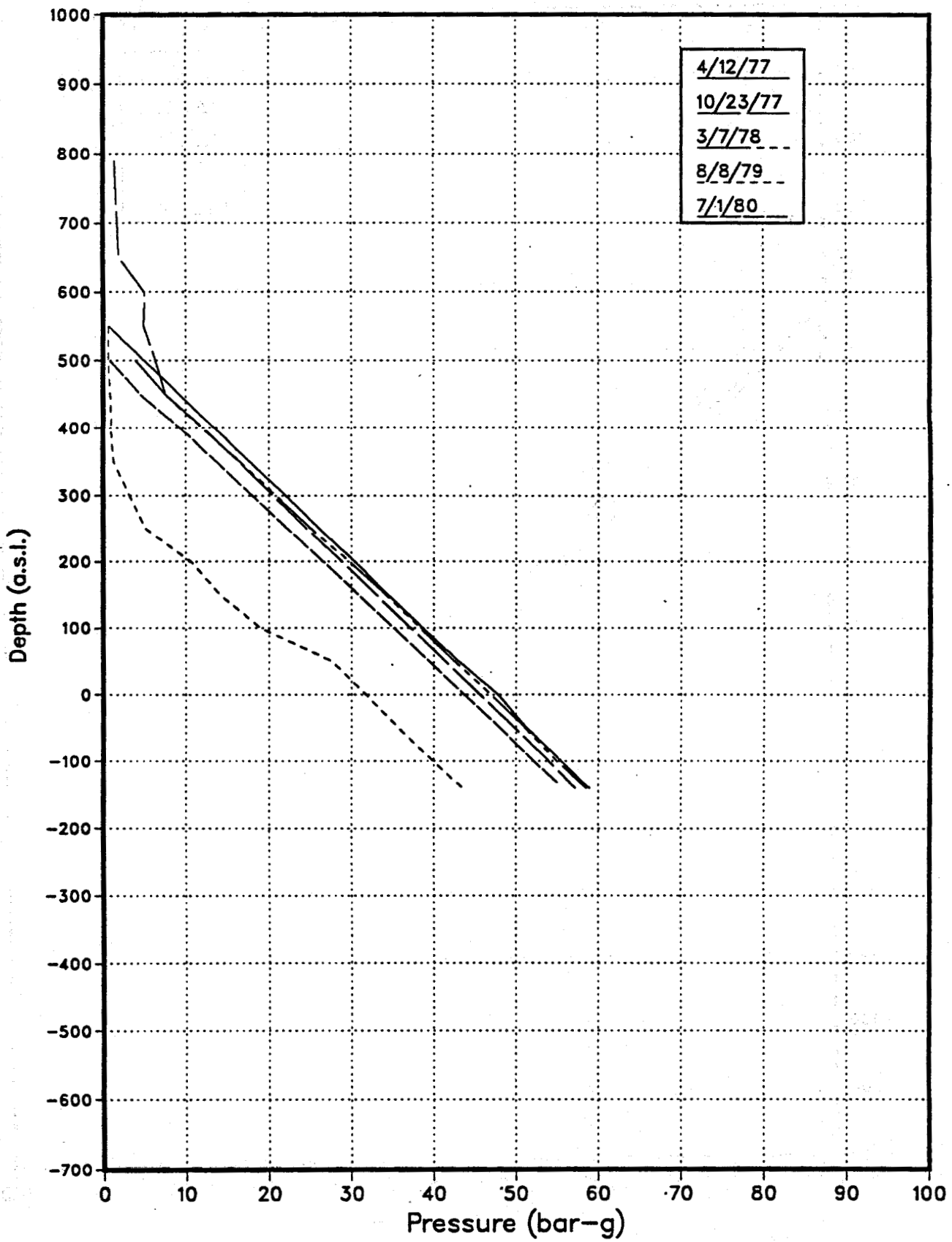
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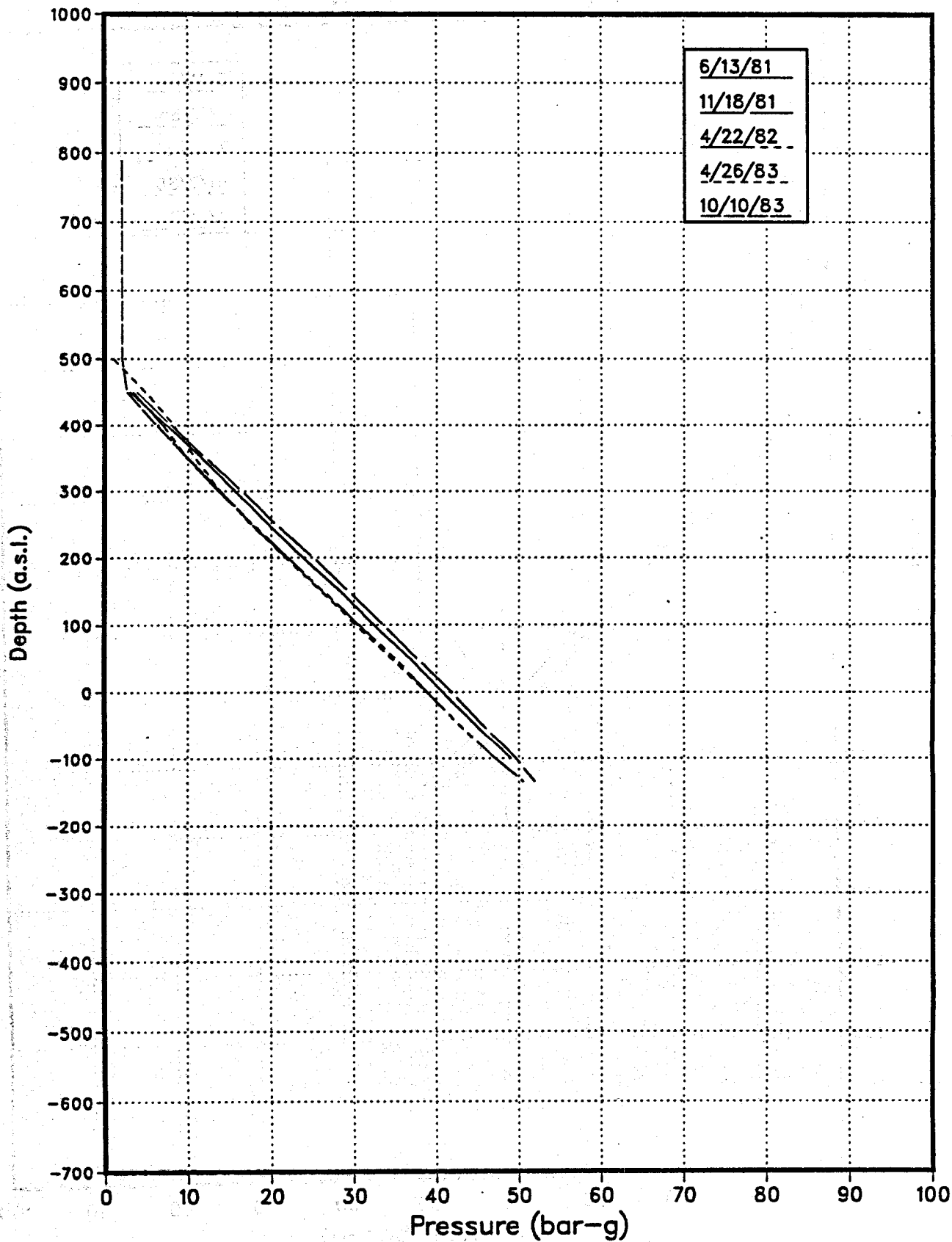
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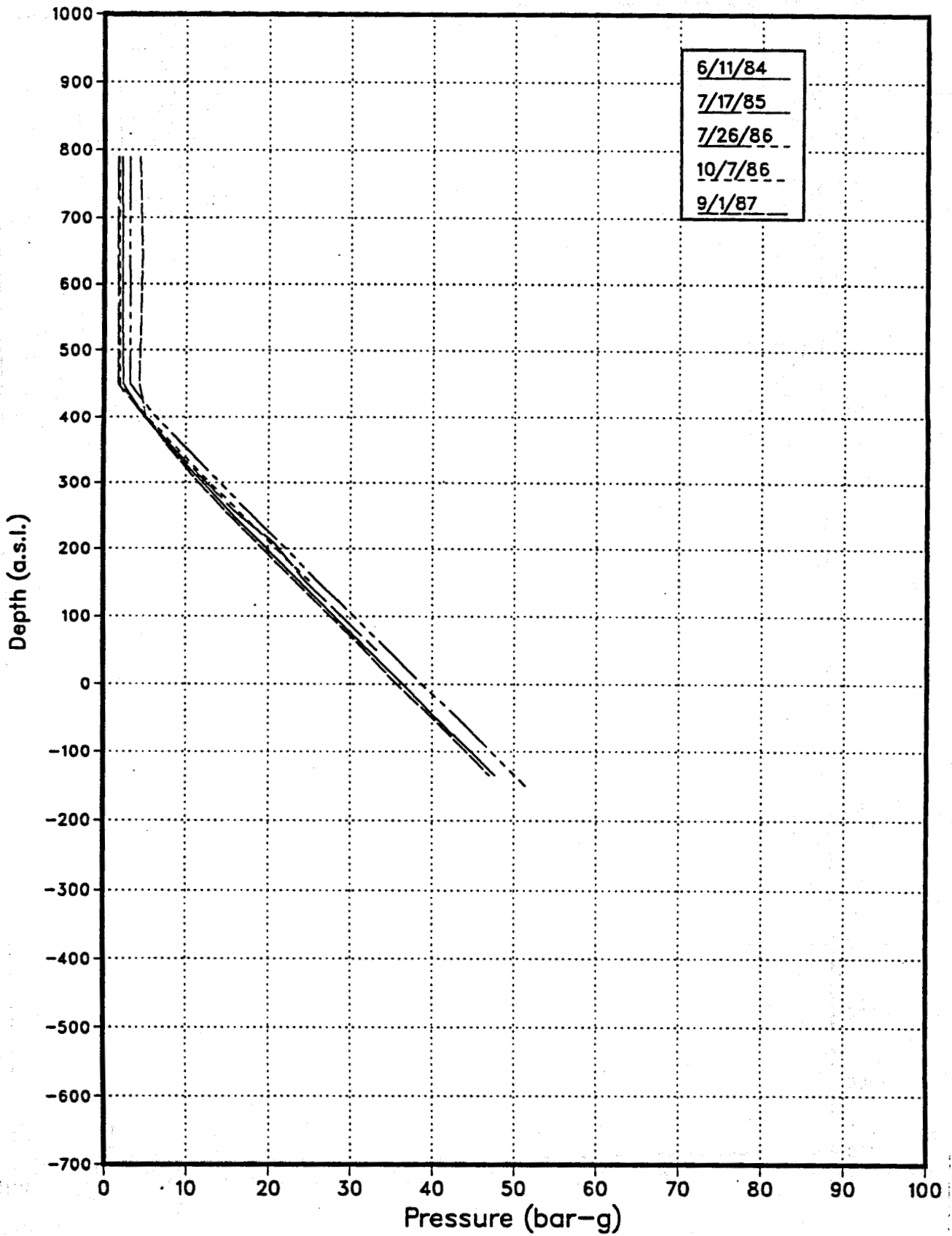
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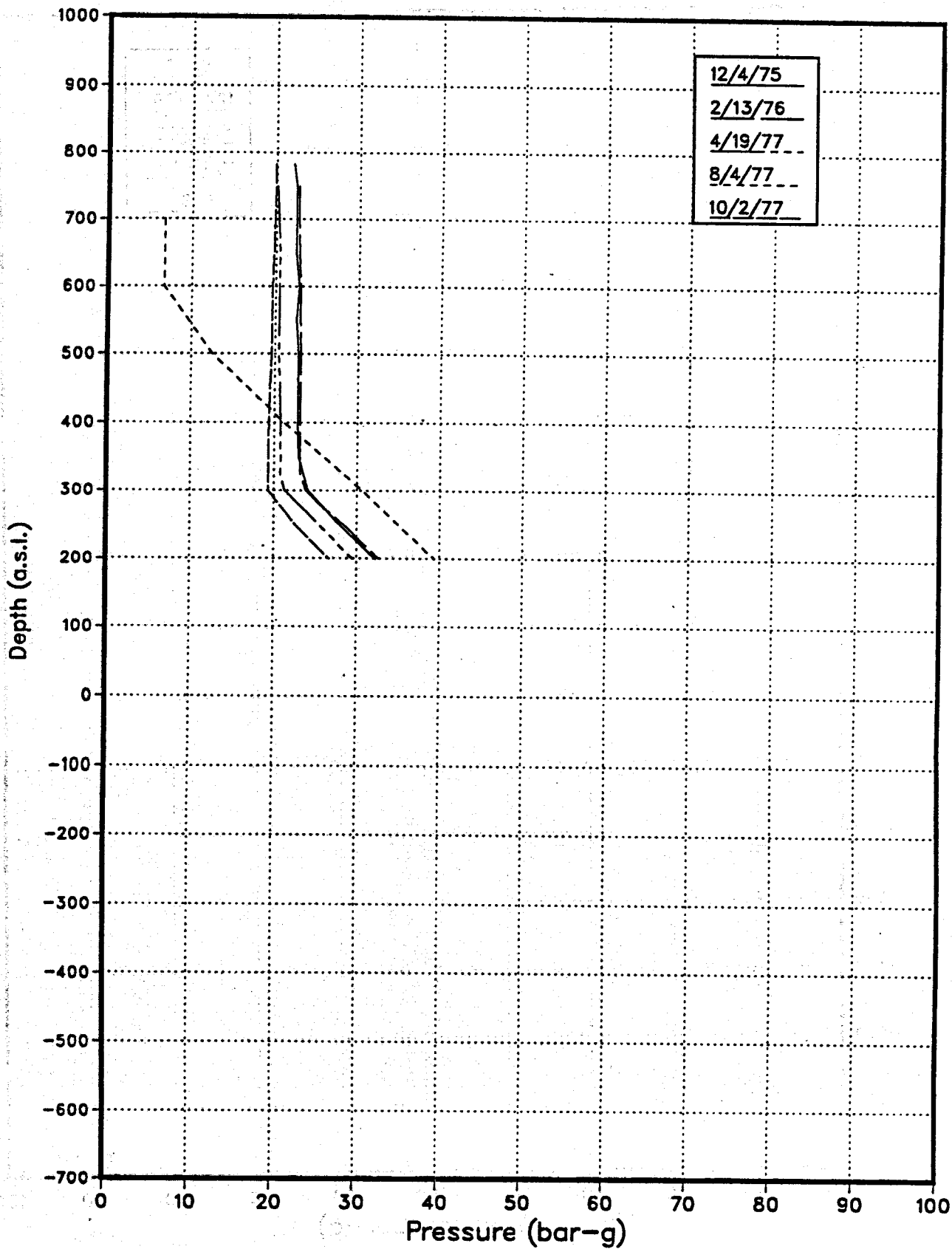
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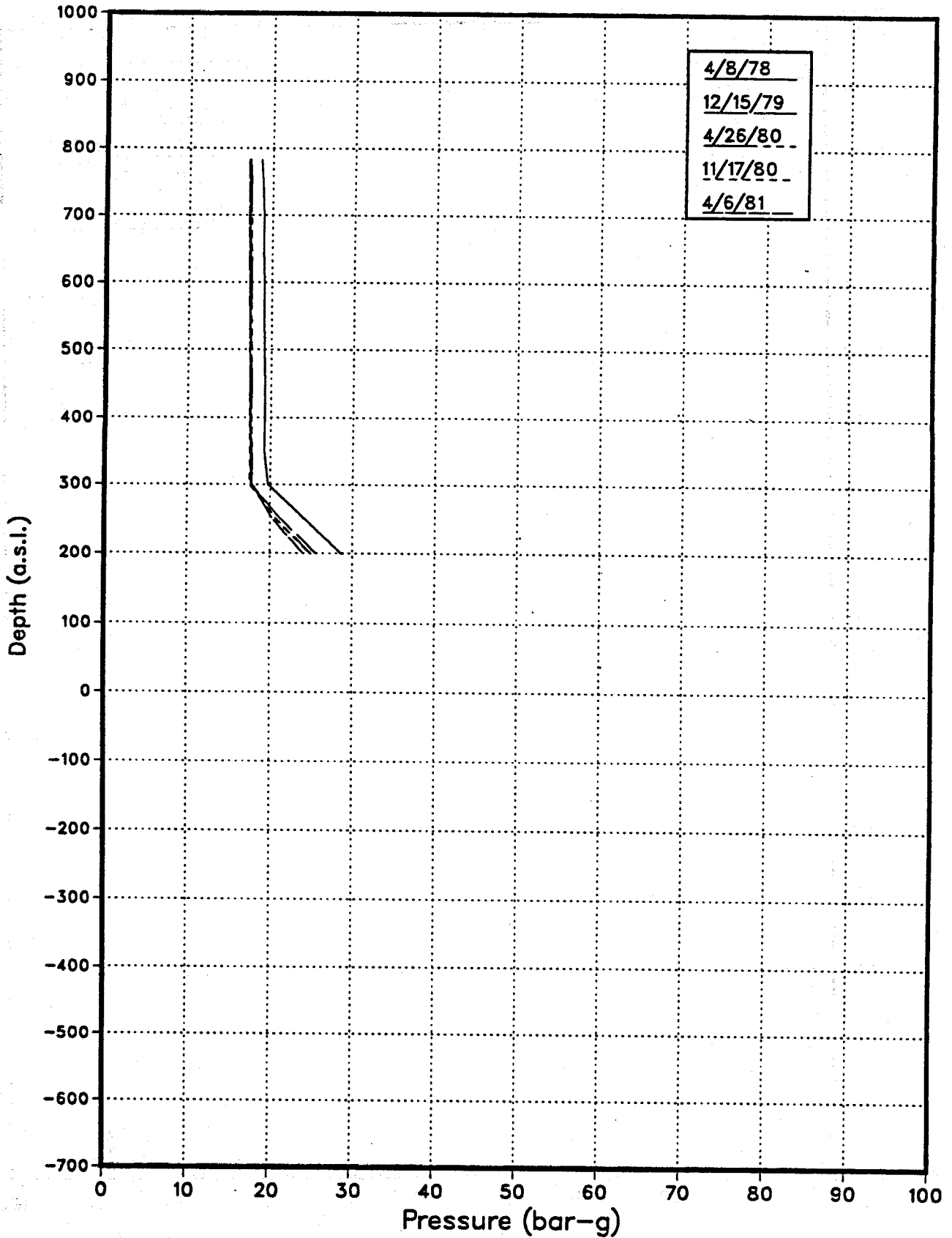
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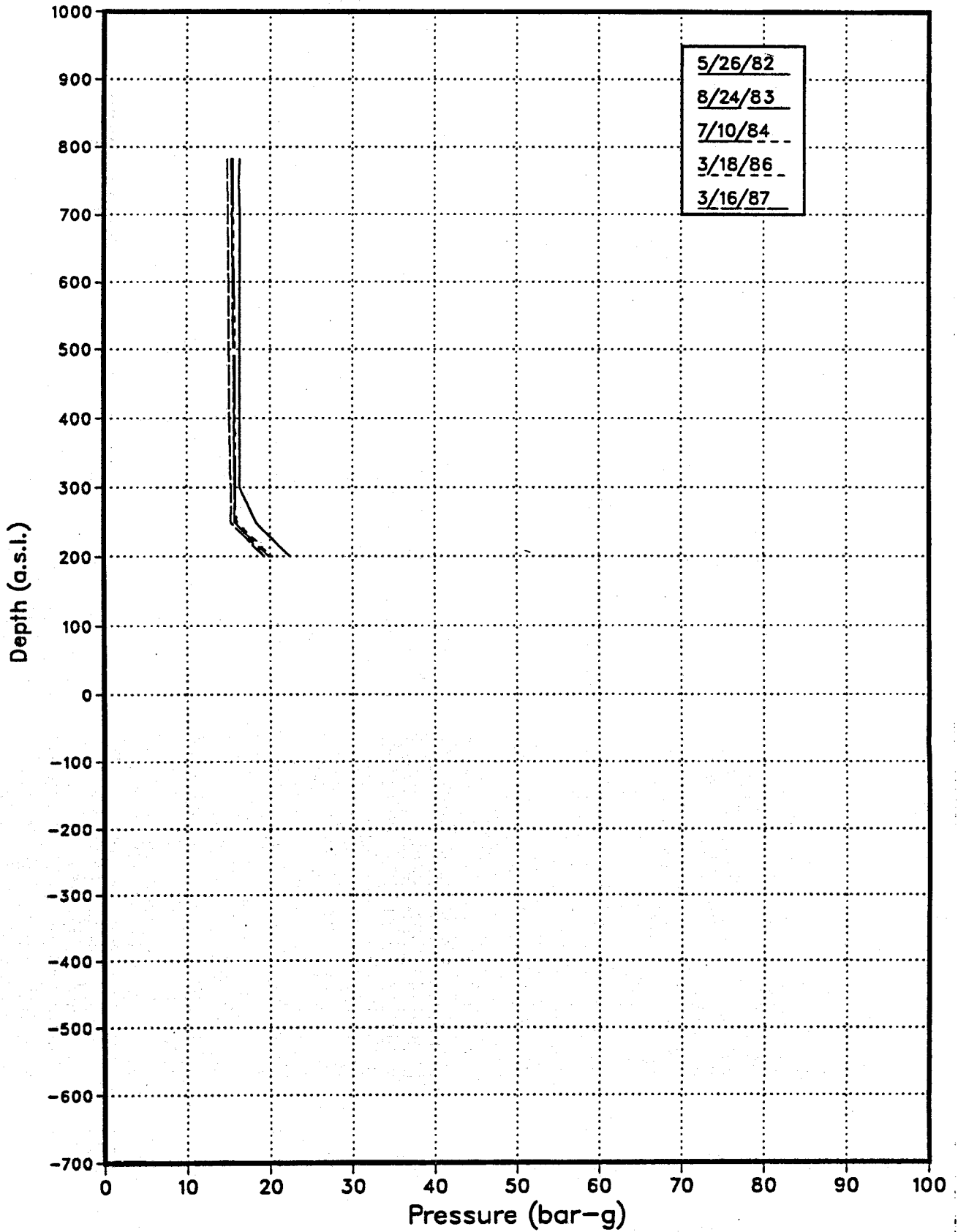
AH6 Pressure Surveys



AH6 Pressure Surveys



AH6 Pressure Surveys



Section 10

The following information is provided for your reference:

1. The total number of units is 100.

2. The units are divided into two groups: Group A and Group B.

3. Group A consists of 60 units, and Group B consists of 40 units.

4. The units are further categorized by type: Single, Double, and Triple.

5. The distribution of units is as follows:

Group	Single	Double	Triple
Group A	30	20	10
Group B	20	15	5

6. The total number of units in each category is:

- Single: 50
- Double: 35
- Triple: 15

7. The units are further categorized by location: North, South, and East.

8. The distribution of units is as follows:

Location	Single	Double	Triple
North	25	15	5
South	20	10	5
East	5	10	5

9. The total number of units in each location is:

- North: 45
- South: 35
- East: 20

10. The units are further categorized by color: Red, Blue, and Green.

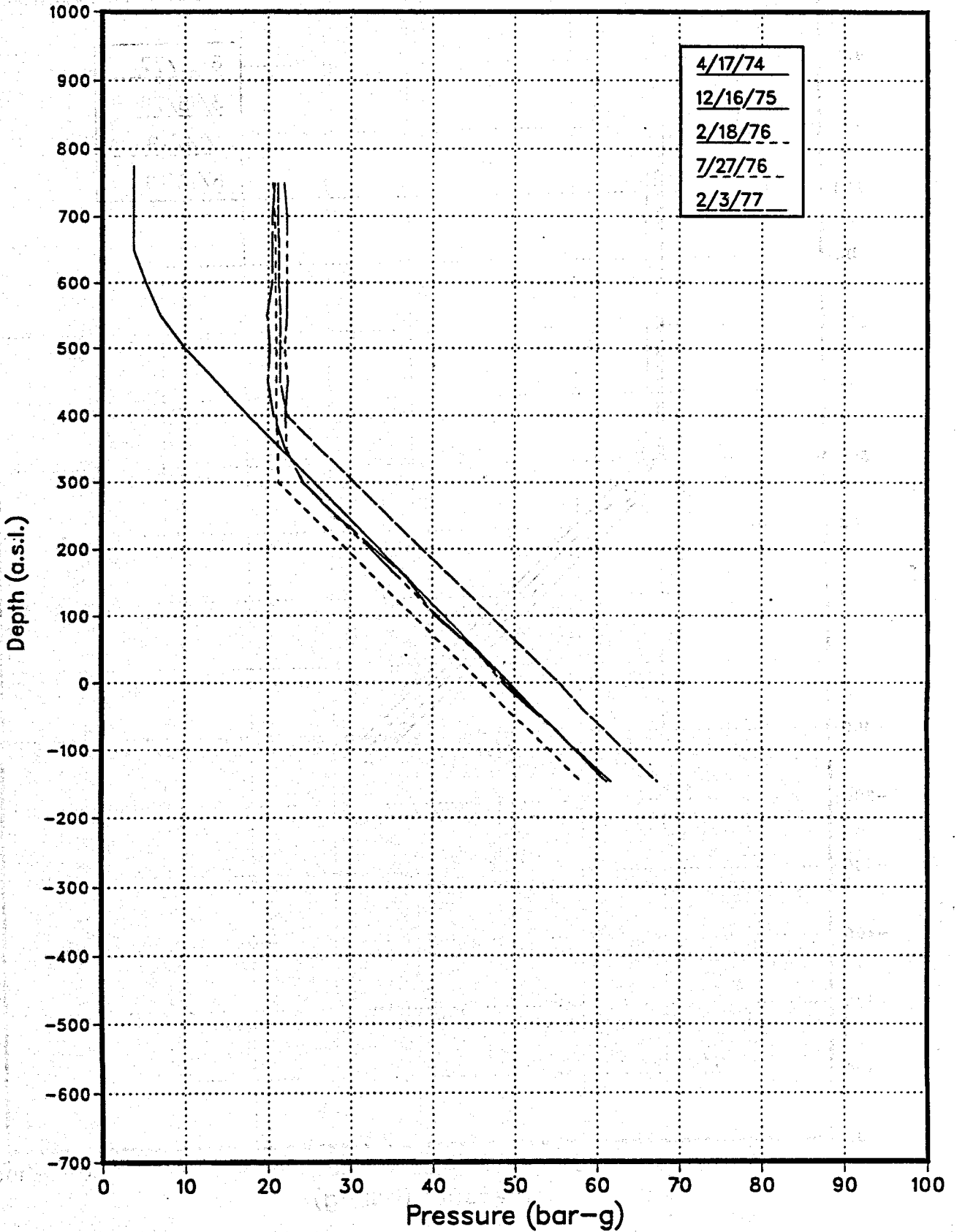
11. The distribution of units is as follows:

Color	Single	Double	Triple
Red	15	10	5
Blue	20	15	5
Green	15	10	5

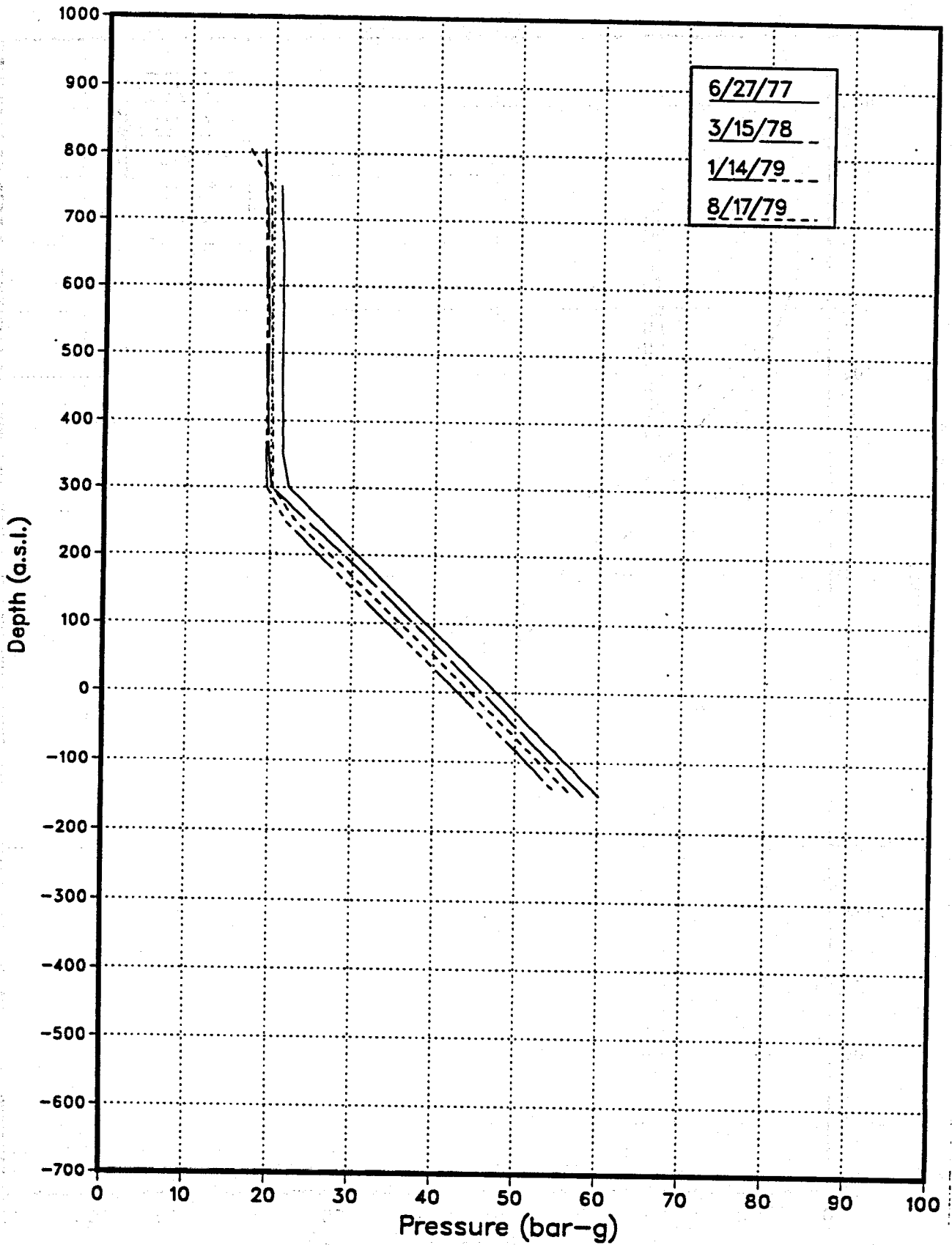
12. The total number of units in each color is:

- Red: 30
- Blue: 35
- Green: 30

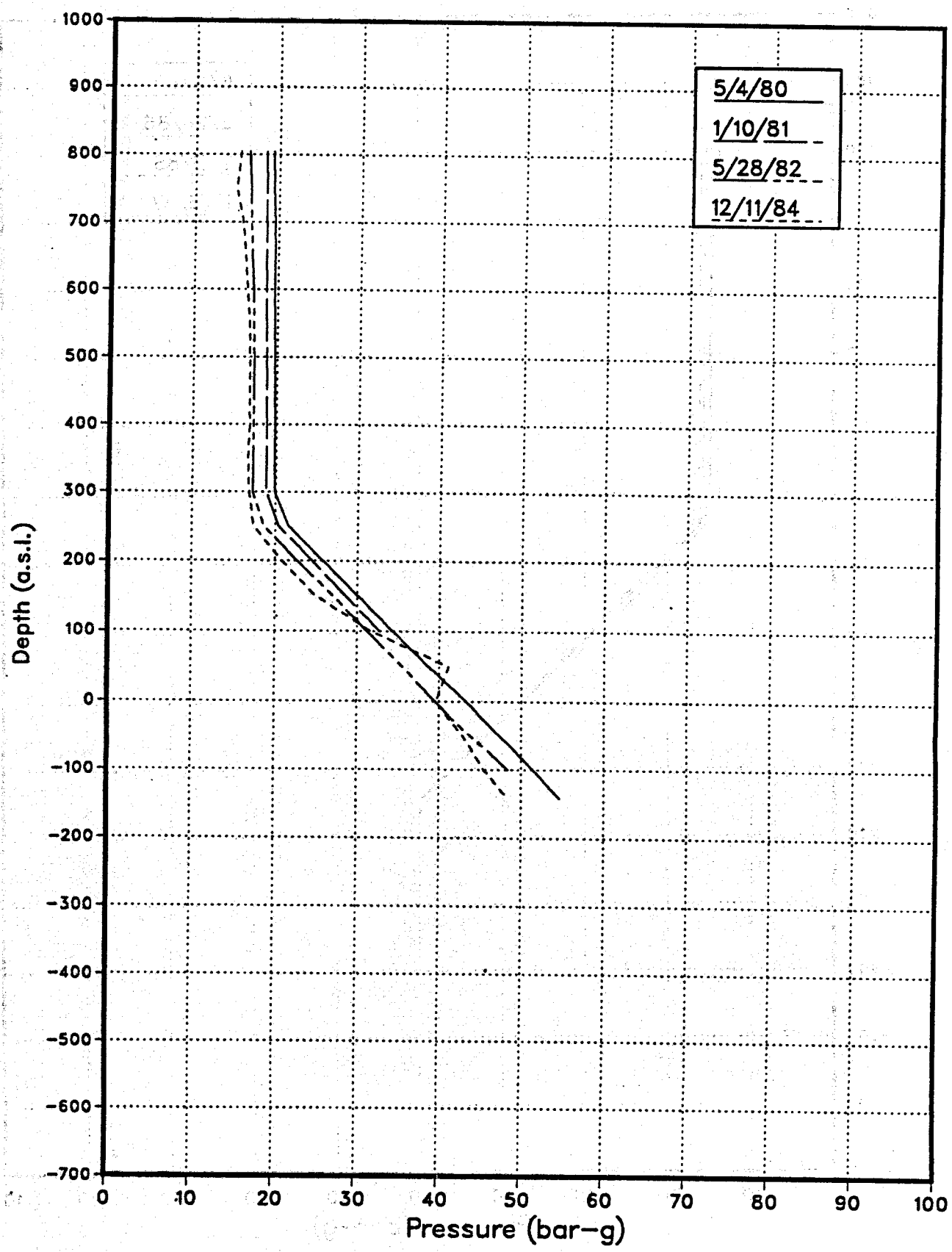
AH7 Pressure Surveys



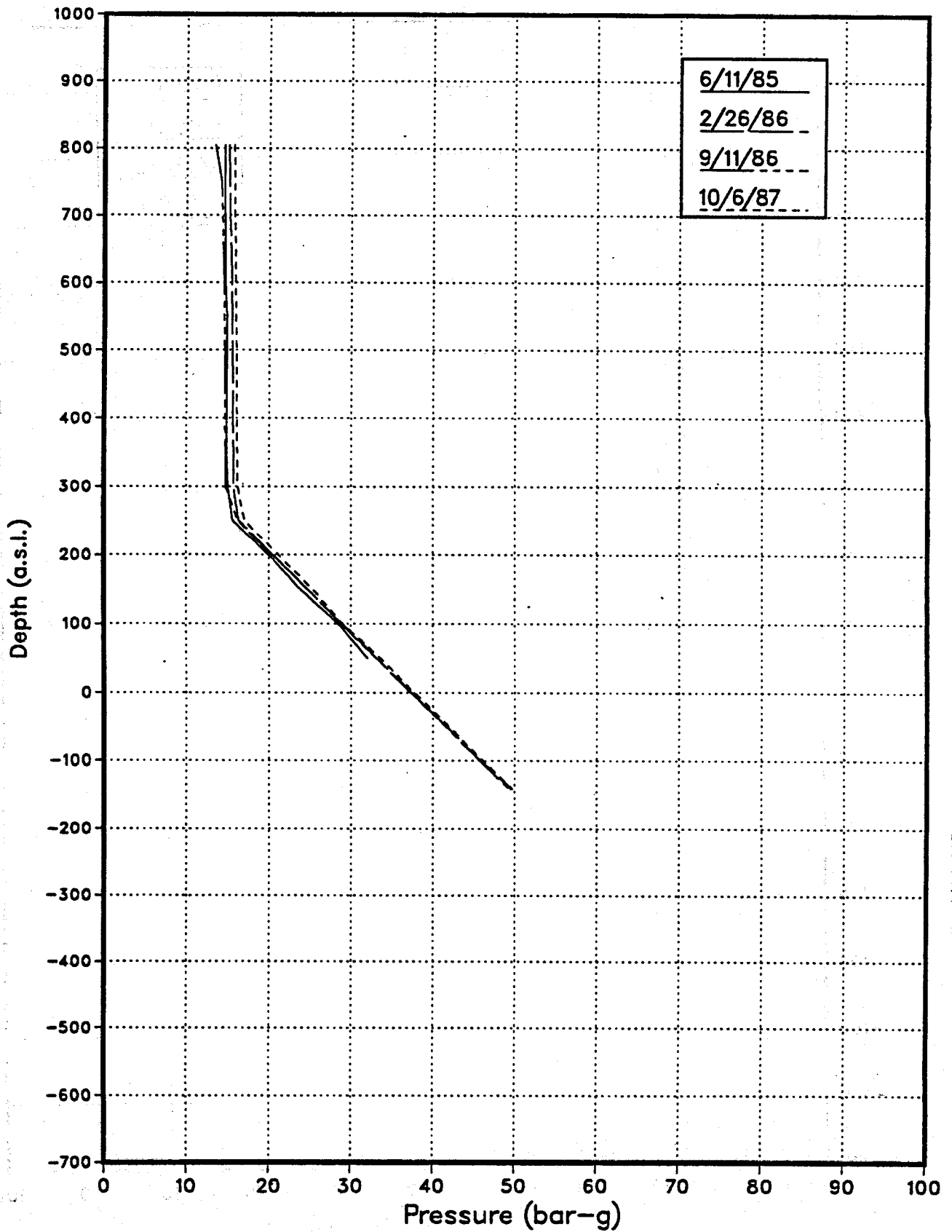
AH7 Pressure Surveys



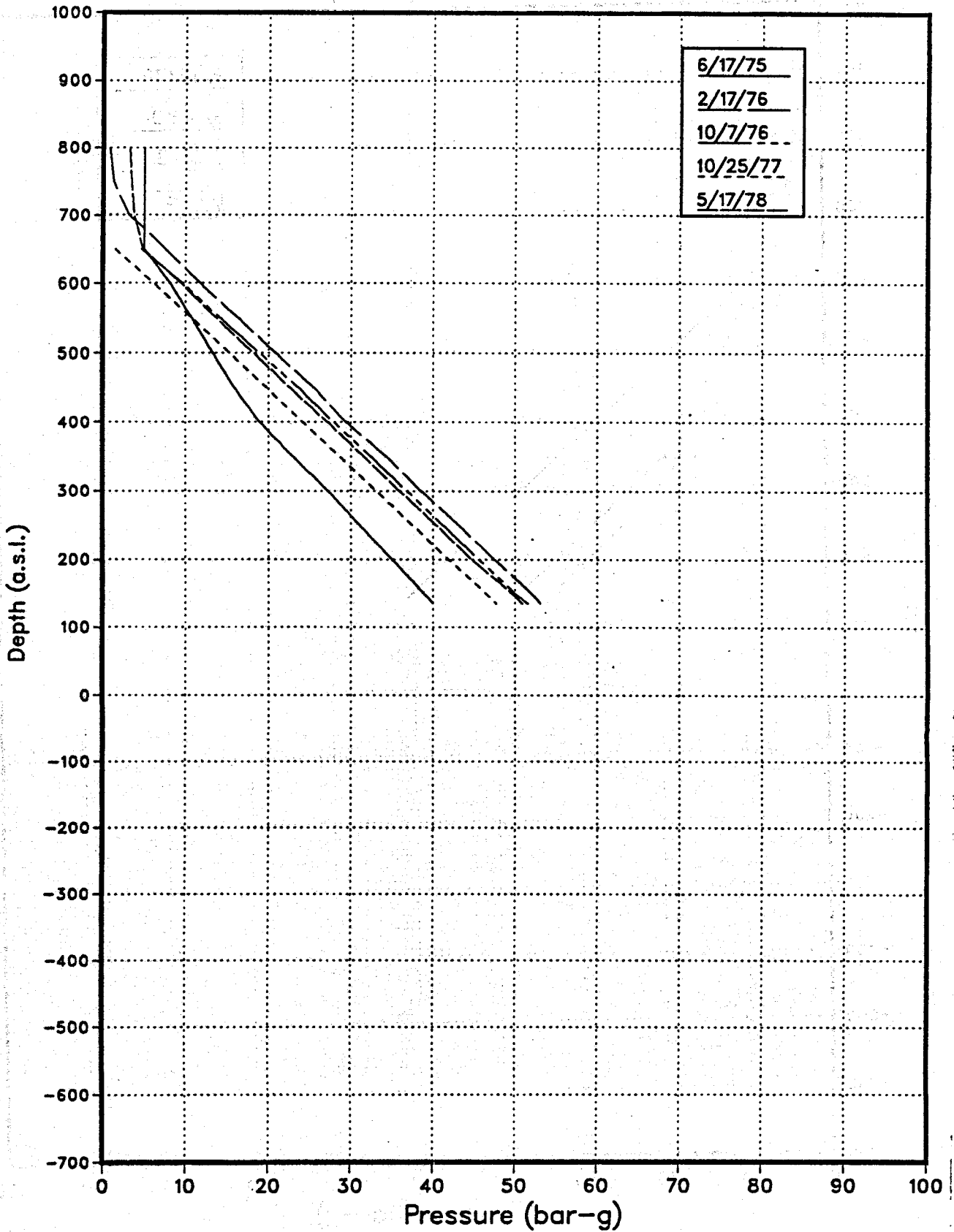
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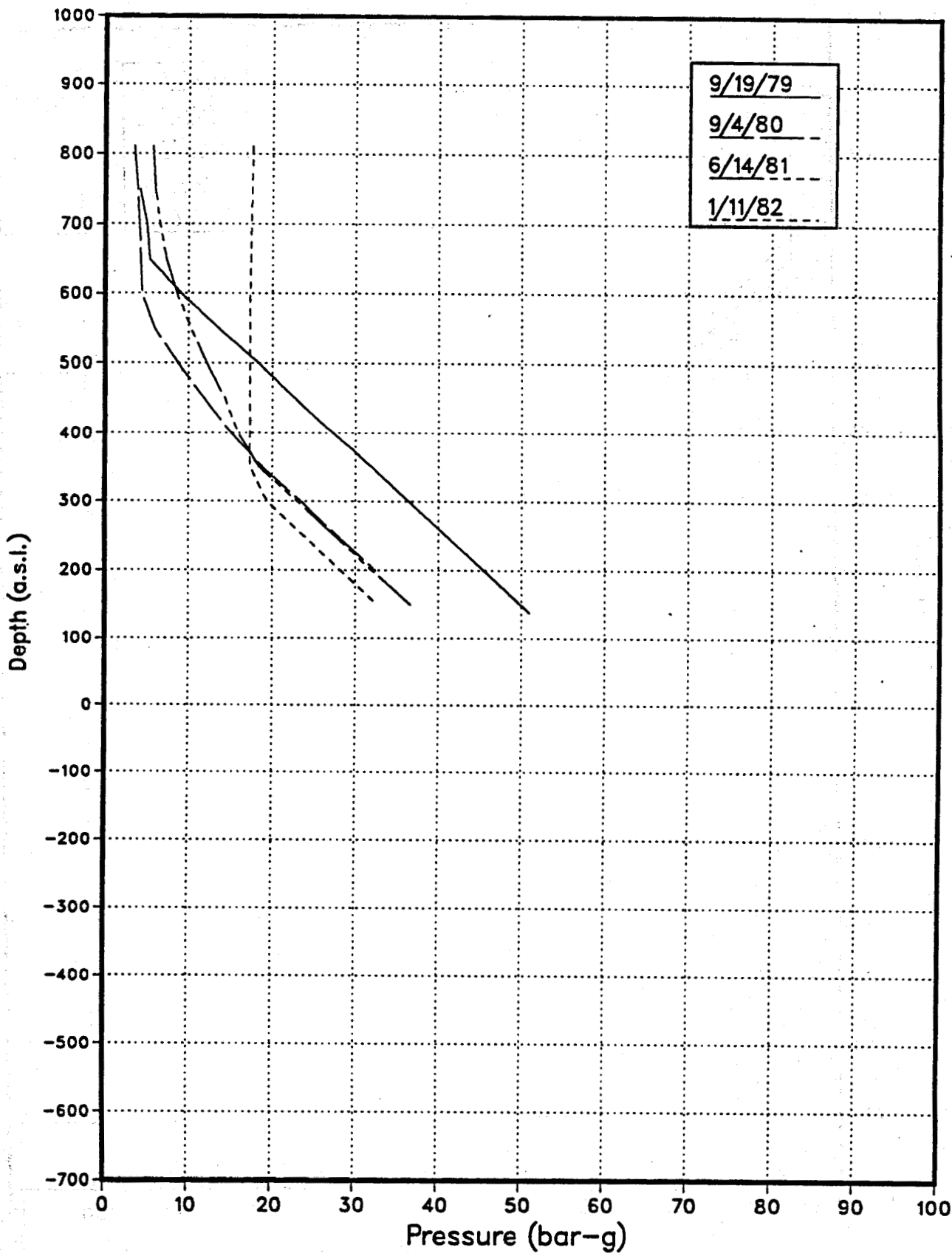
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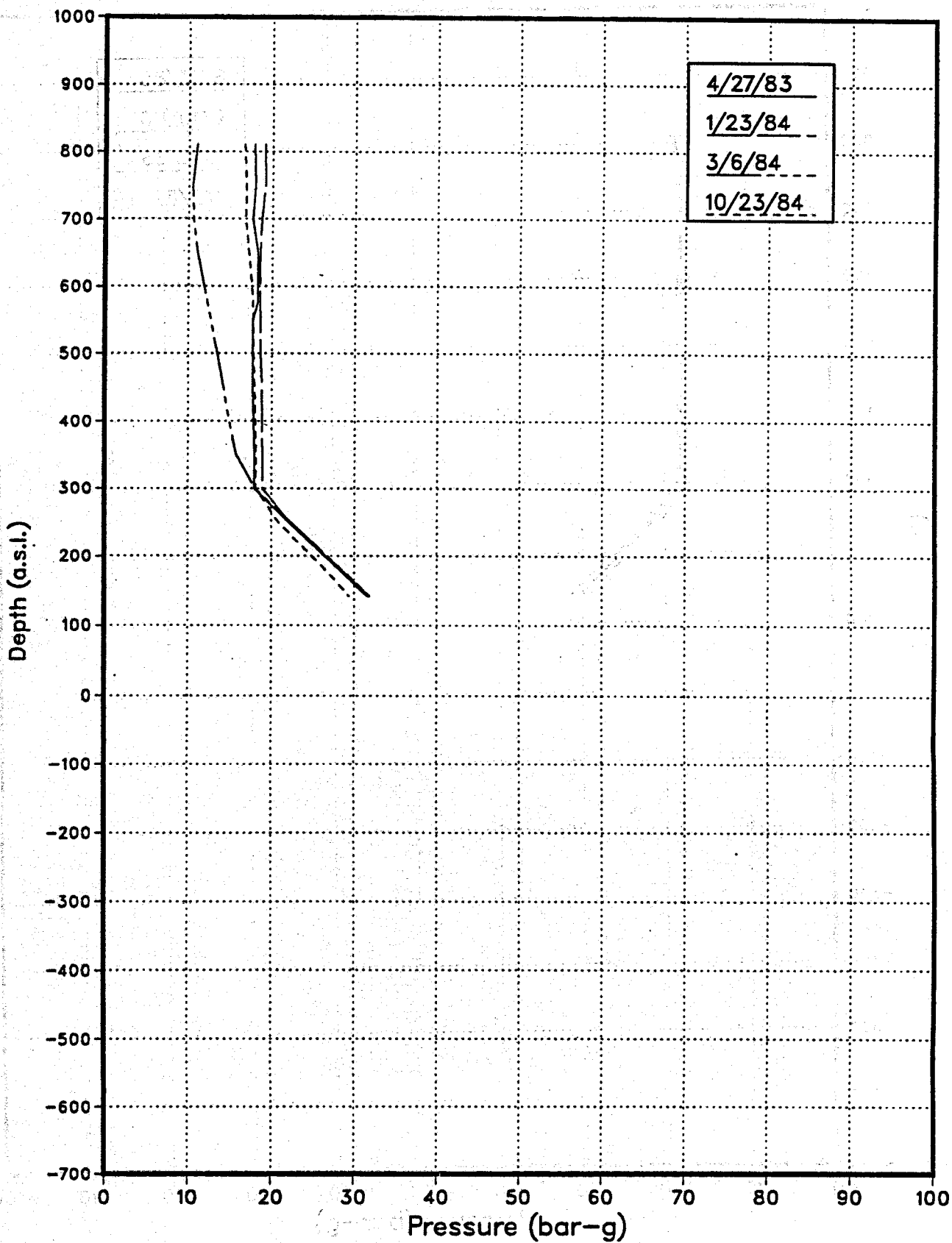
AH8 Pressure Surveys



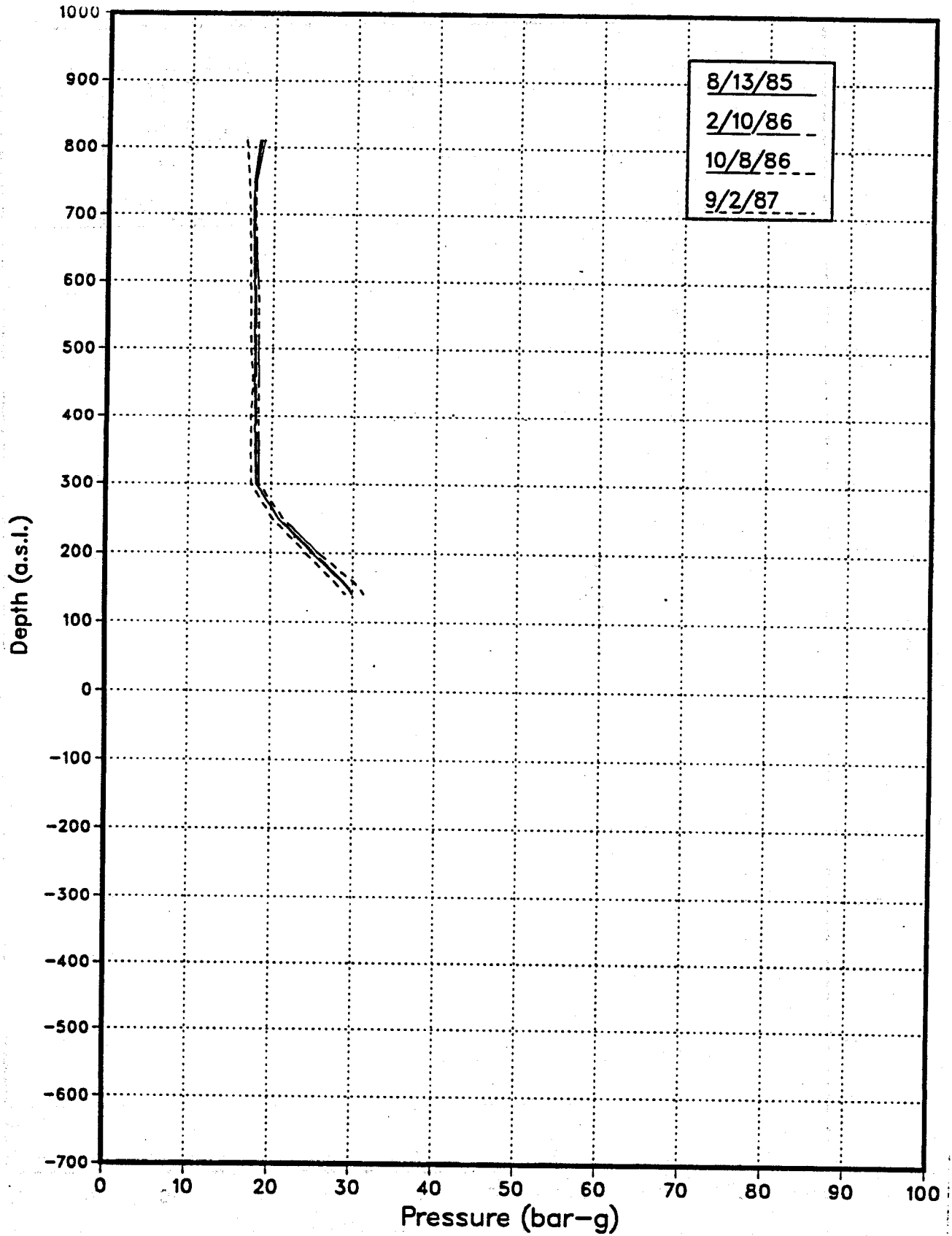
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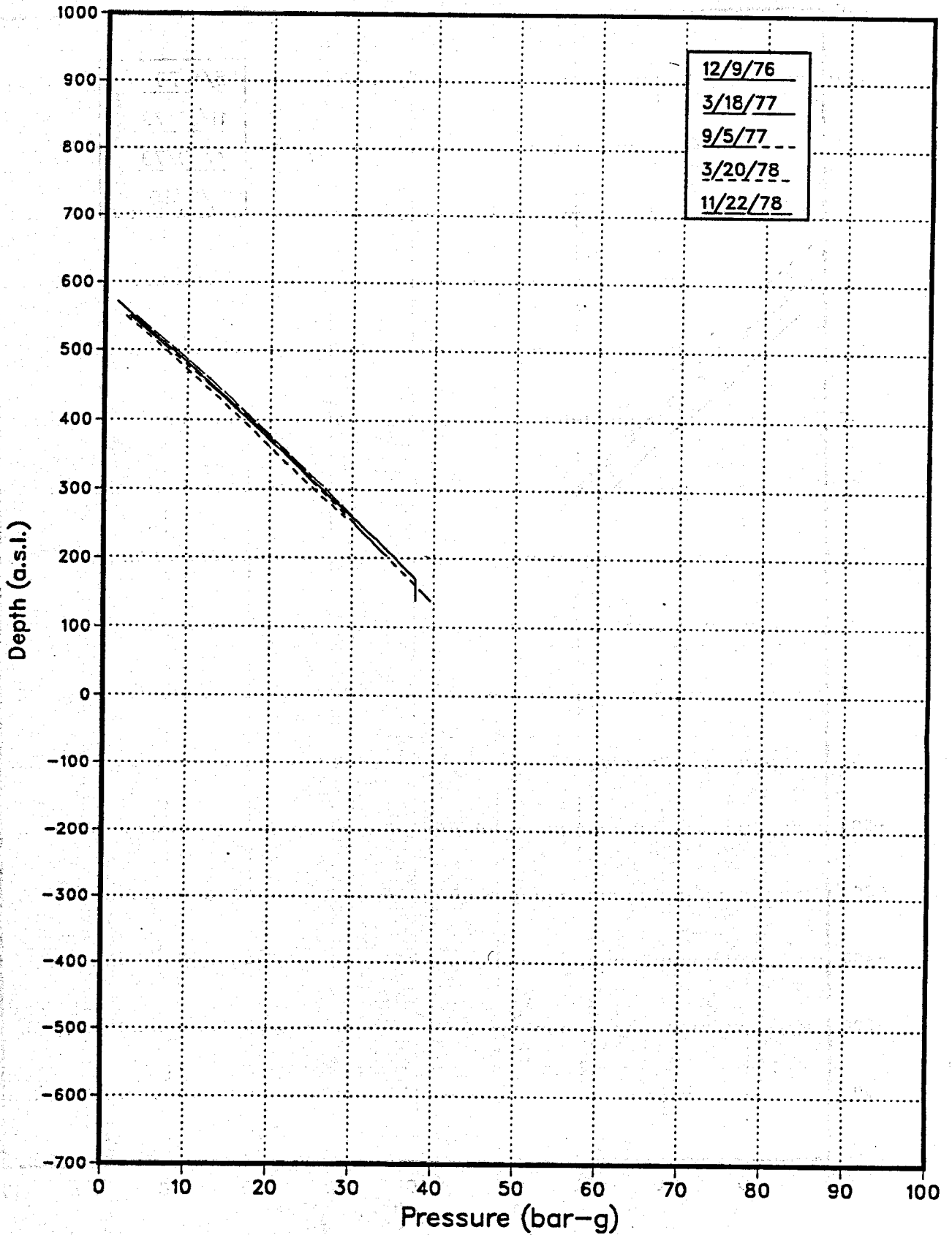
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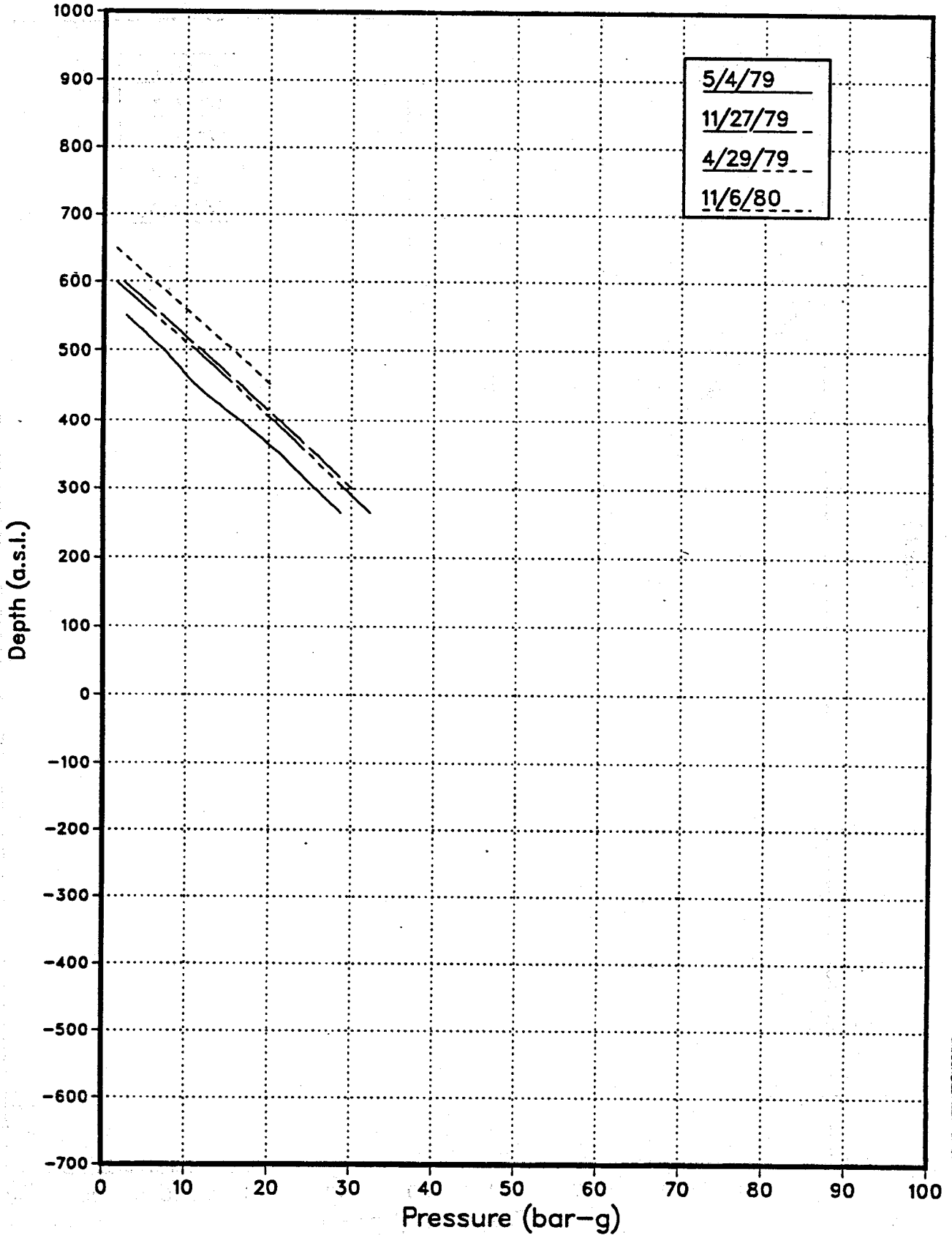
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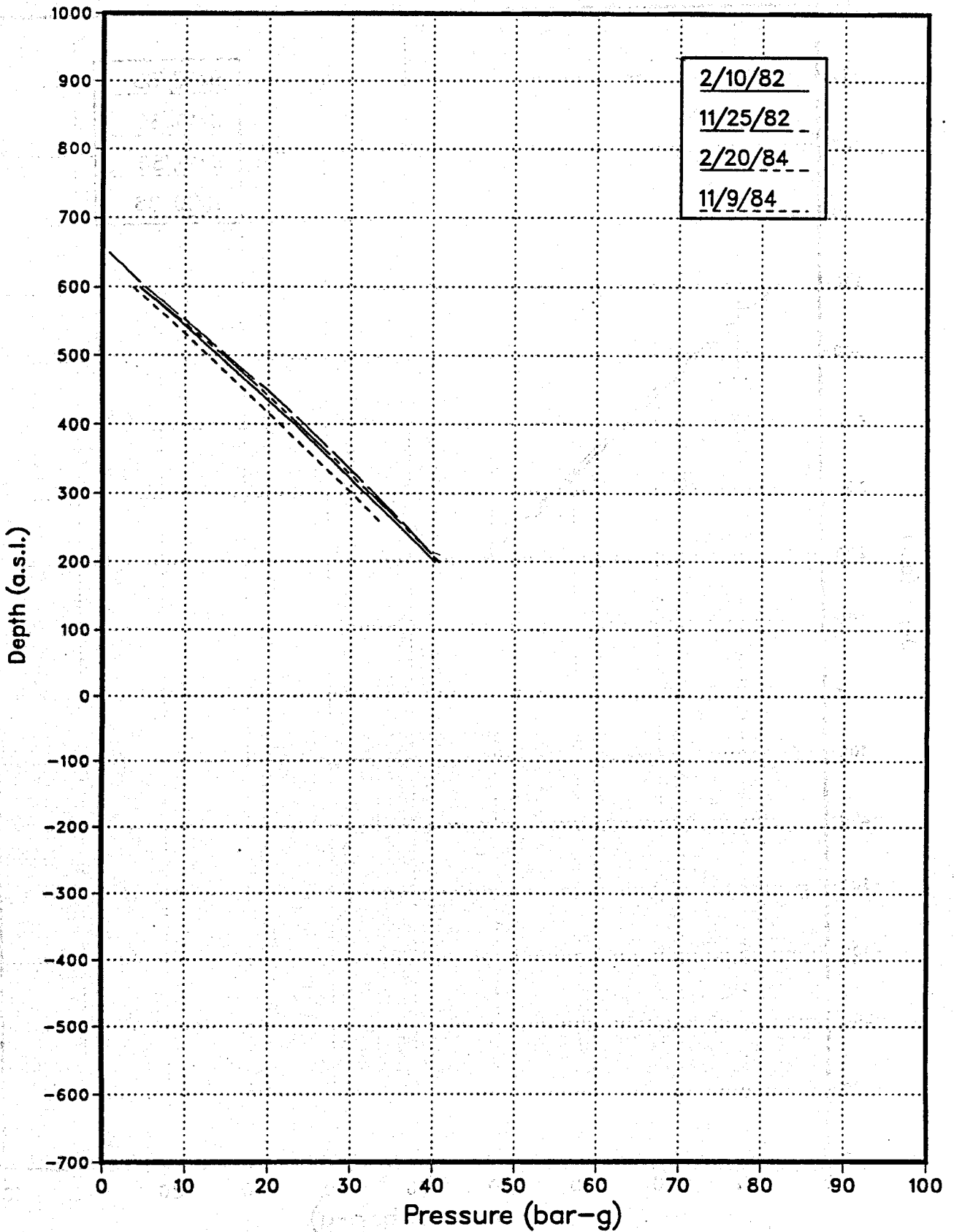
AH9 Pressure Surveys



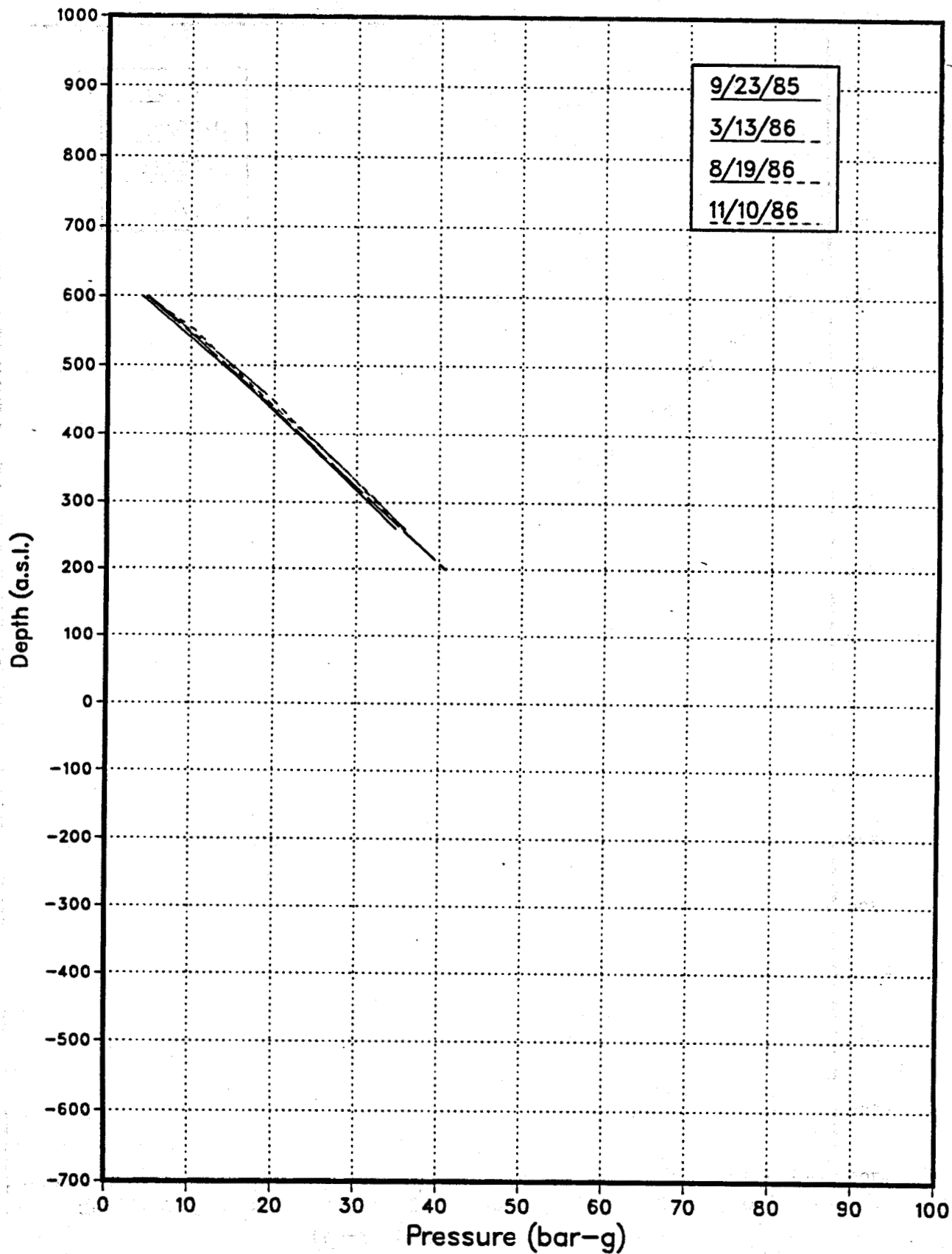
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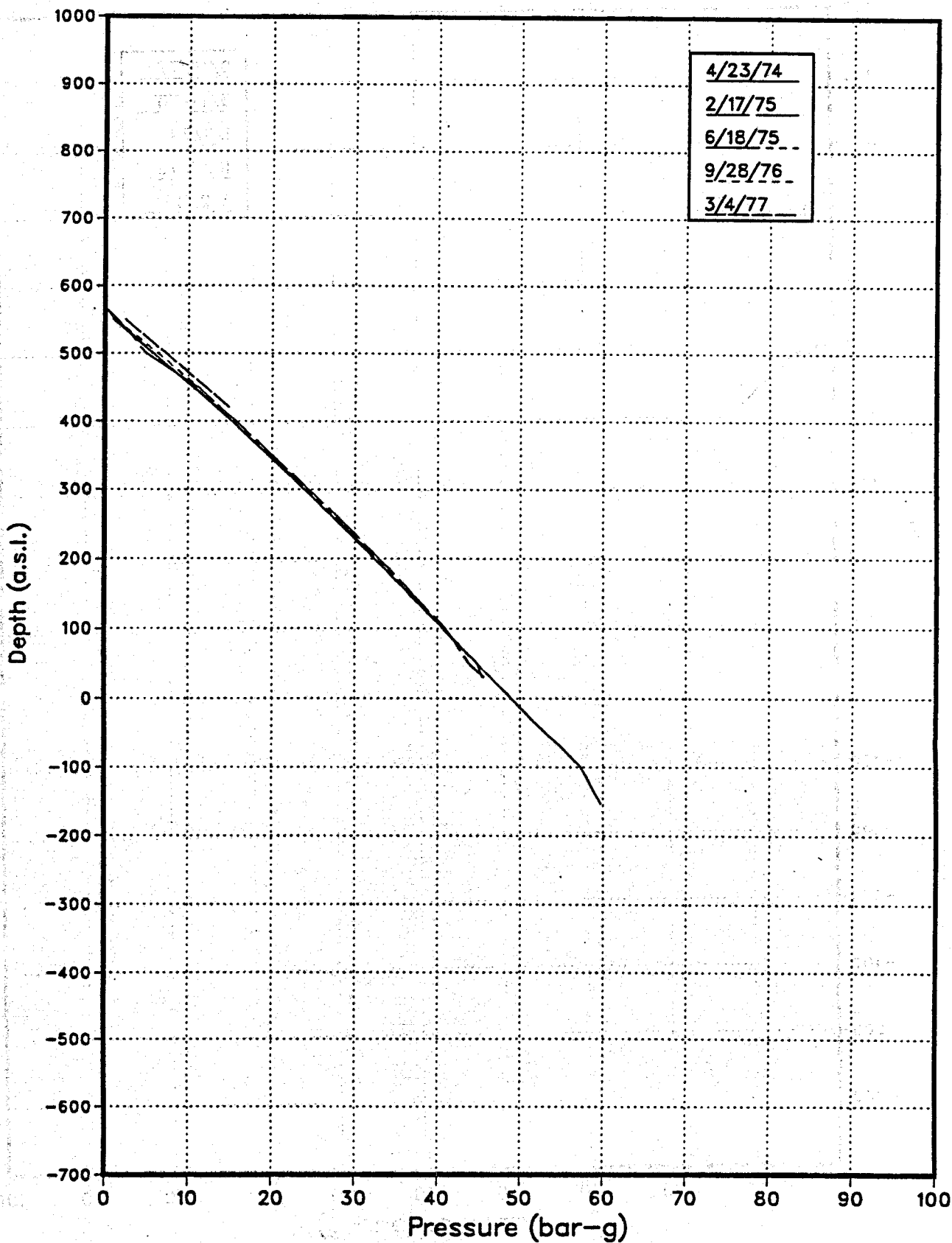
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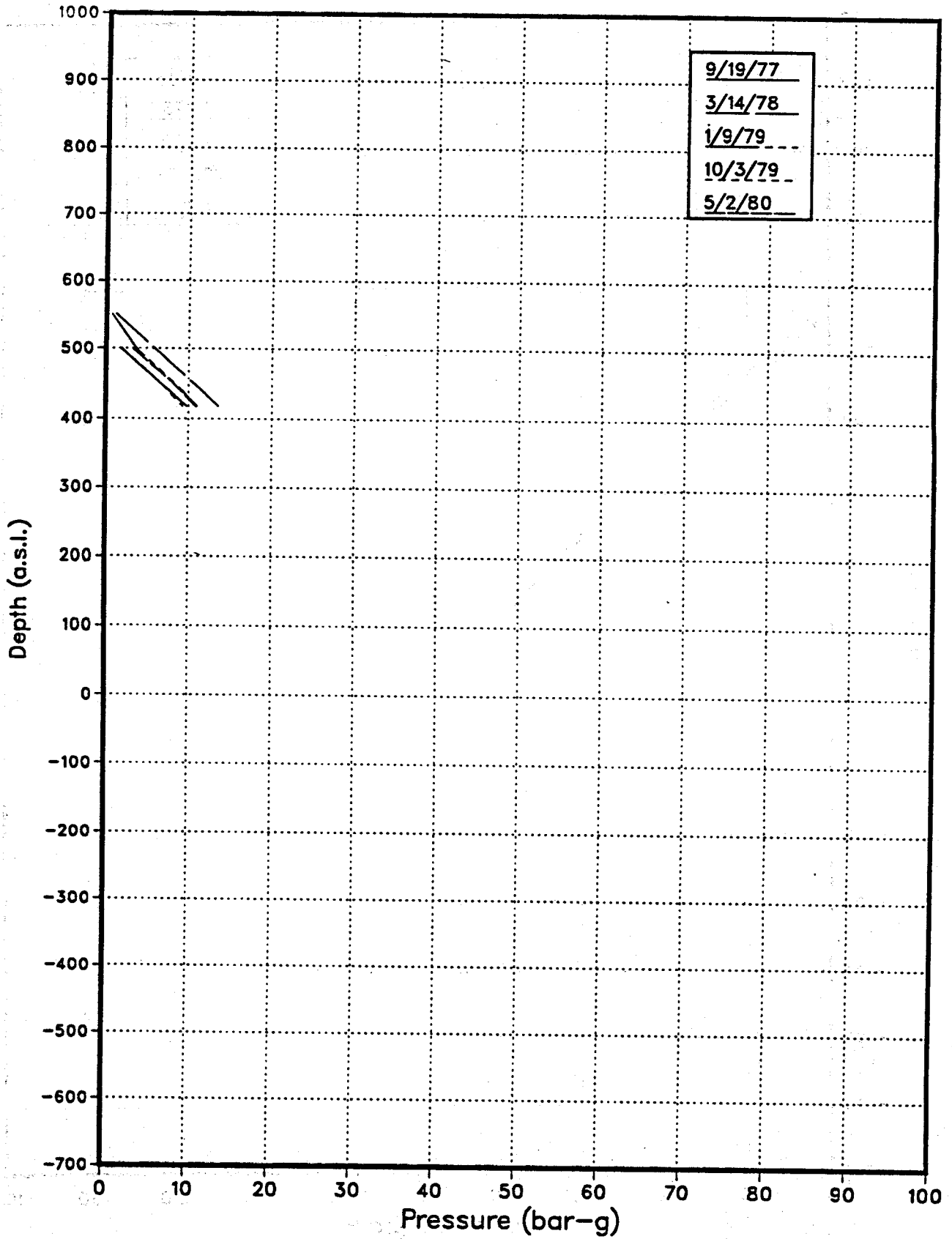
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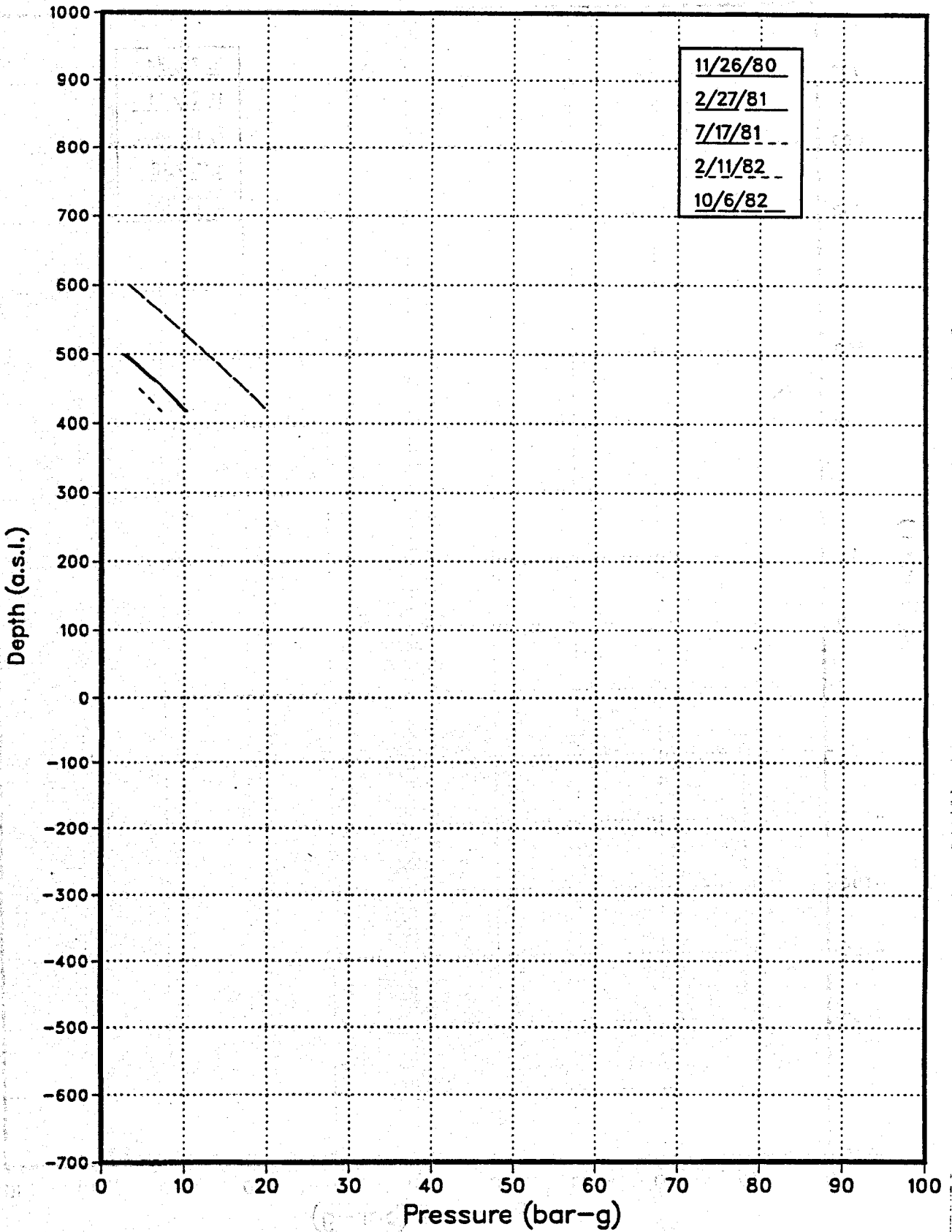
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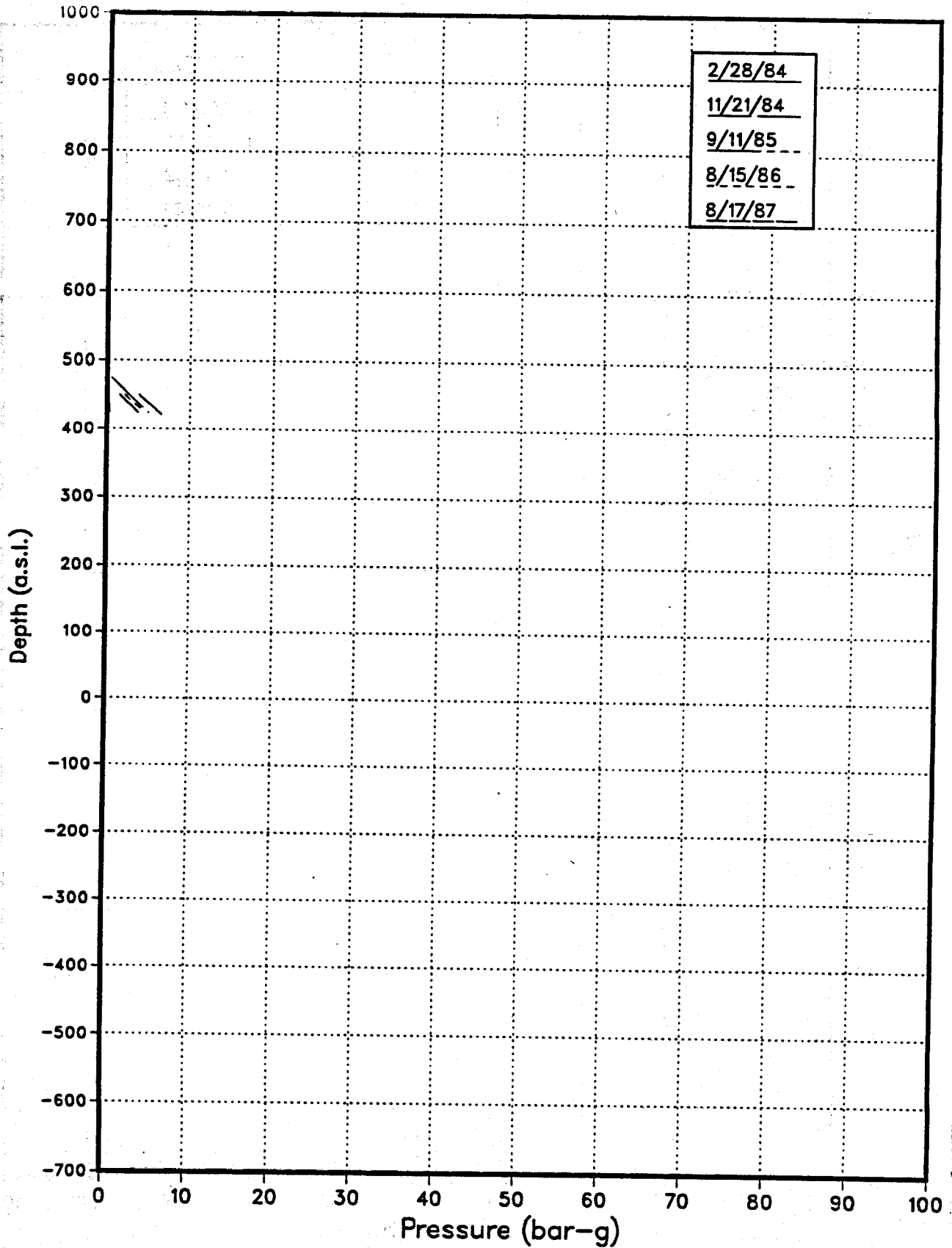
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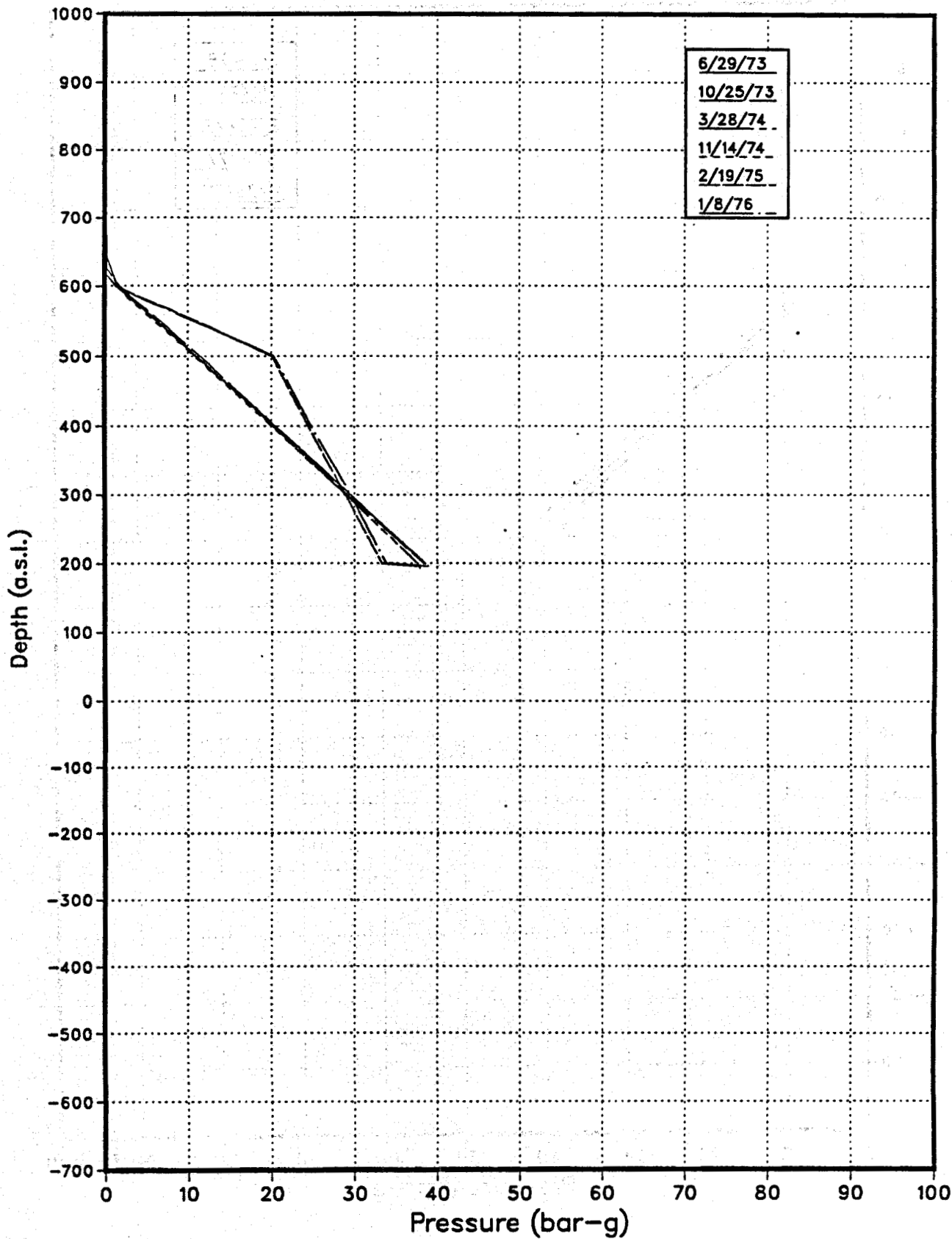
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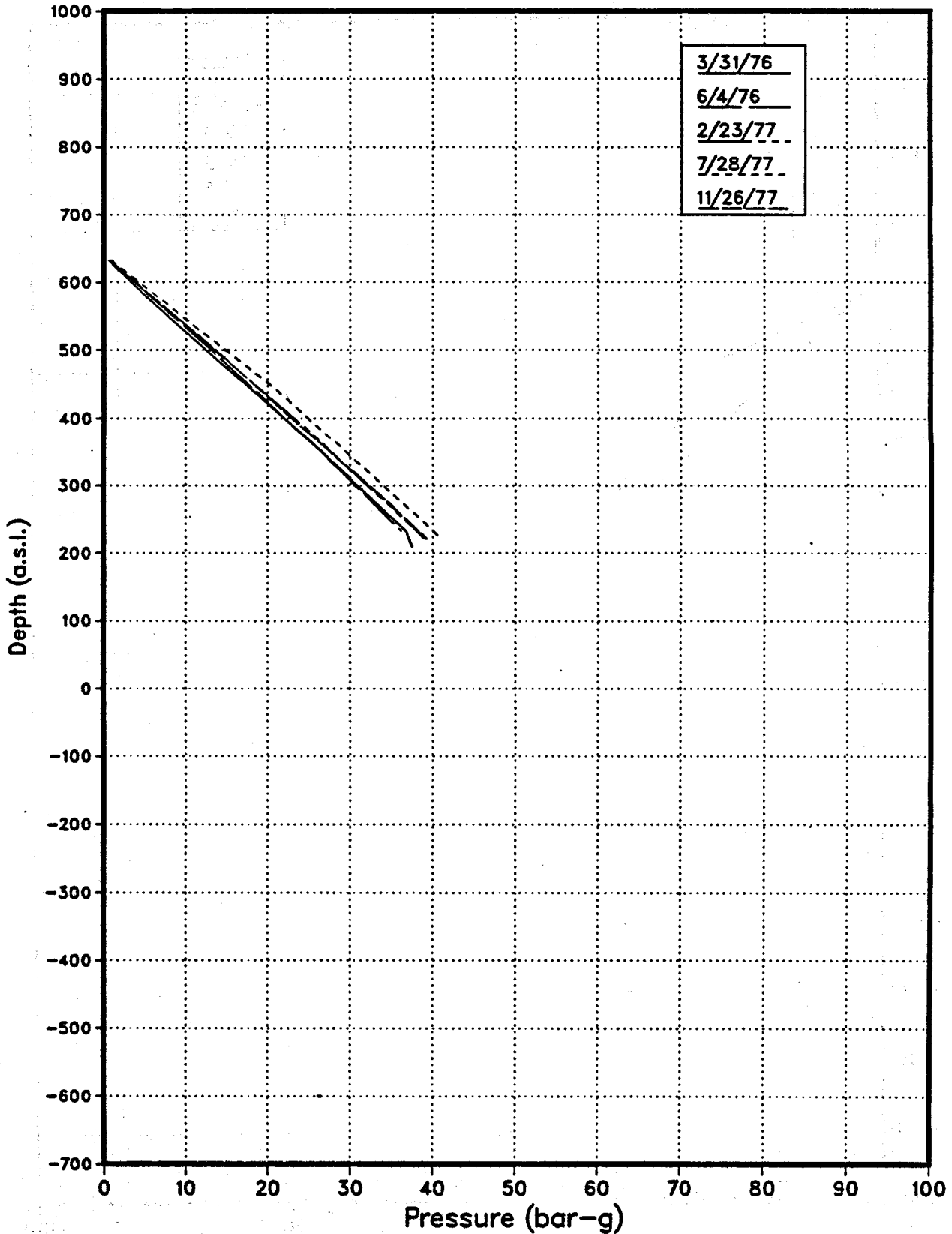
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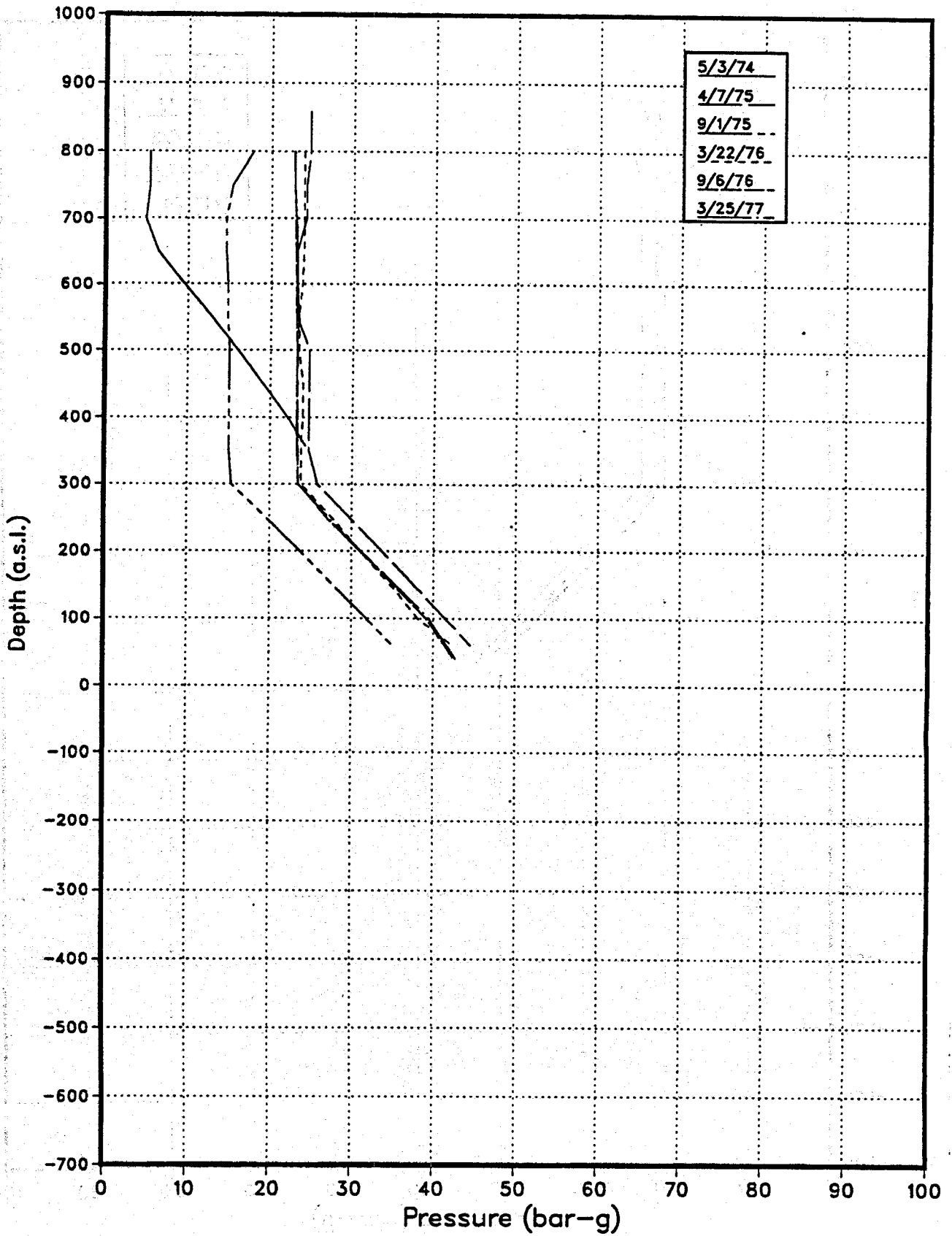
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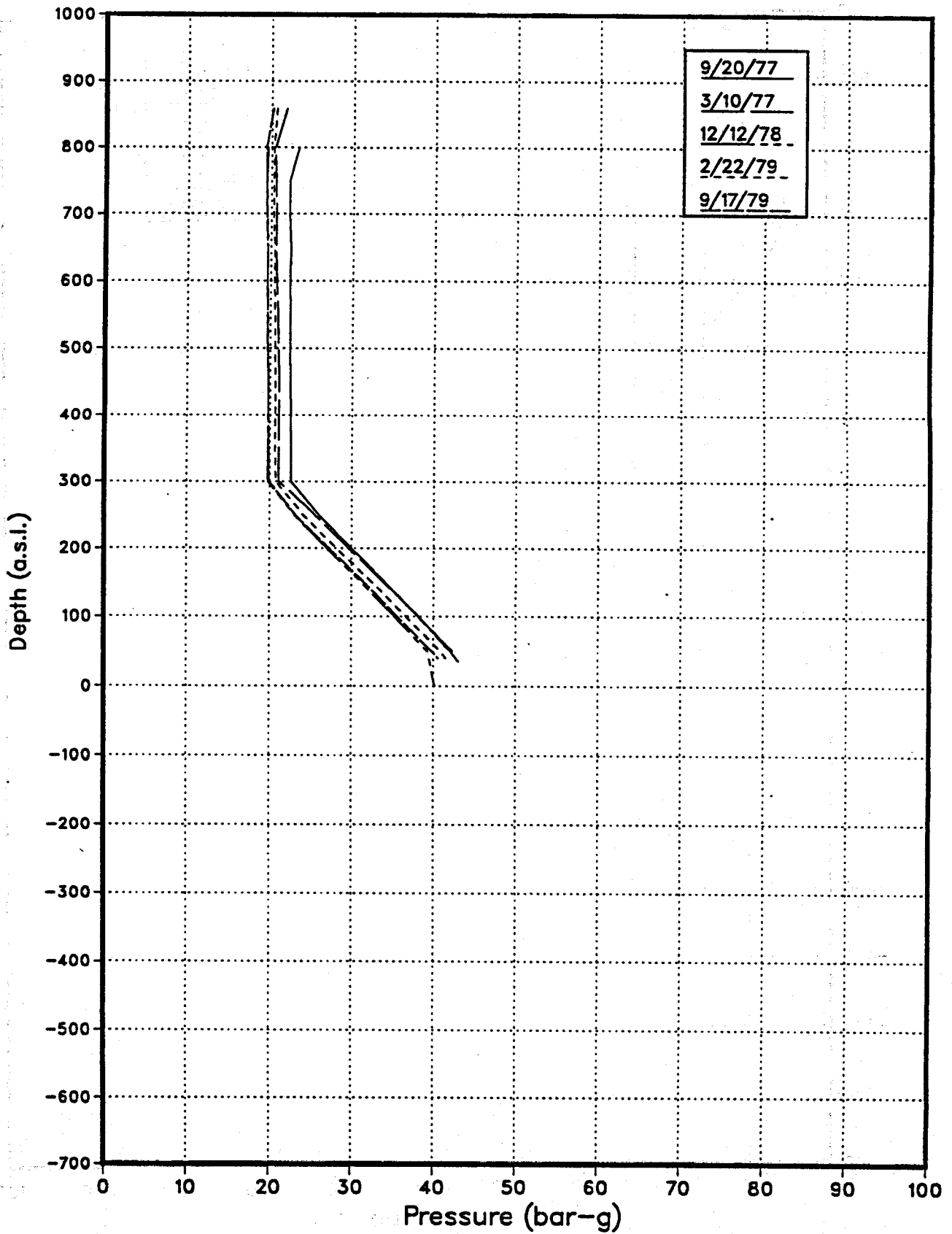
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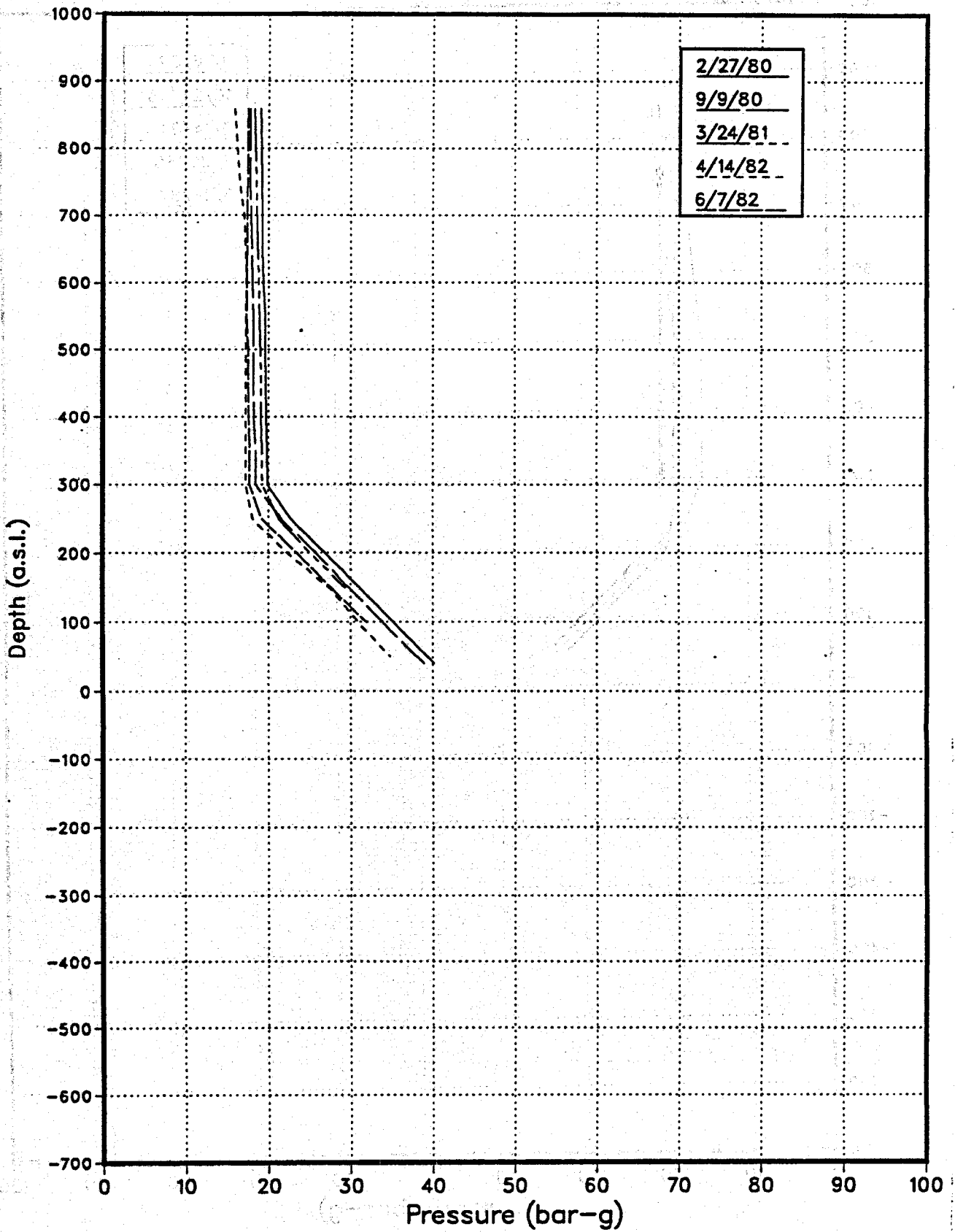
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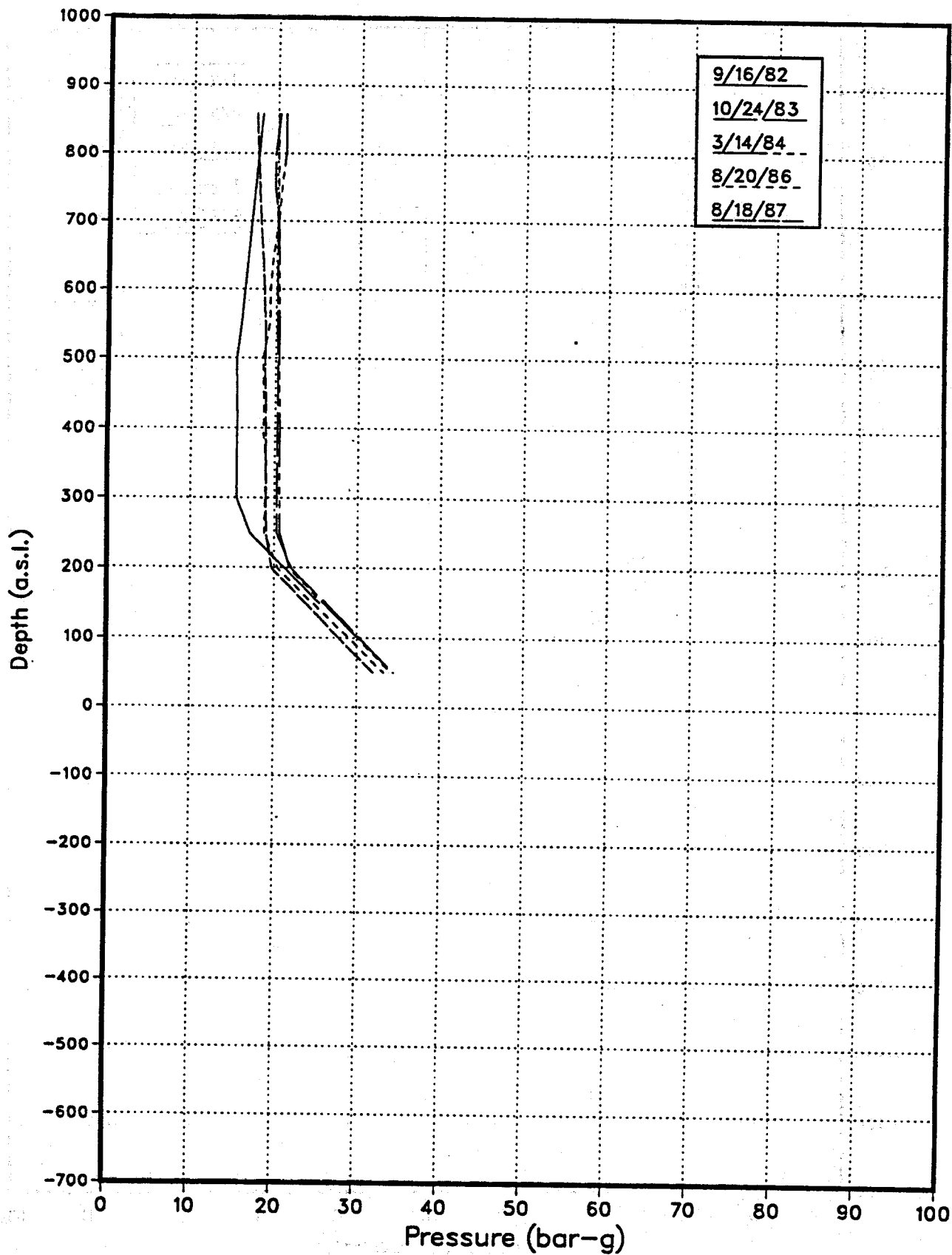
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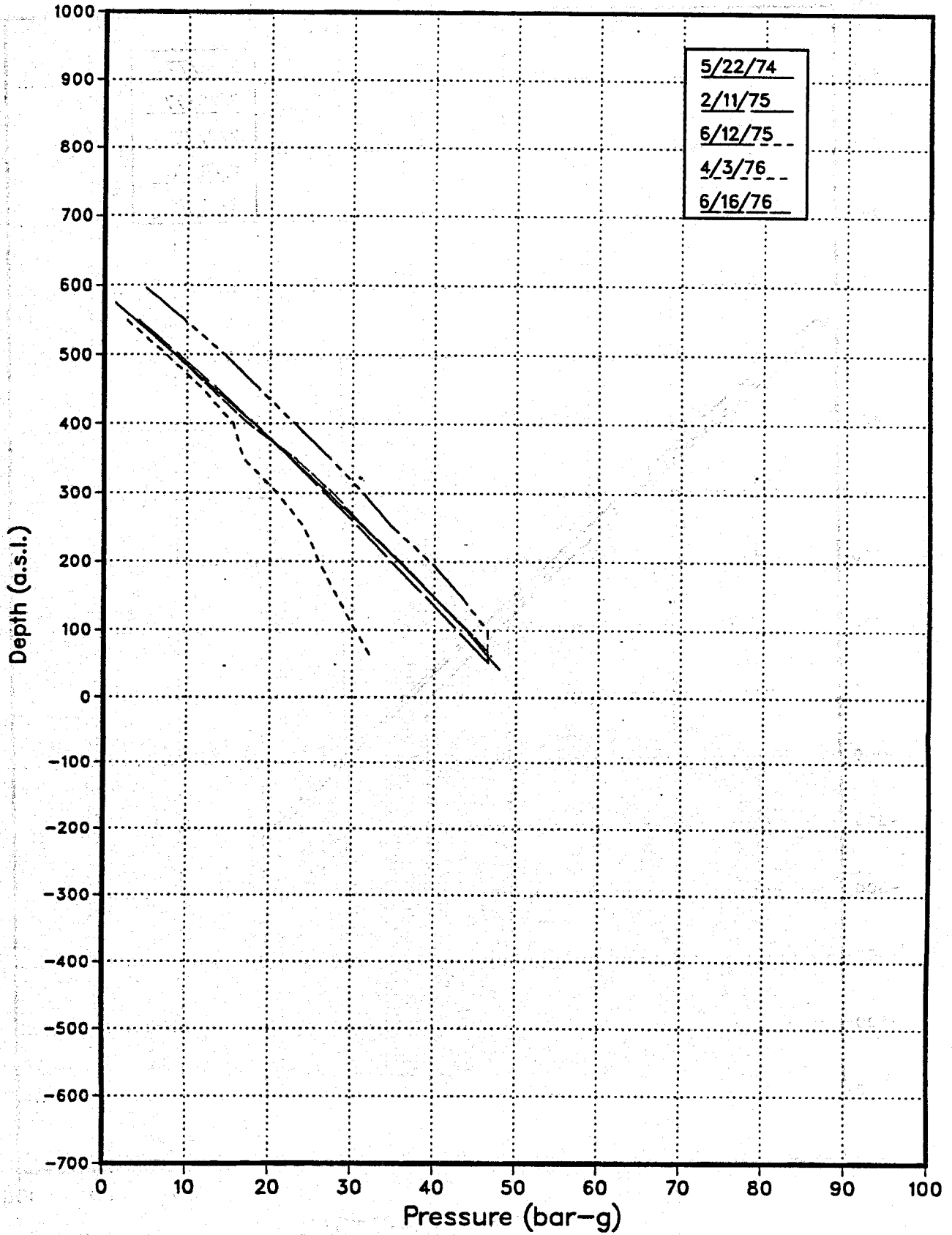
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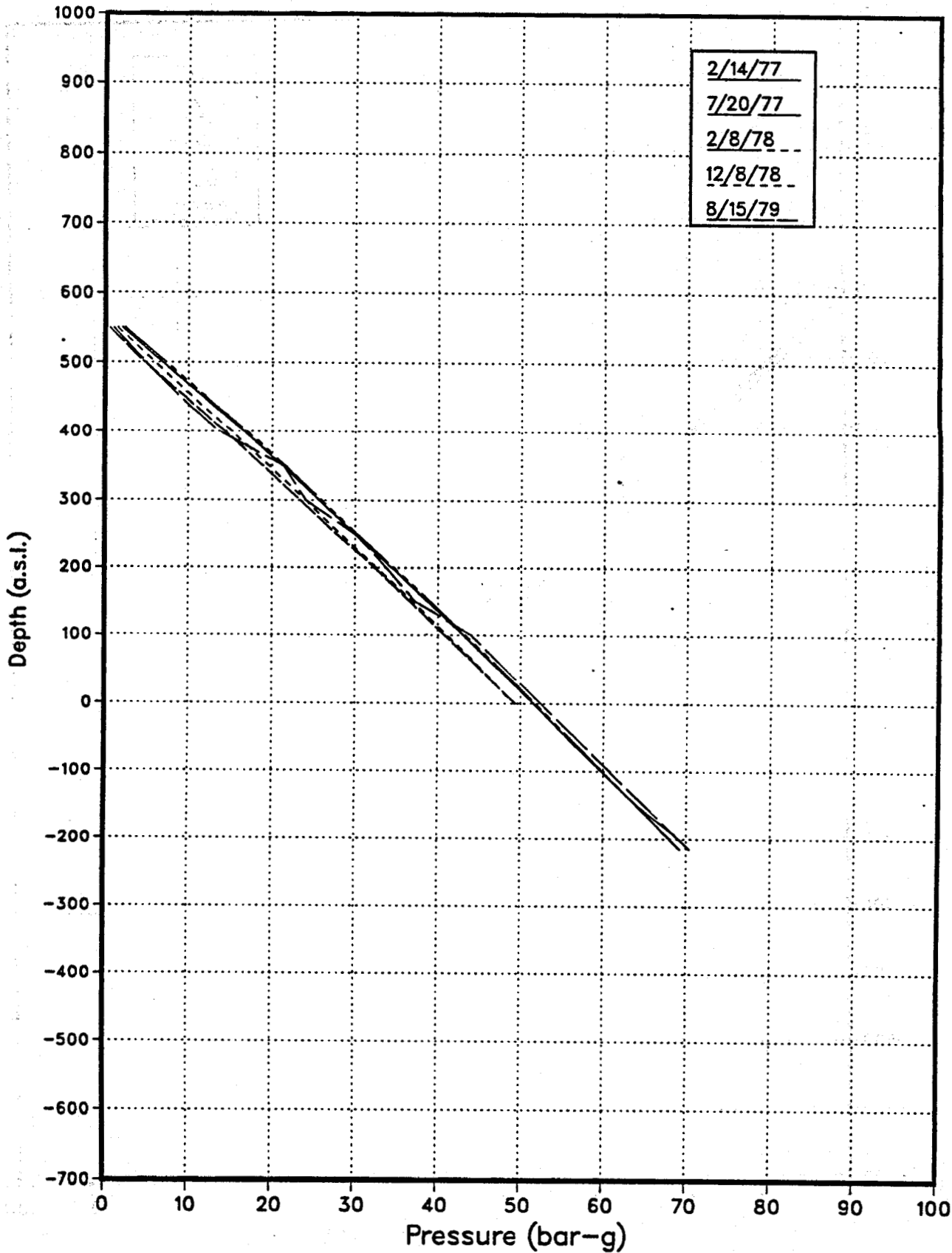
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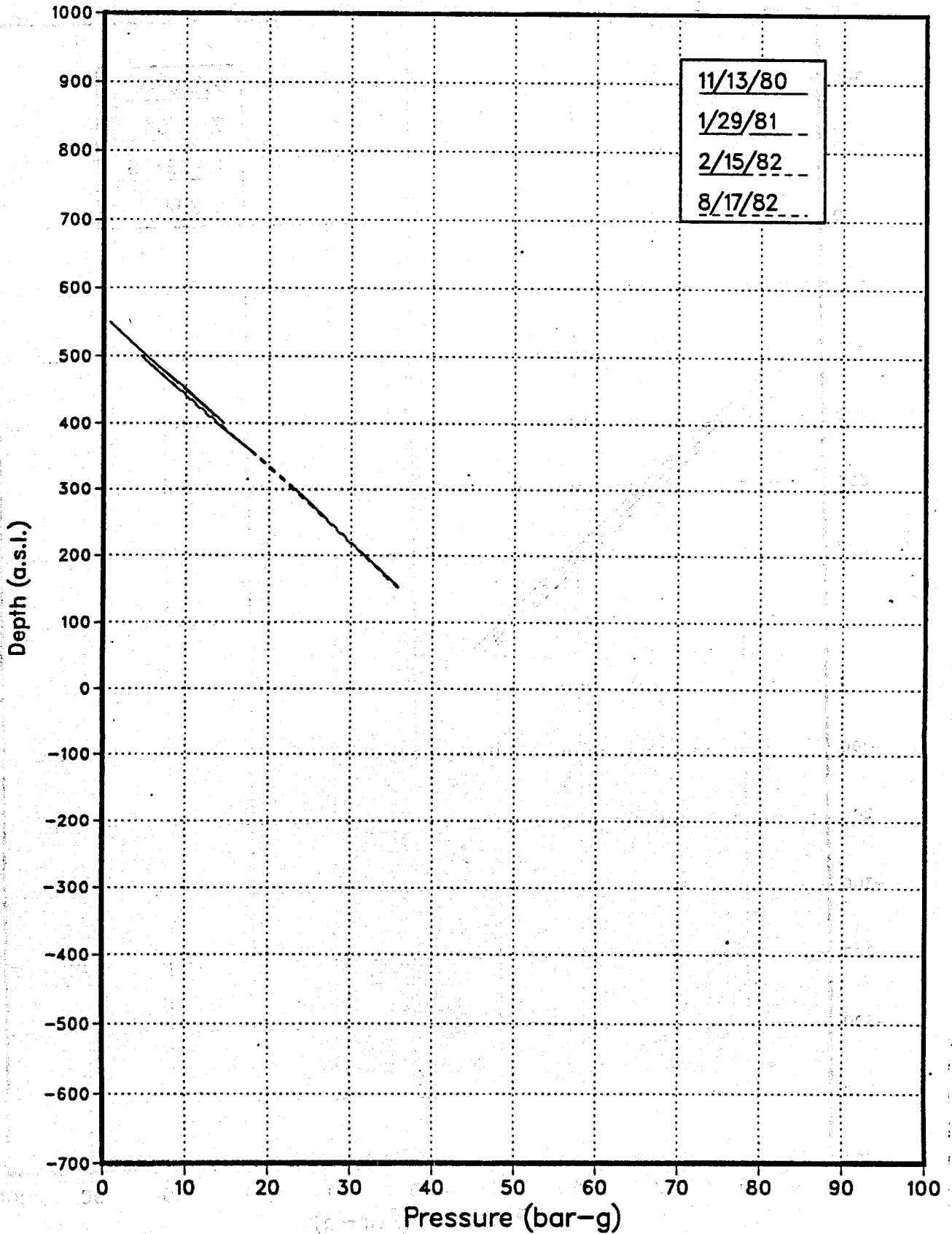
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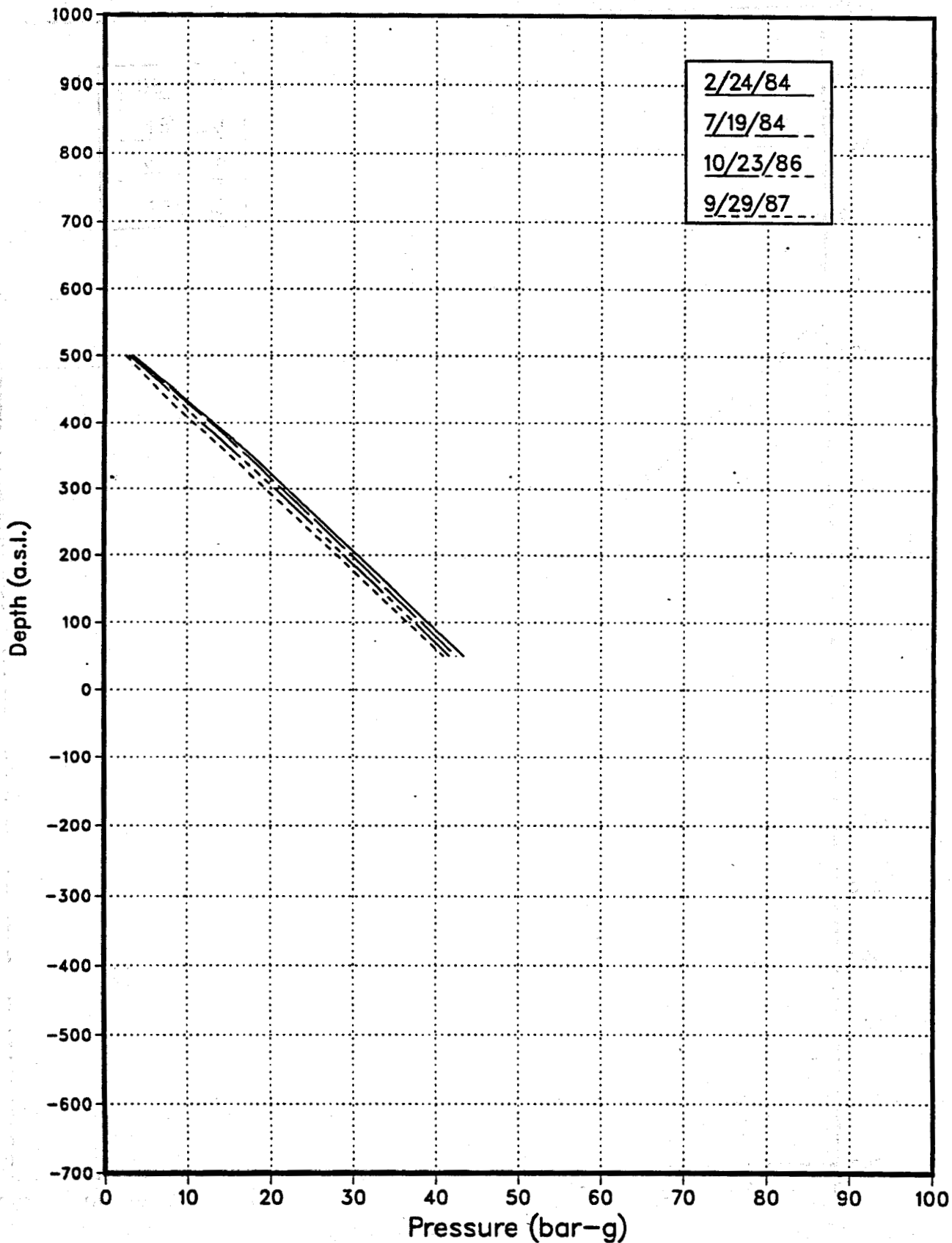
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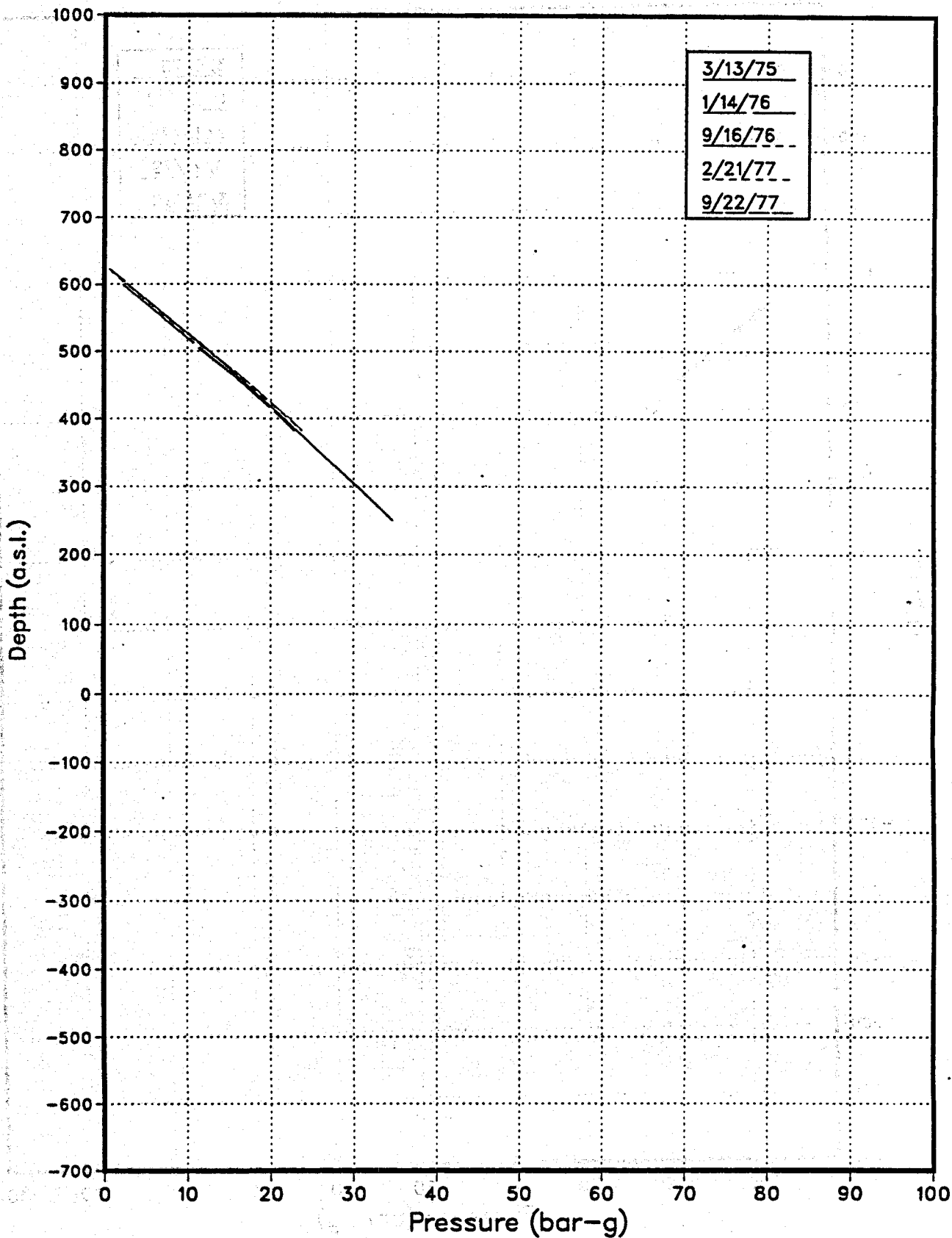
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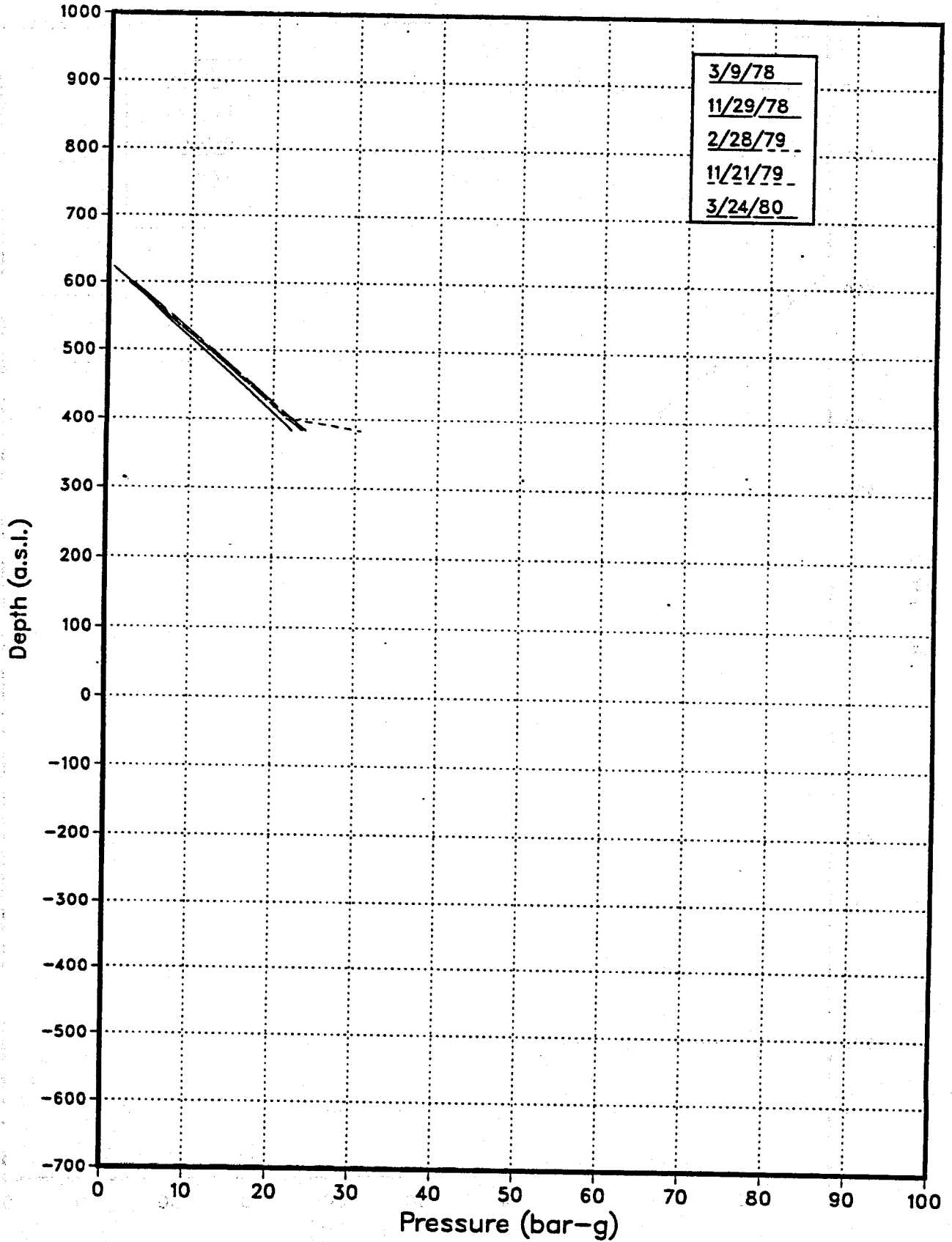
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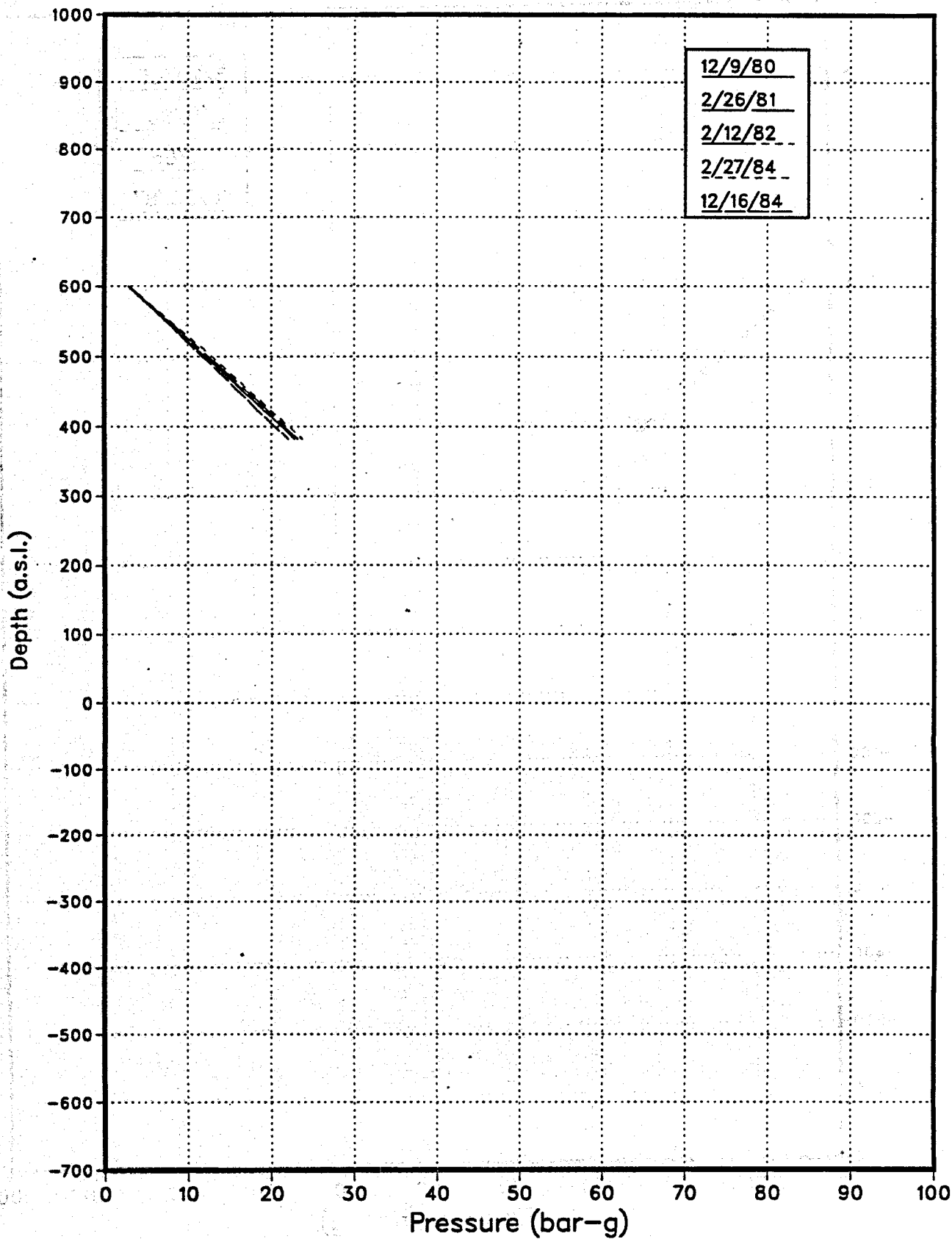
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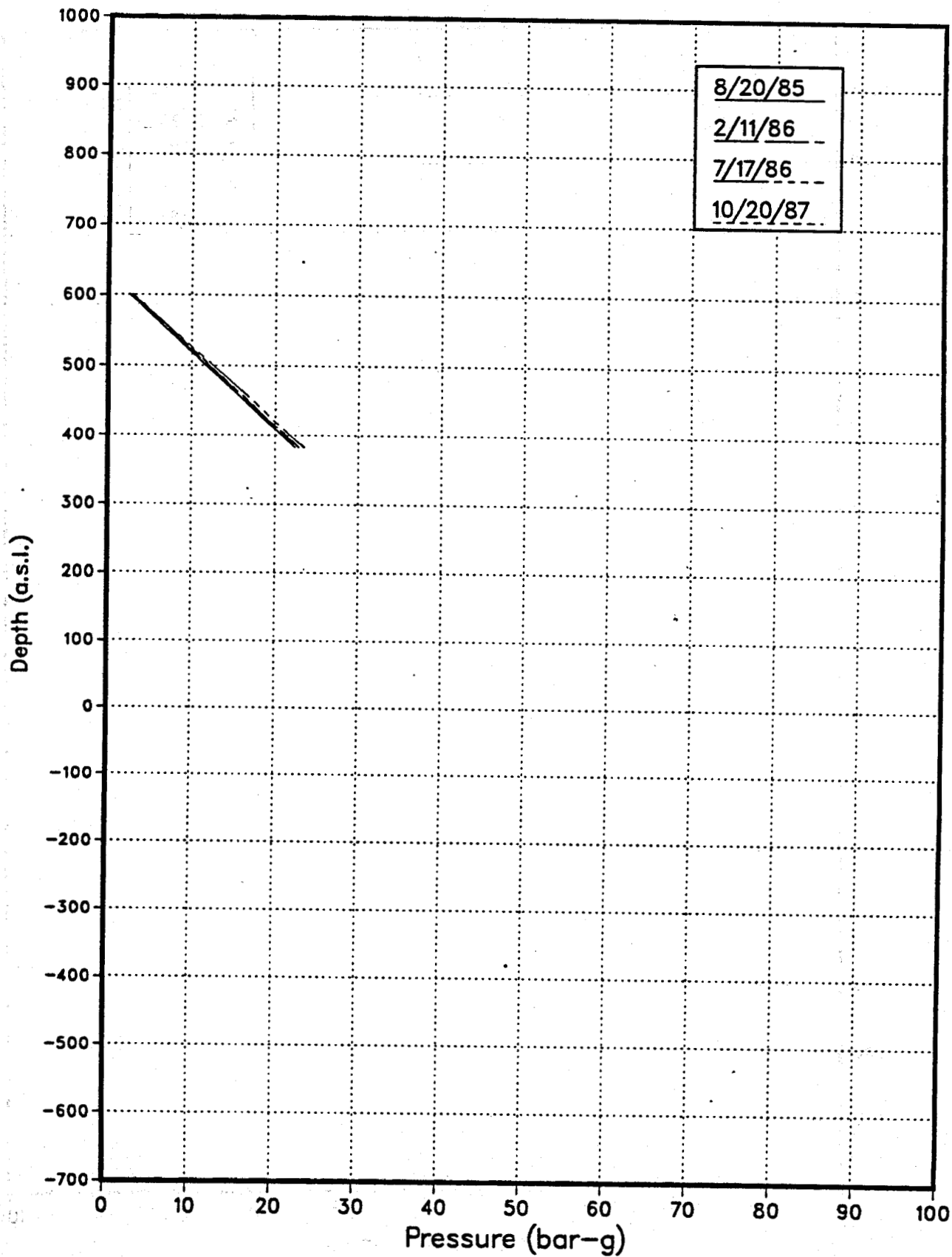
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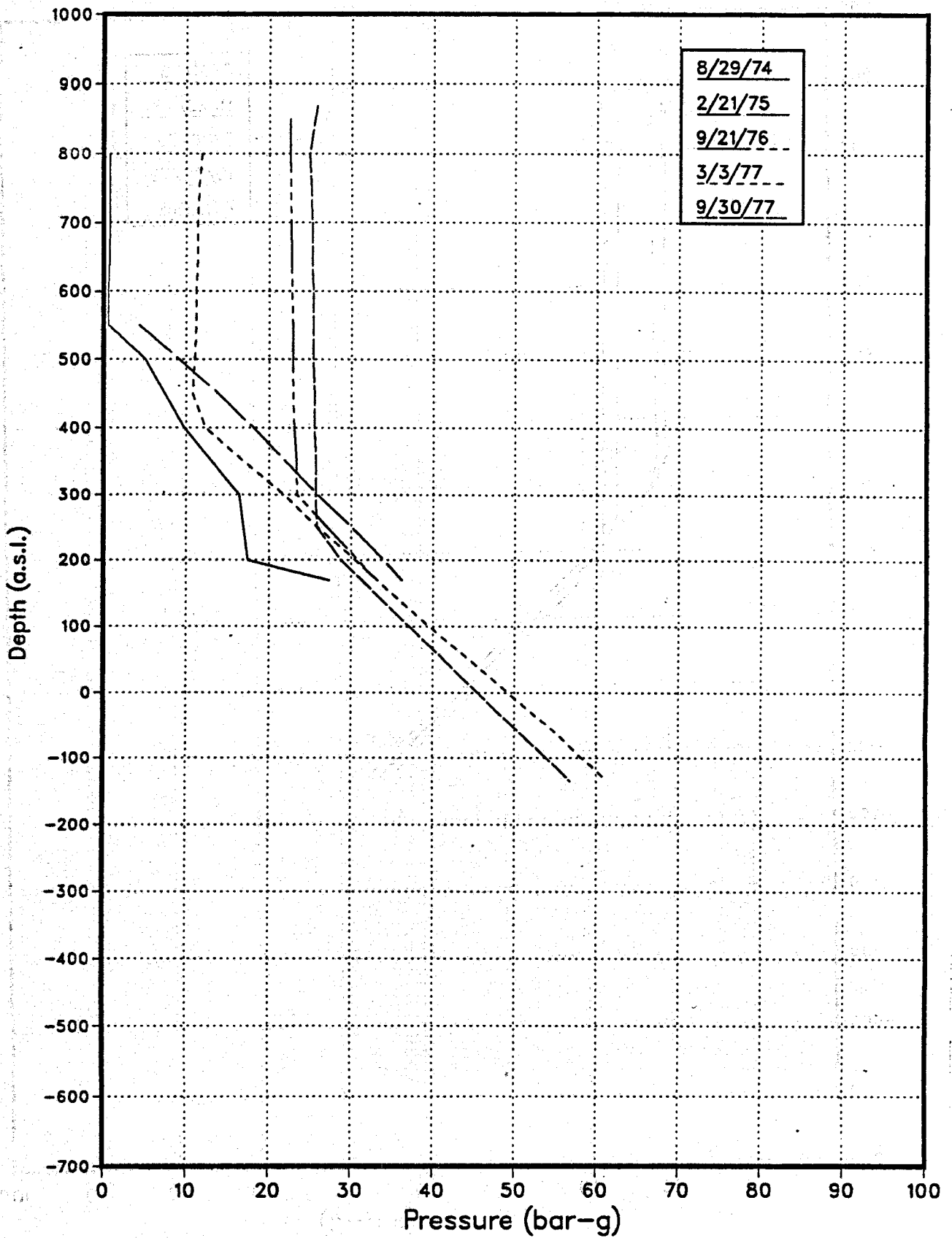
AH15 Pressure Surveys



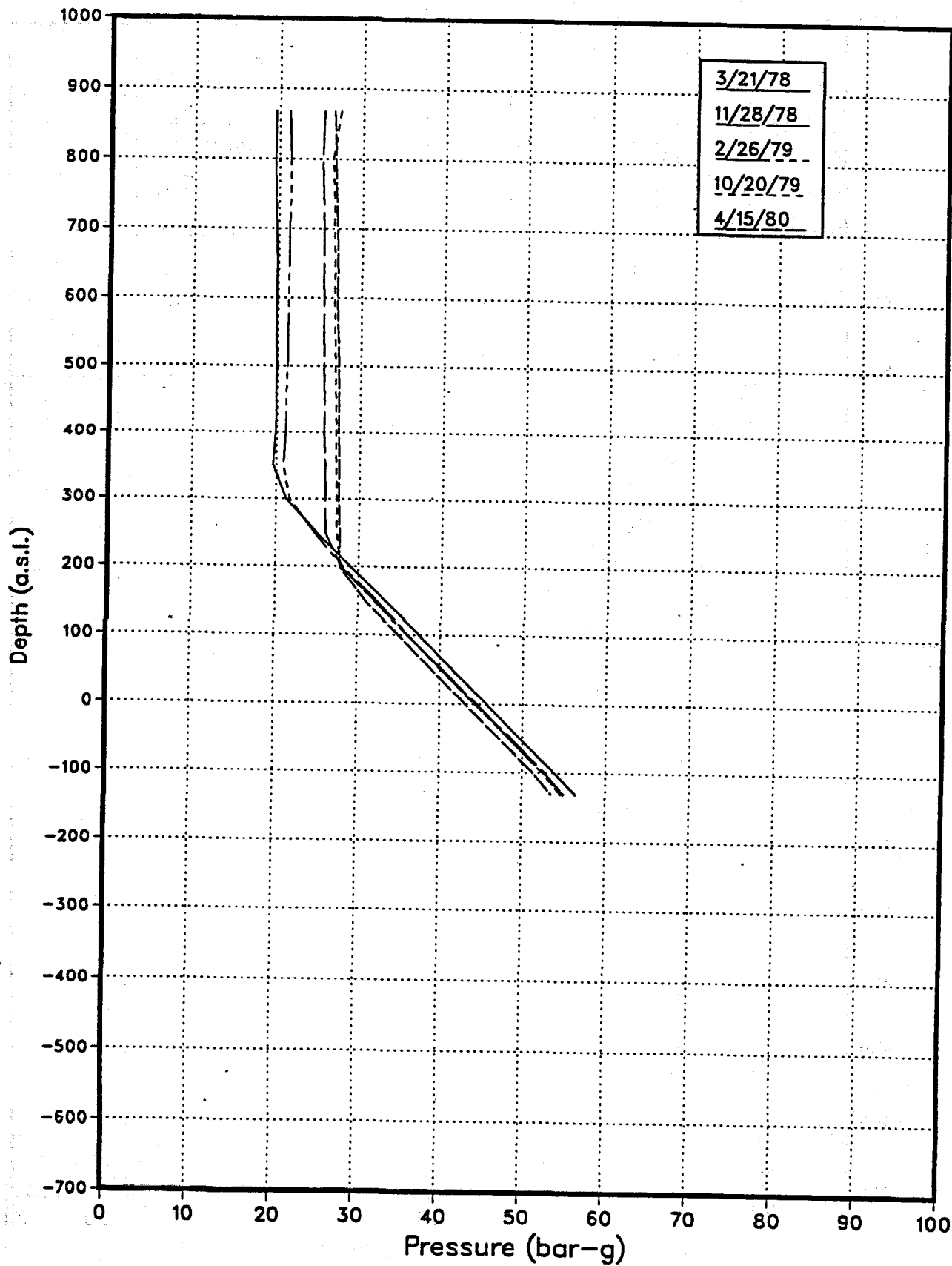
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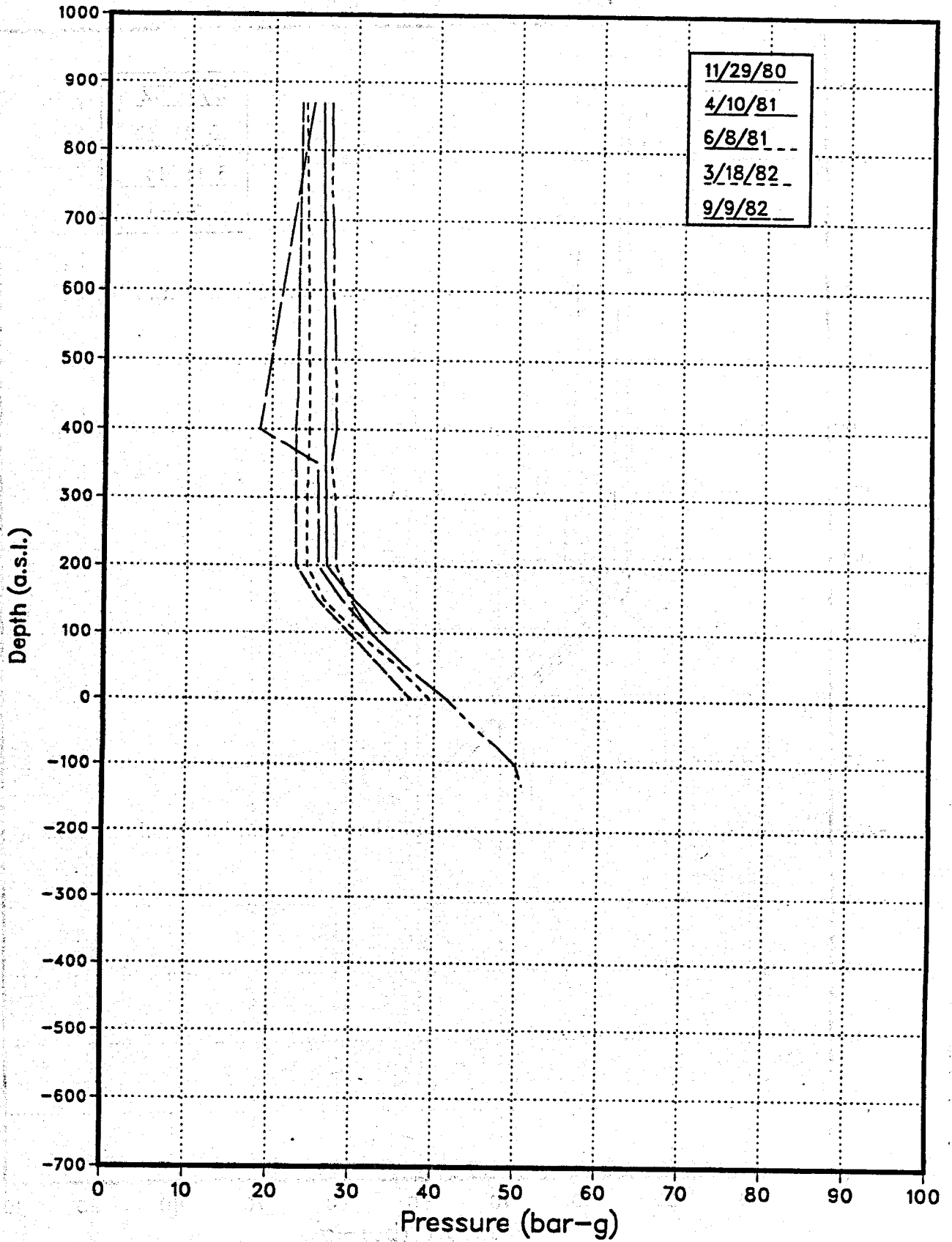
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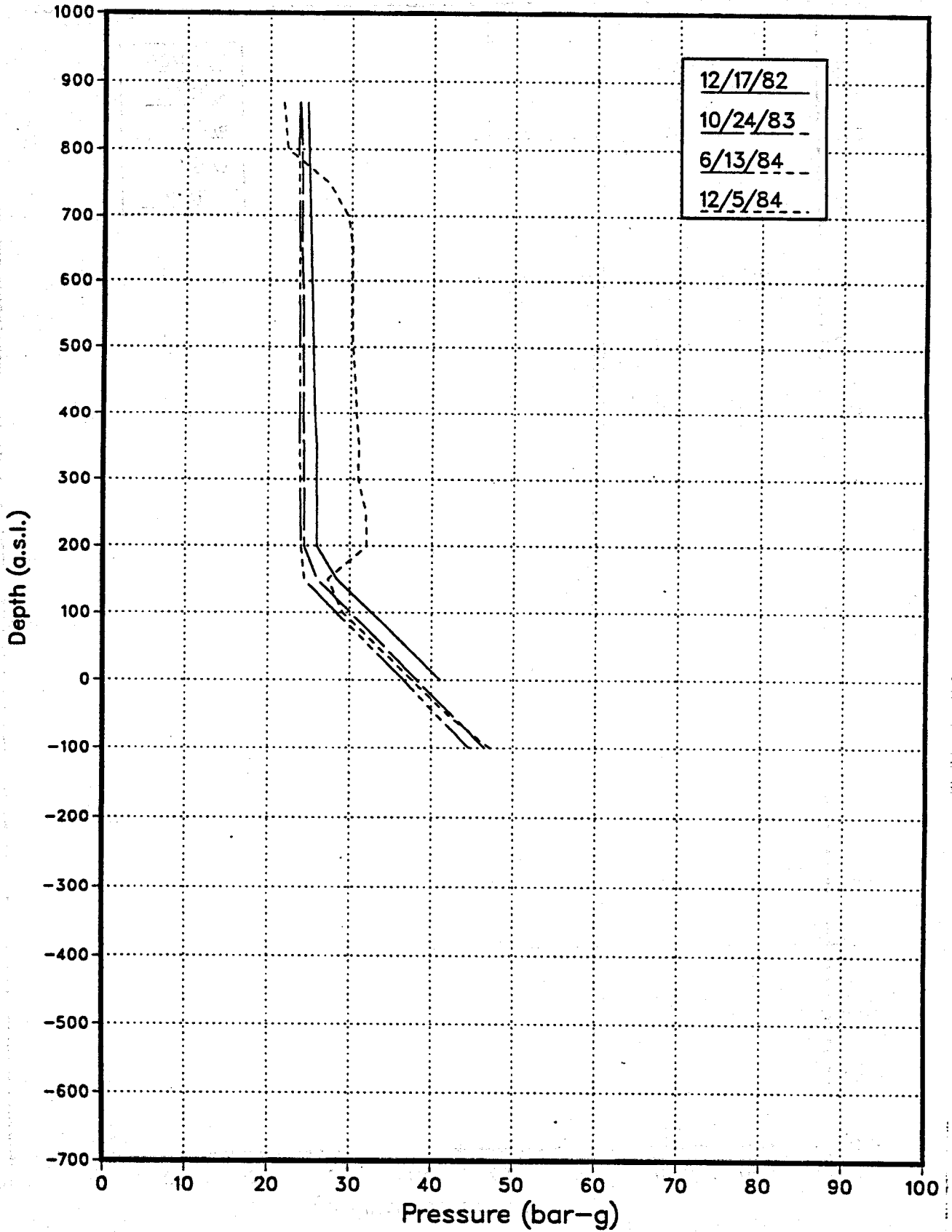
AH16 Pressure Surveys



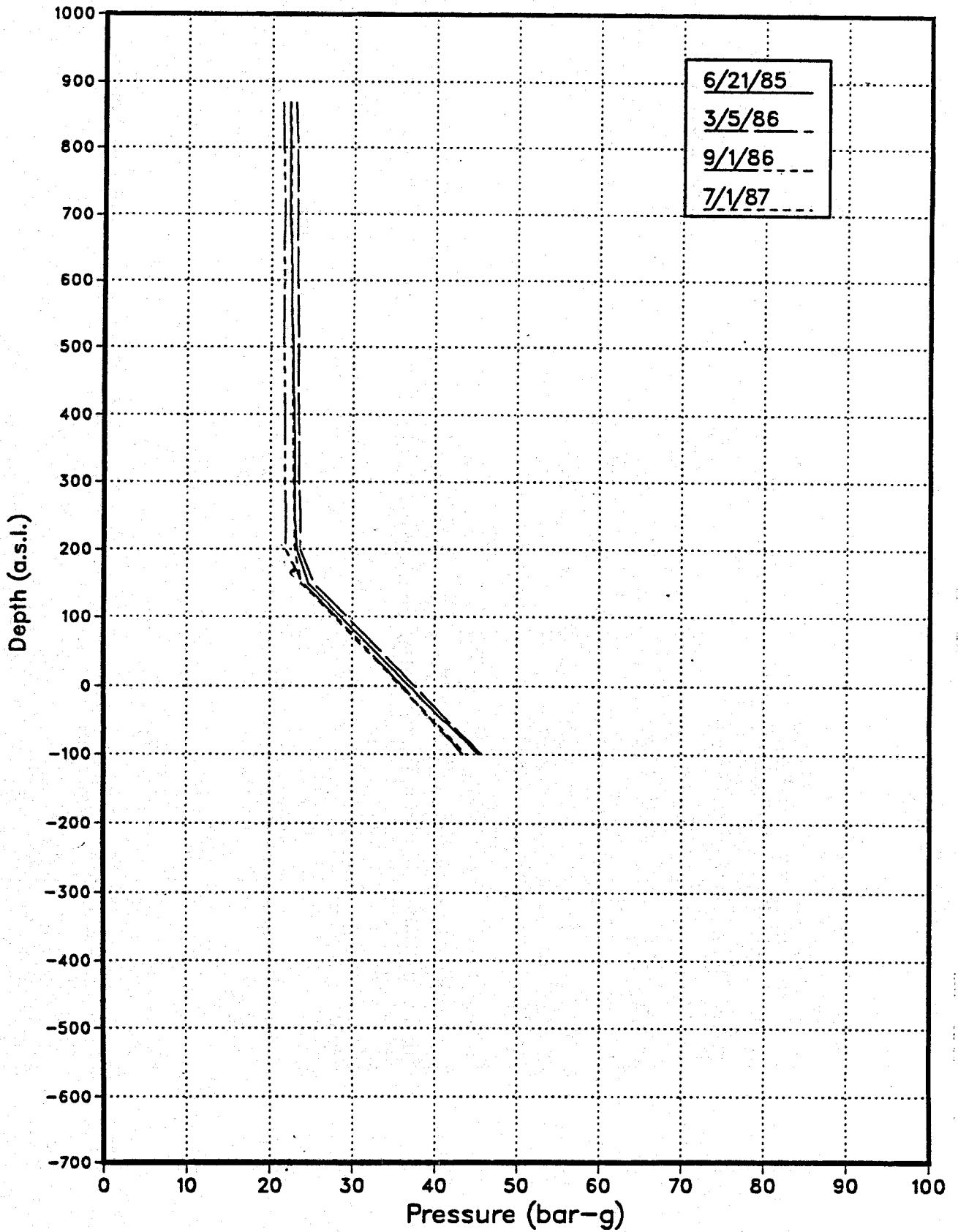
AH16 Pressure Surveys



AH16 Pressure Surveys



AH16 Pressure Surveys



833/10

MEMORANDUM FOR THE RECORD

DATE: 10/15/54

TO: SAC, NEW YORK

FROM: SA [Name], NEW YORK

SUBJECT: [Subject Name]

[Detailed description of the memorandum's content, including a summary of the investigation and any findings.]

[Additional details or references related to the case.]

[Further information or conclusions.]

[Closing remarks or administrative notes.]

[Final sentence or signature line.]

[Administrative markings or routing information.]

[Additional notes or references.]

[Further details or conclusions.]

[Closing remarks or administrative notes.]

[Final sentence or signature line.]

[Administrative markings or routing information.]

[Additional notes or references.]

[Further details or conclusions.]

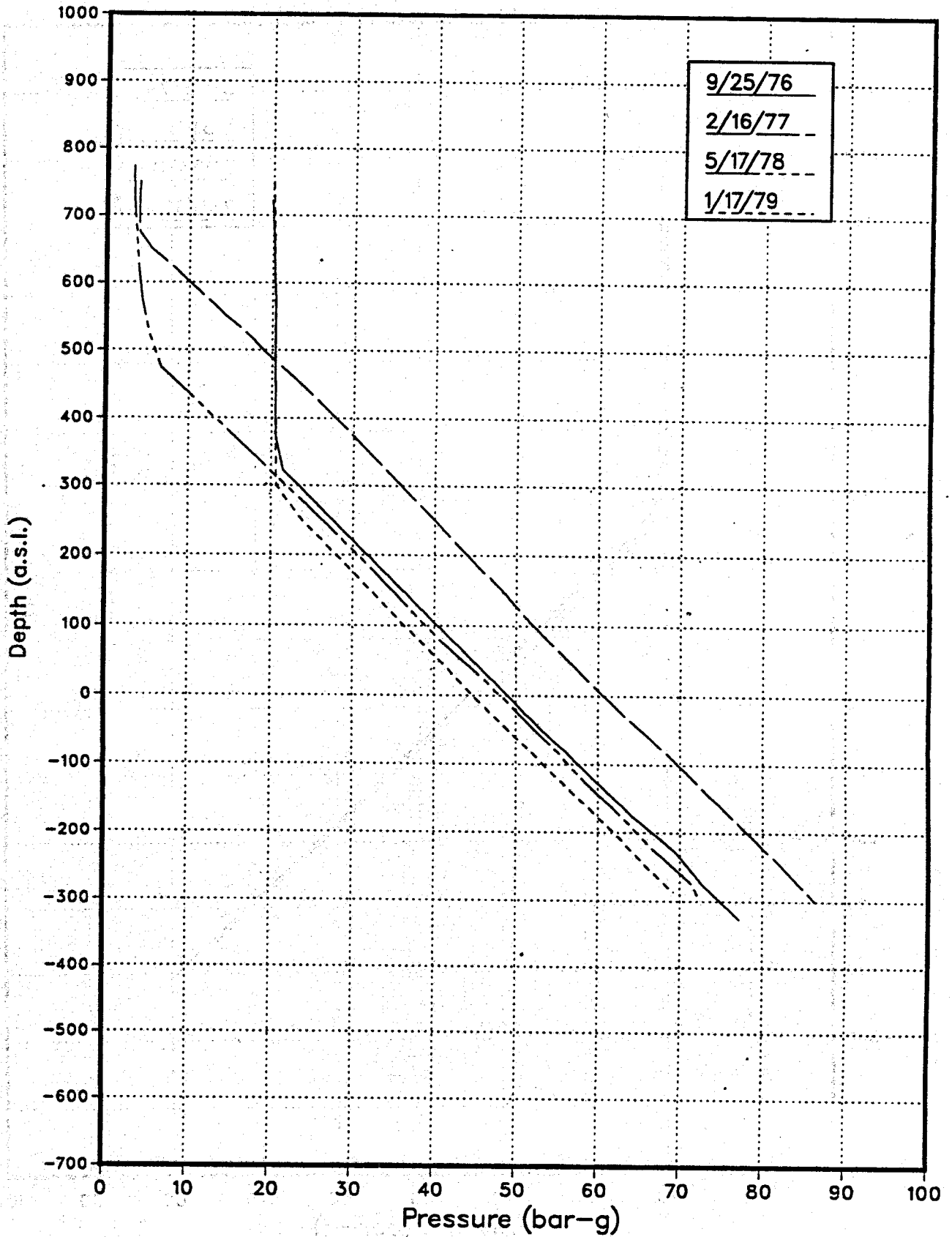
[Closing remarks or administrative notes.]

[Final sentence or signature line.]

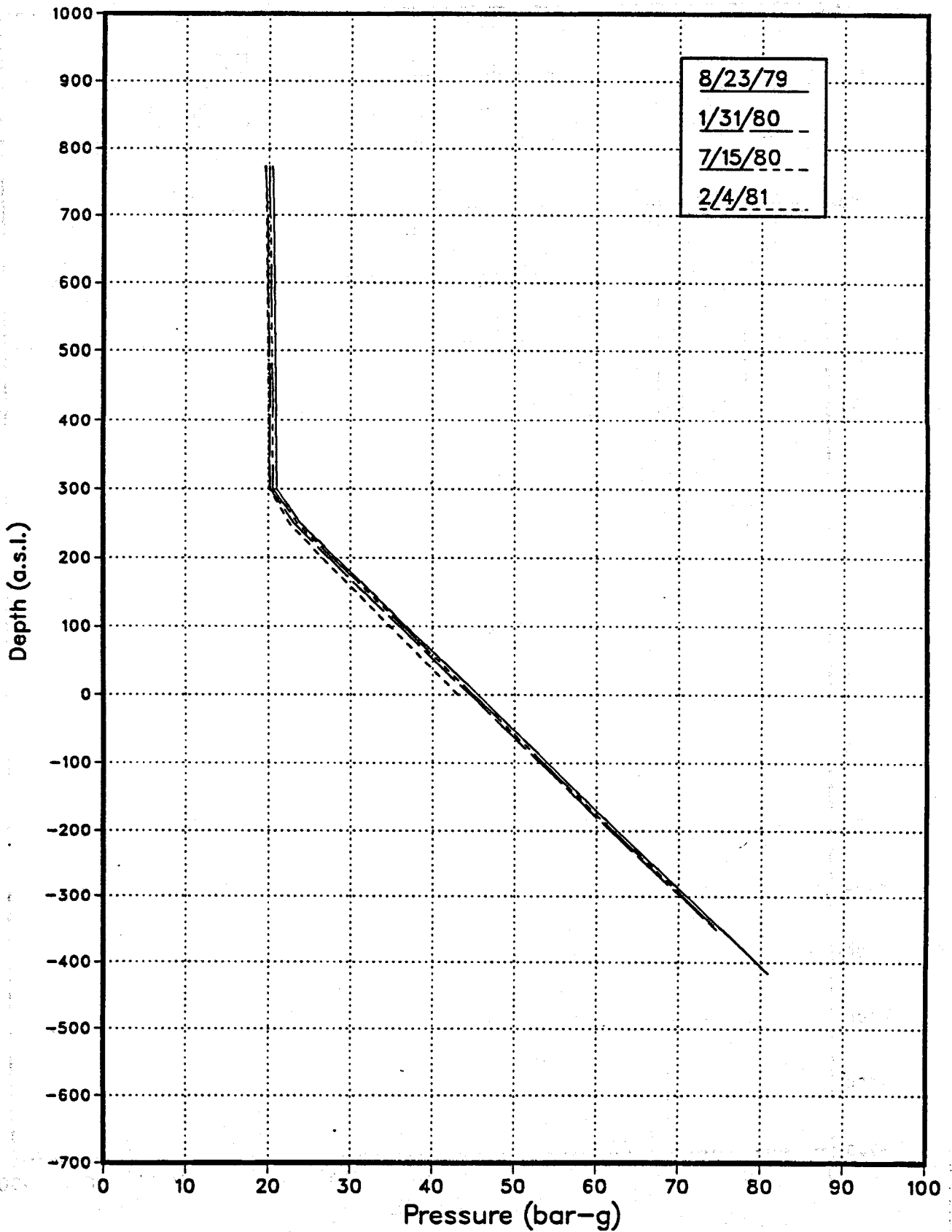
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[Additional notes or references.]

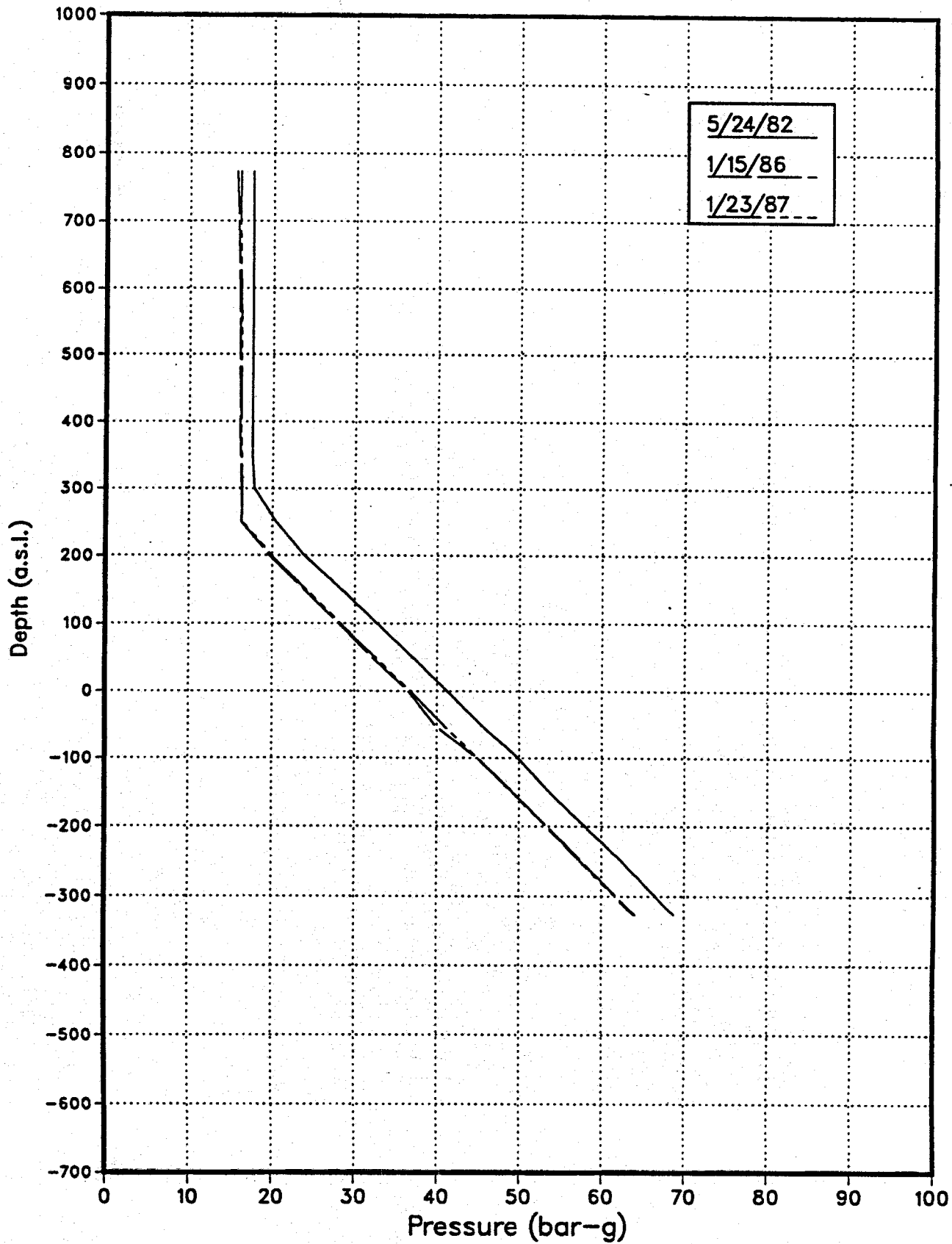
AH17 Pressure Surveys



AH17 Pressure Surveys



AH17 Pressure Surveys



MEMORANDUM FOR THE RECORD

Subject: [Illegible]

Reference is made to [Illegible]

It is noted that [Illegible]

On [Illegible]

[Illegible]

[Illegible]

[Illegible]

[Illegible]

[Illegible]

[Illegible]

[Illegible]

[Illegible]

[Illegible]

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[Illegible]

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[Illegible]

[Illegible]

[Illegible]

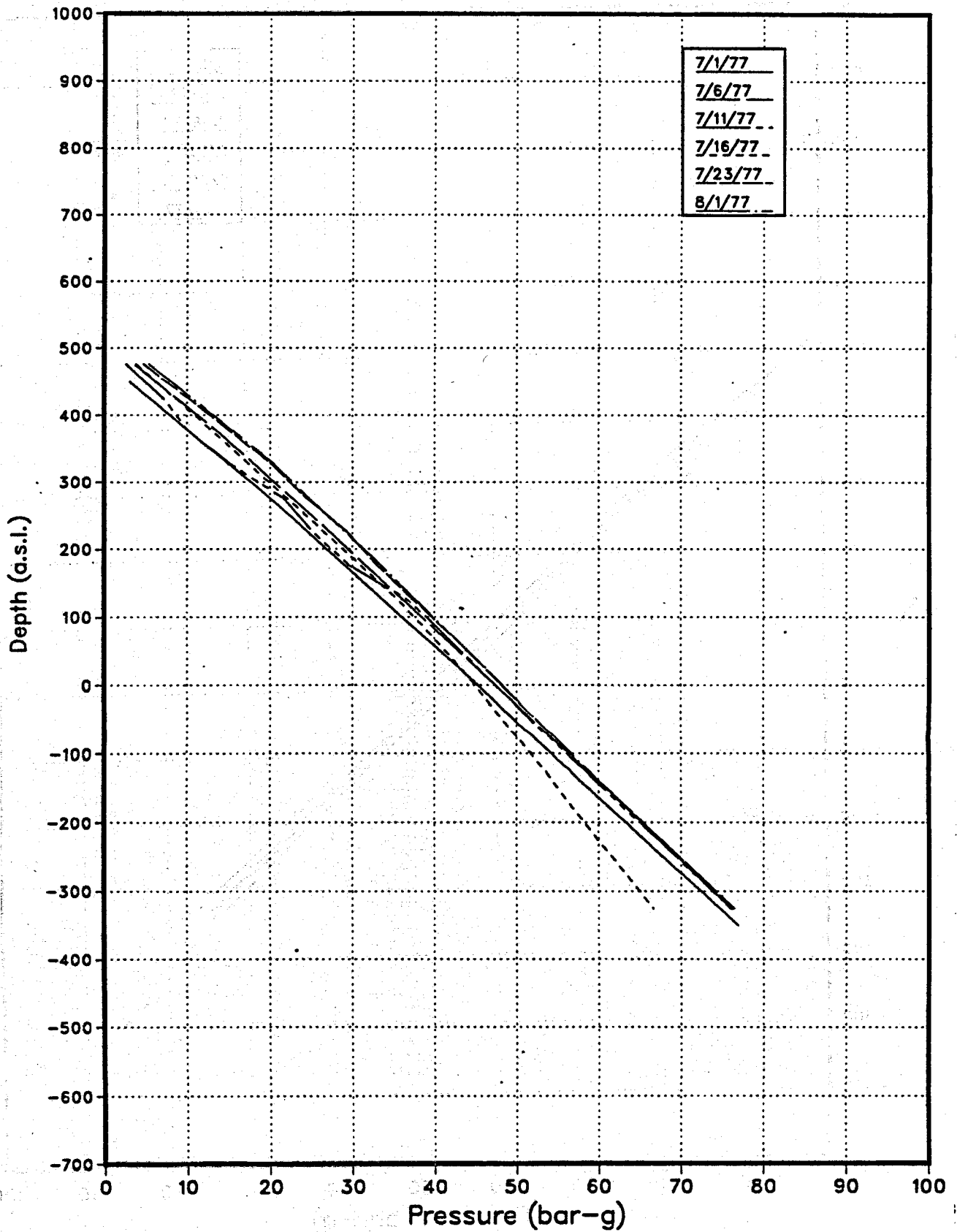
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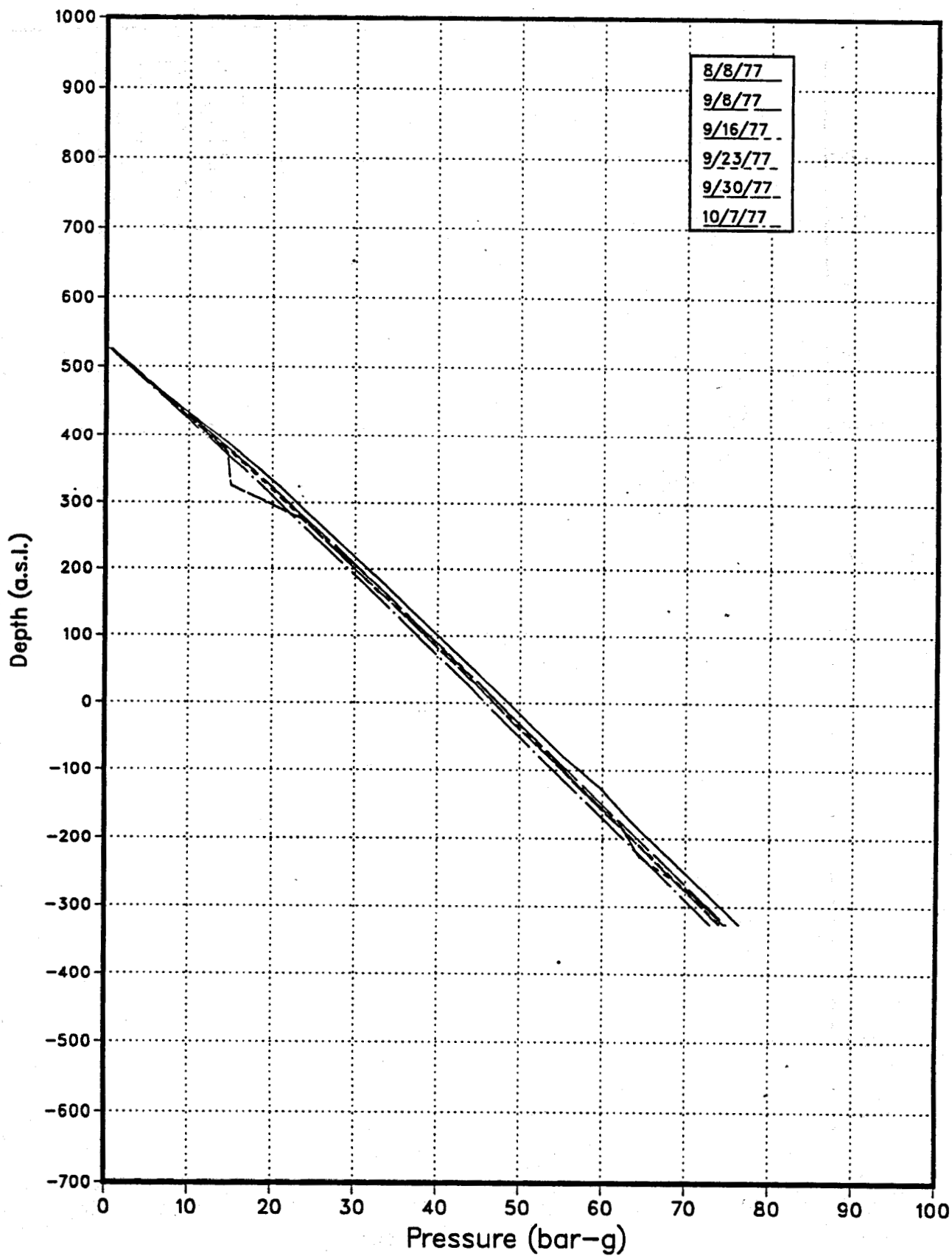
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[Illegible]

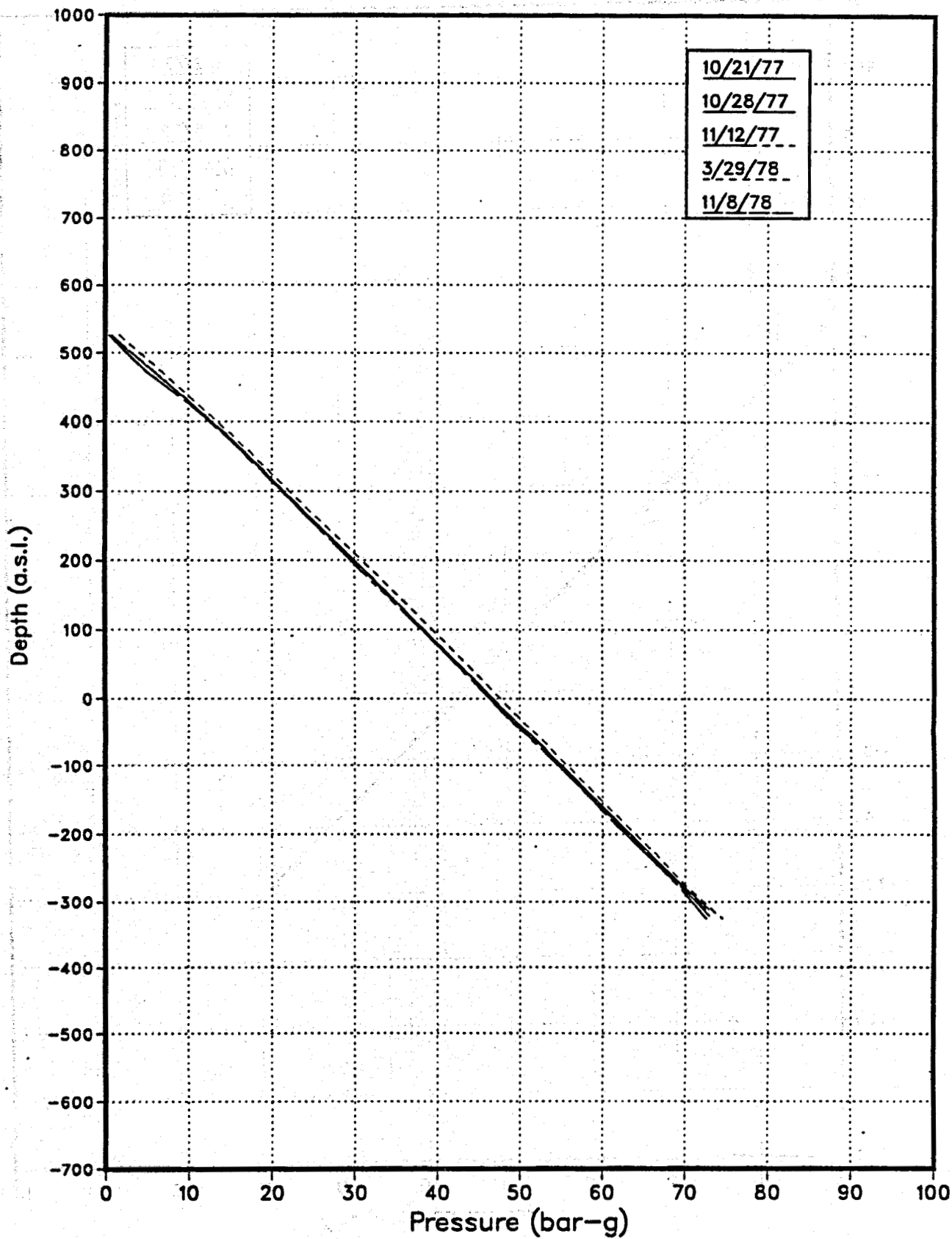
AH18 Pressure Surveys



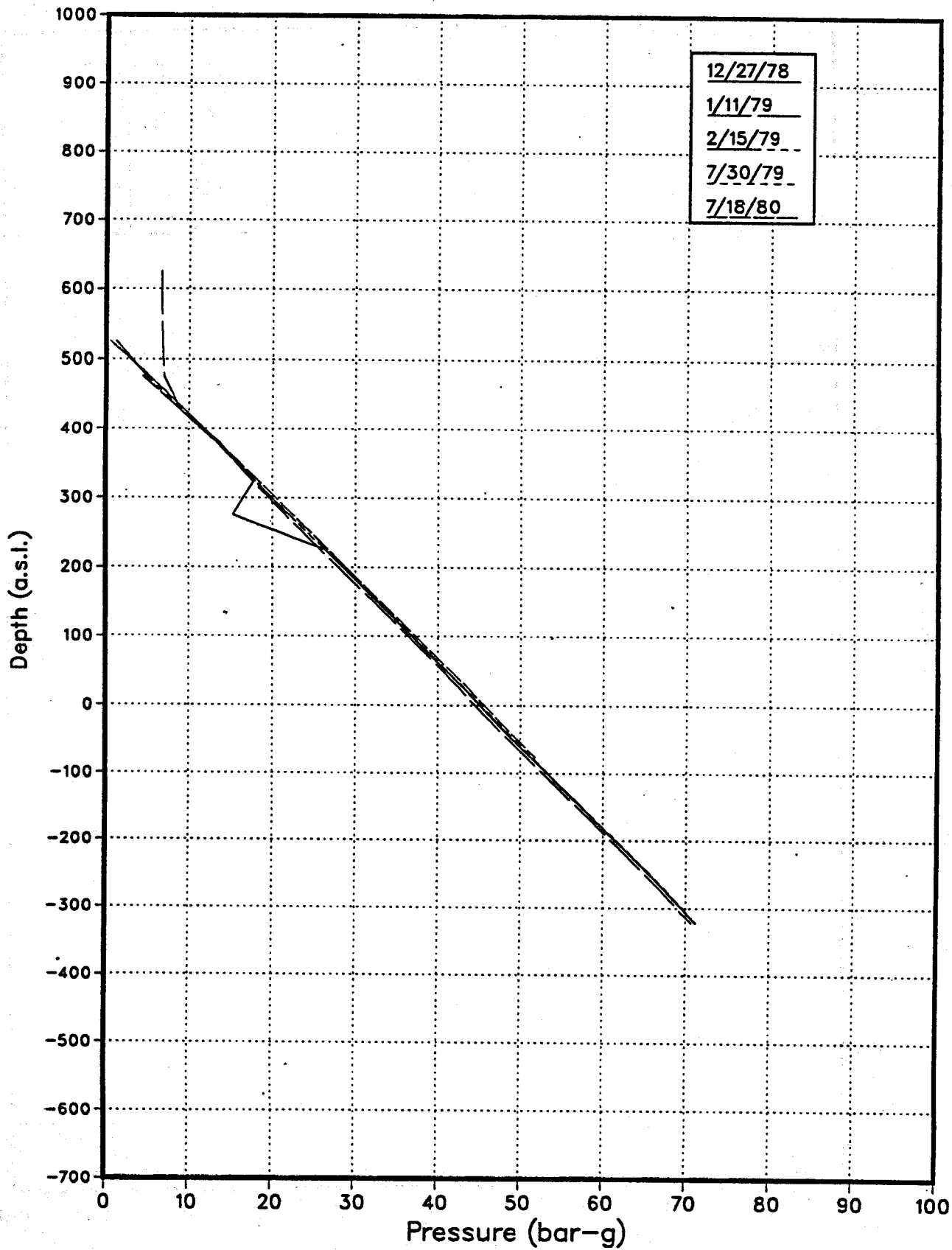
AH18 Pressure Surveys



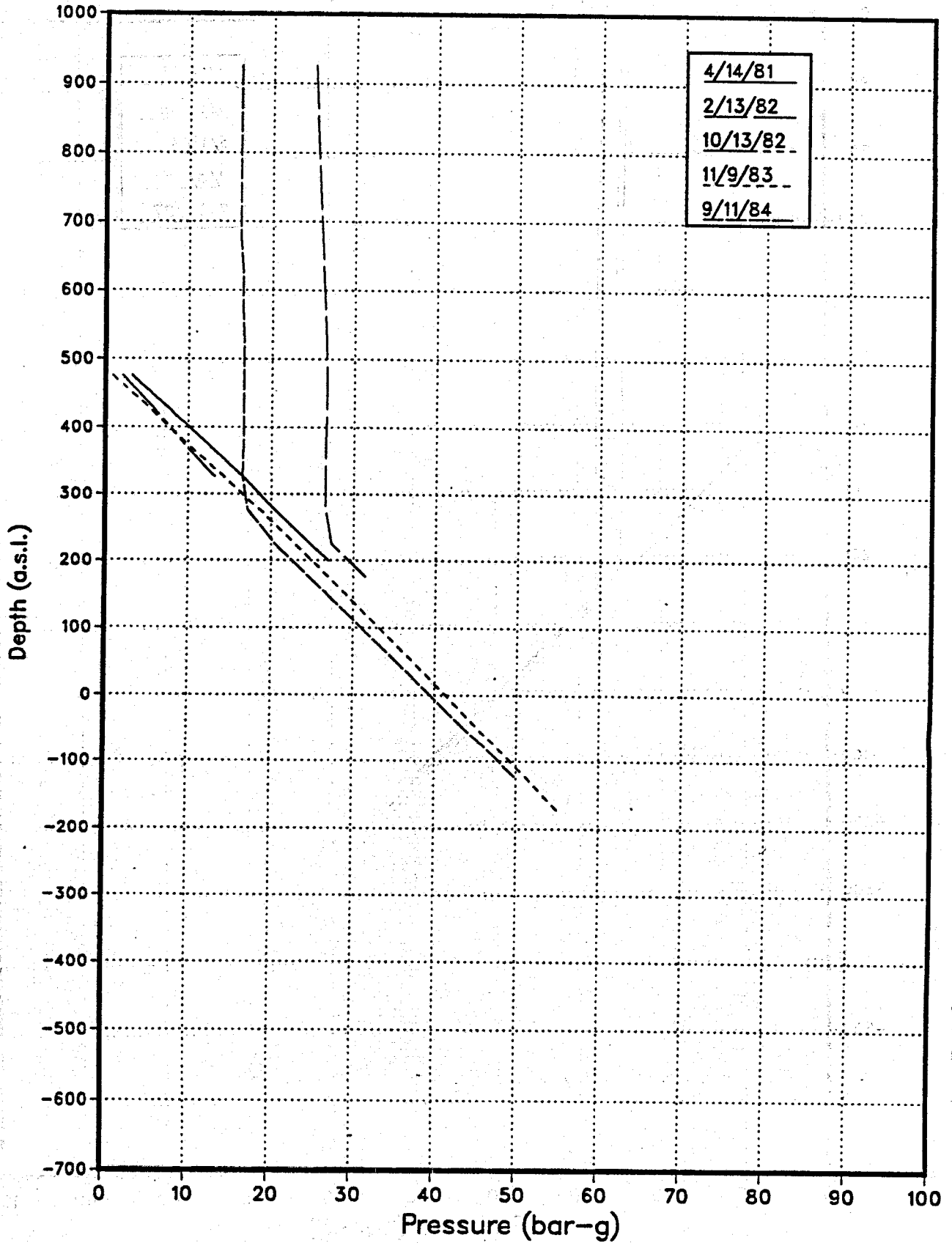
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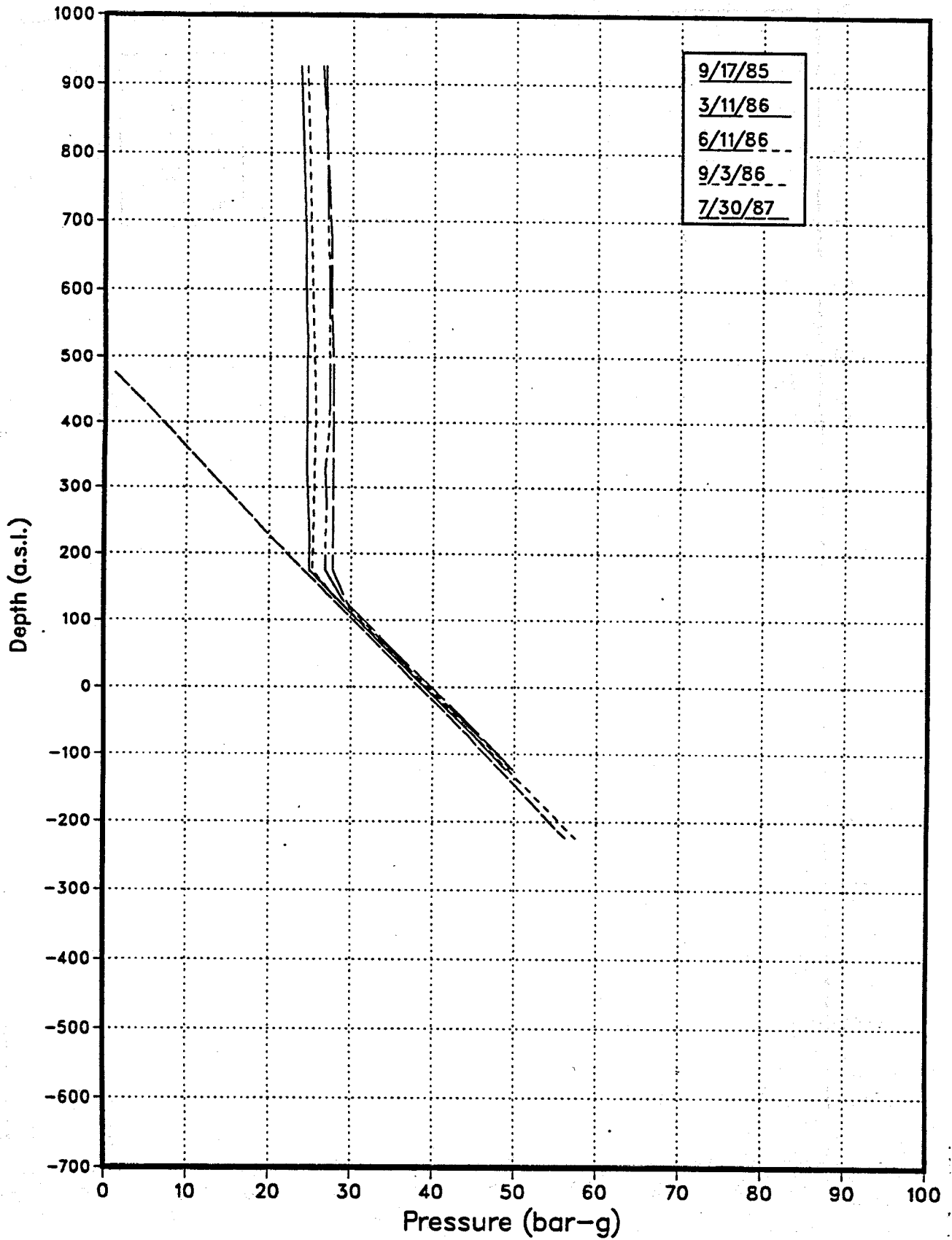
AH18 Pressure Surveys



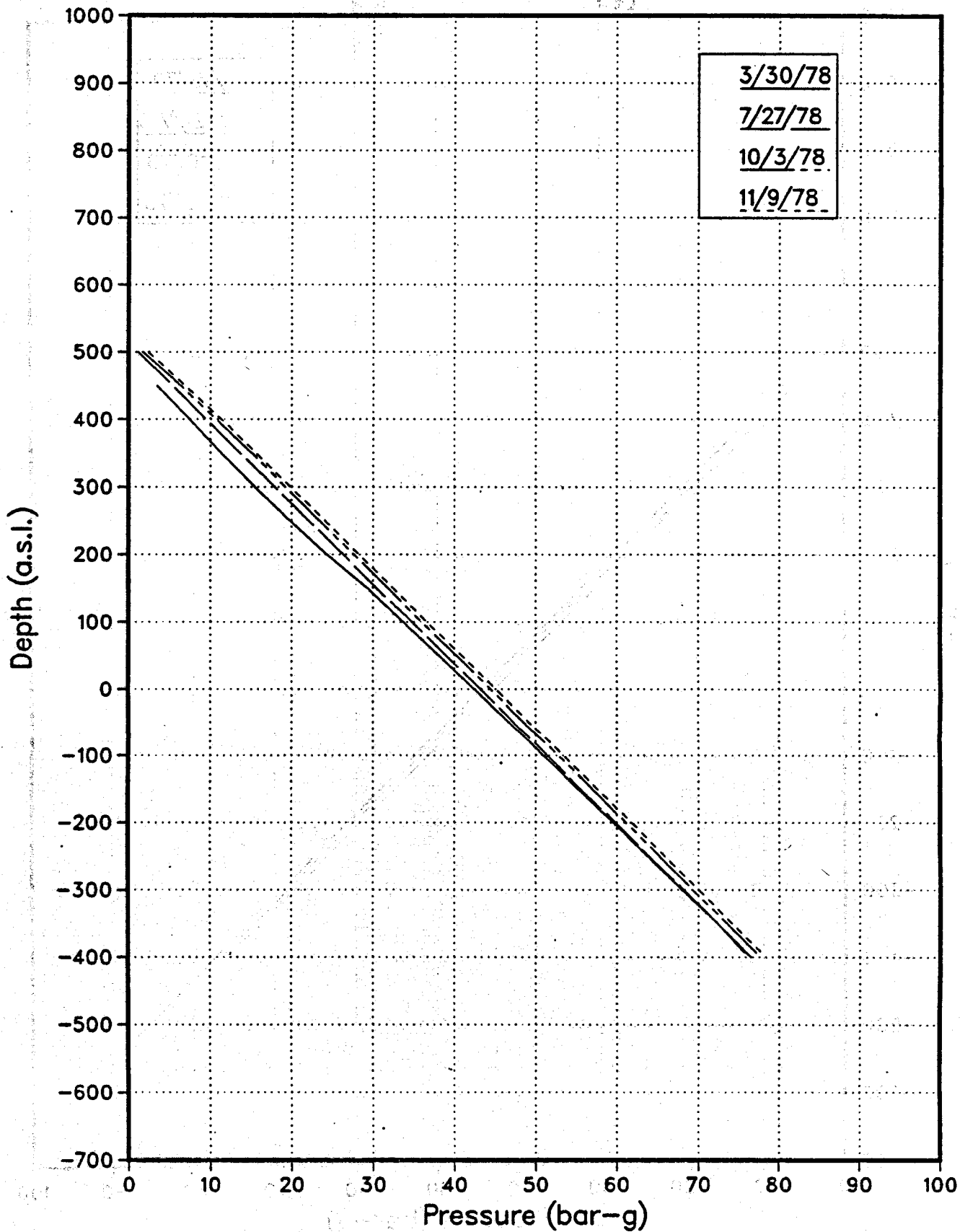
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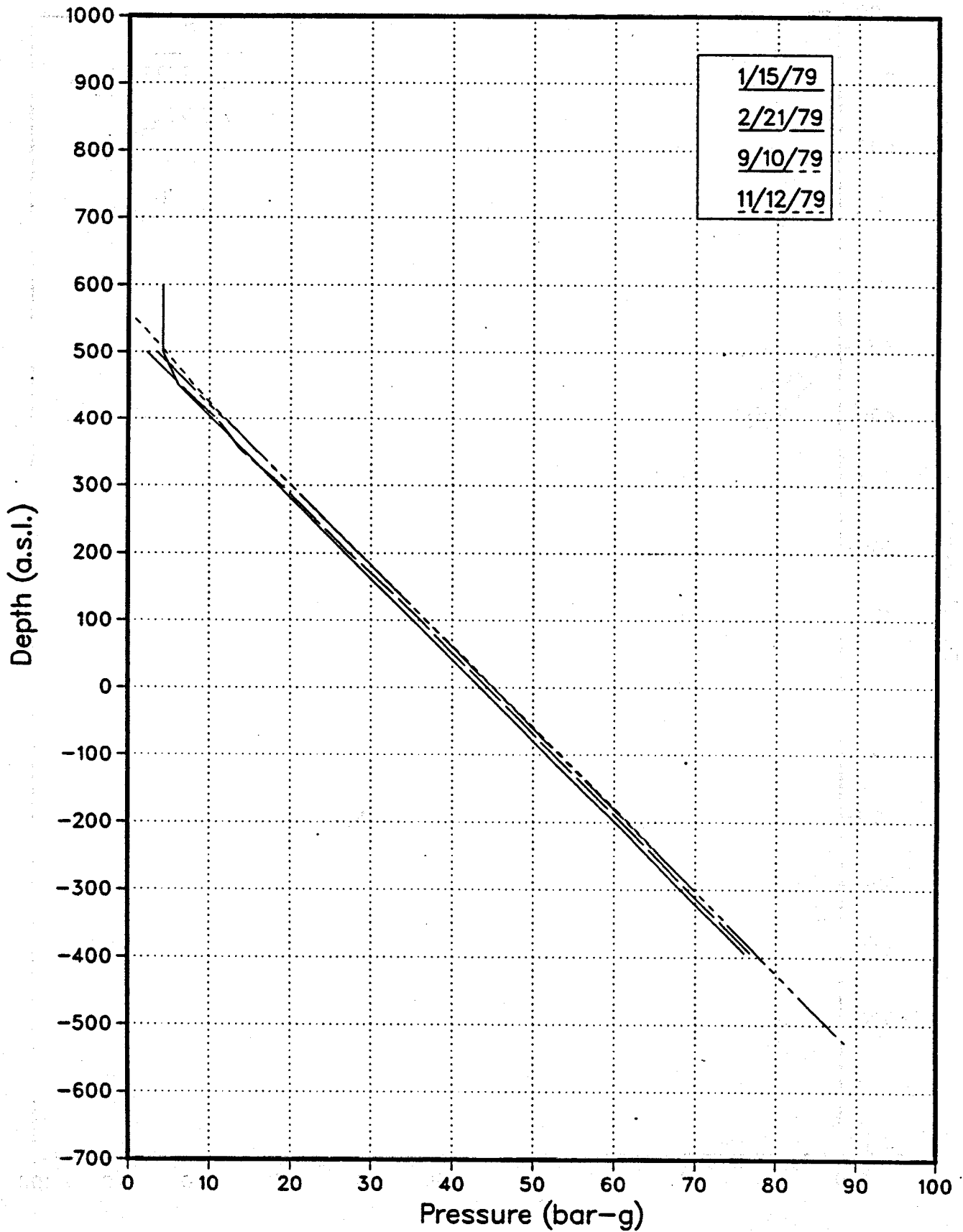
AH18 Pressure Surveys



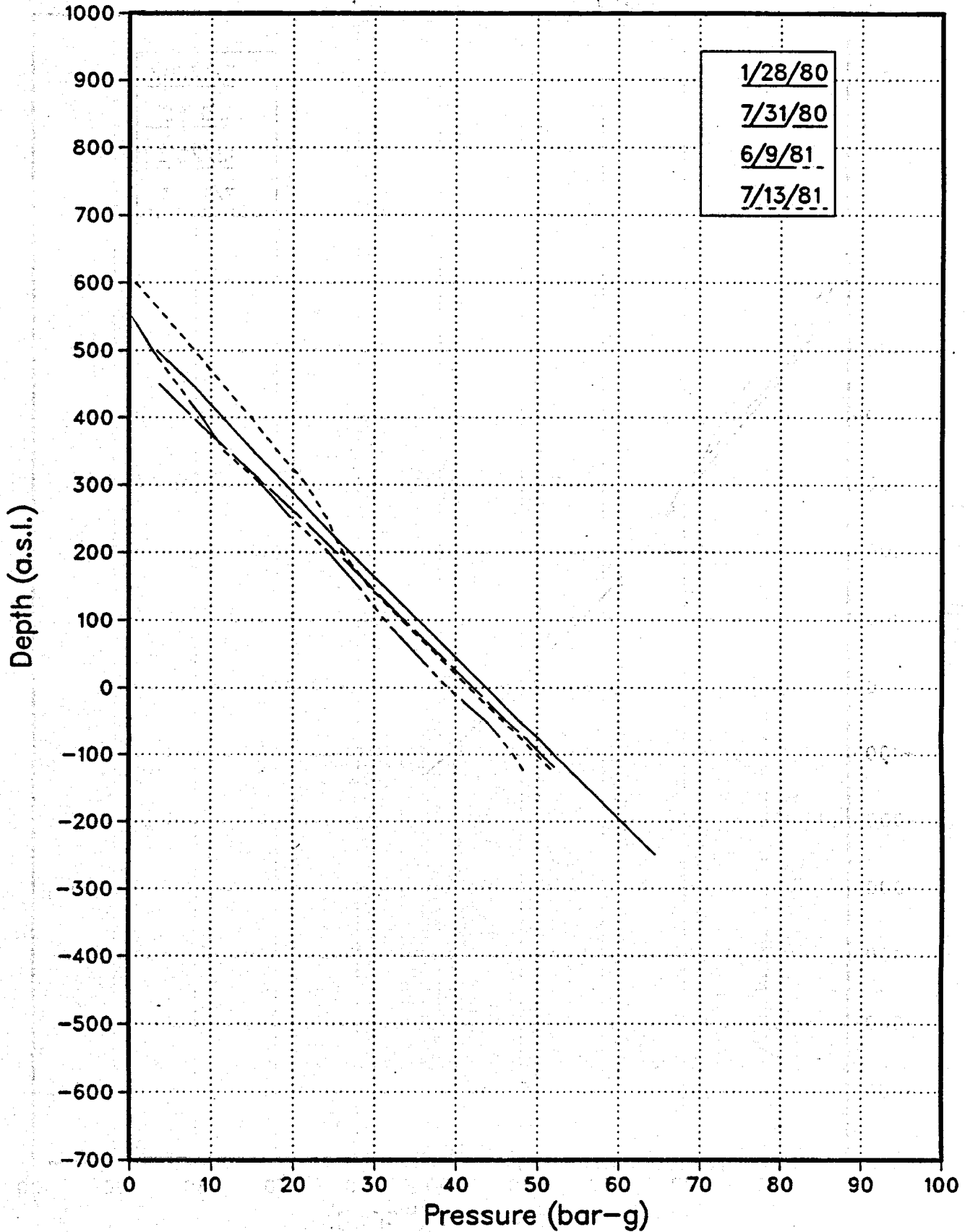
AH19 Pressure Surveys



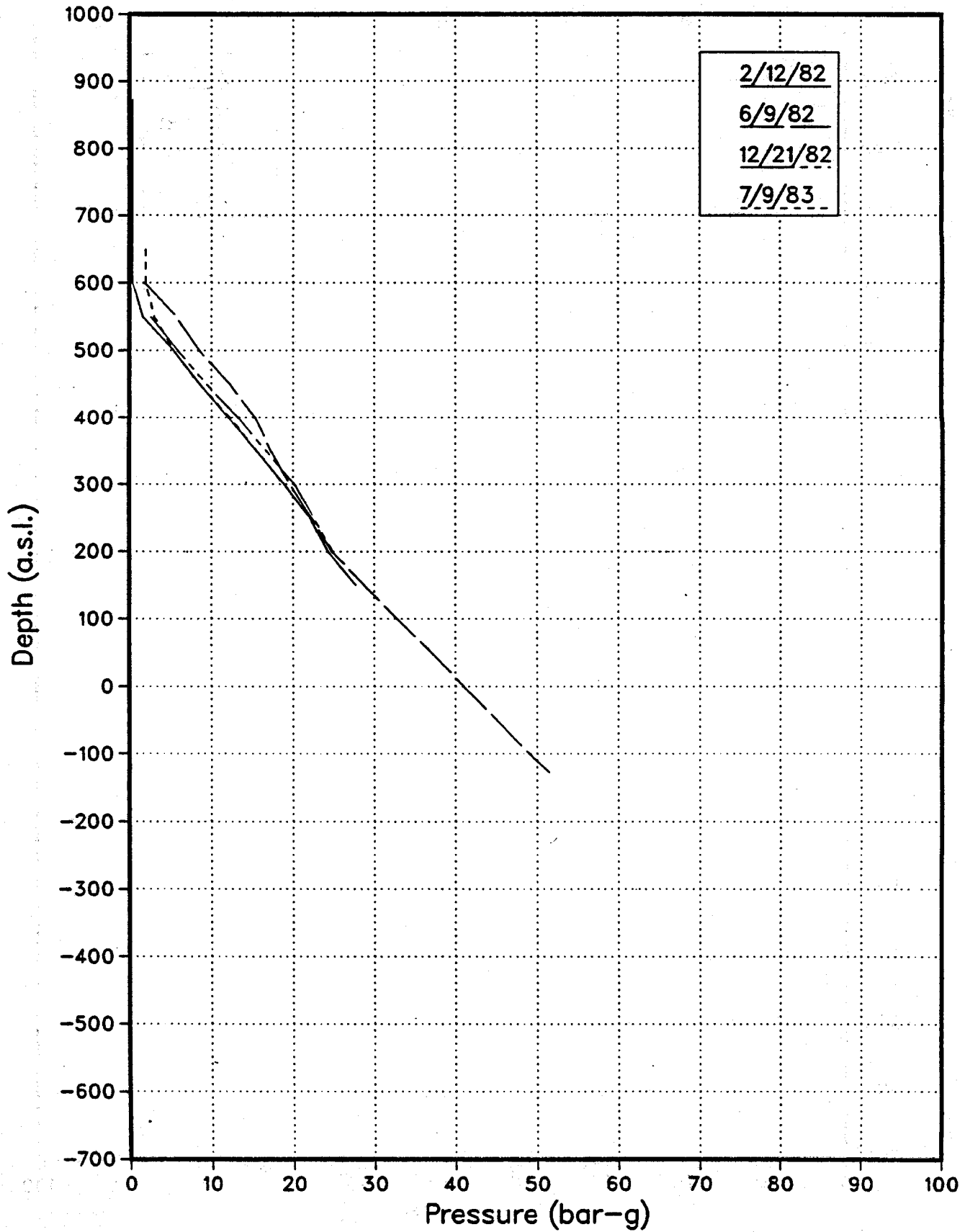
AH19 Pressure Surveys



AH19 Pressure Surveys

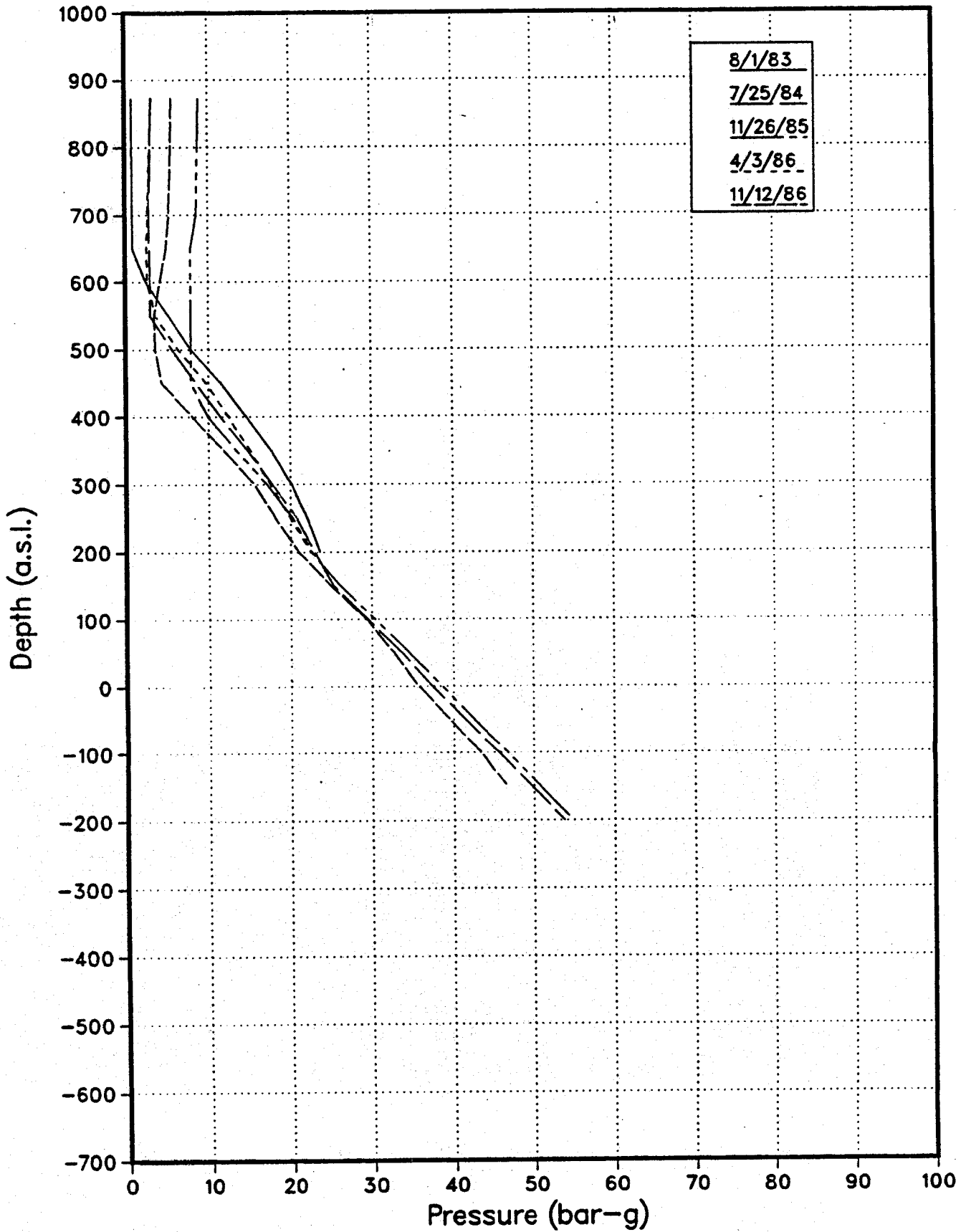


AH19 Pressure Surveys



E77-E78

AH19 Pressure Surveys

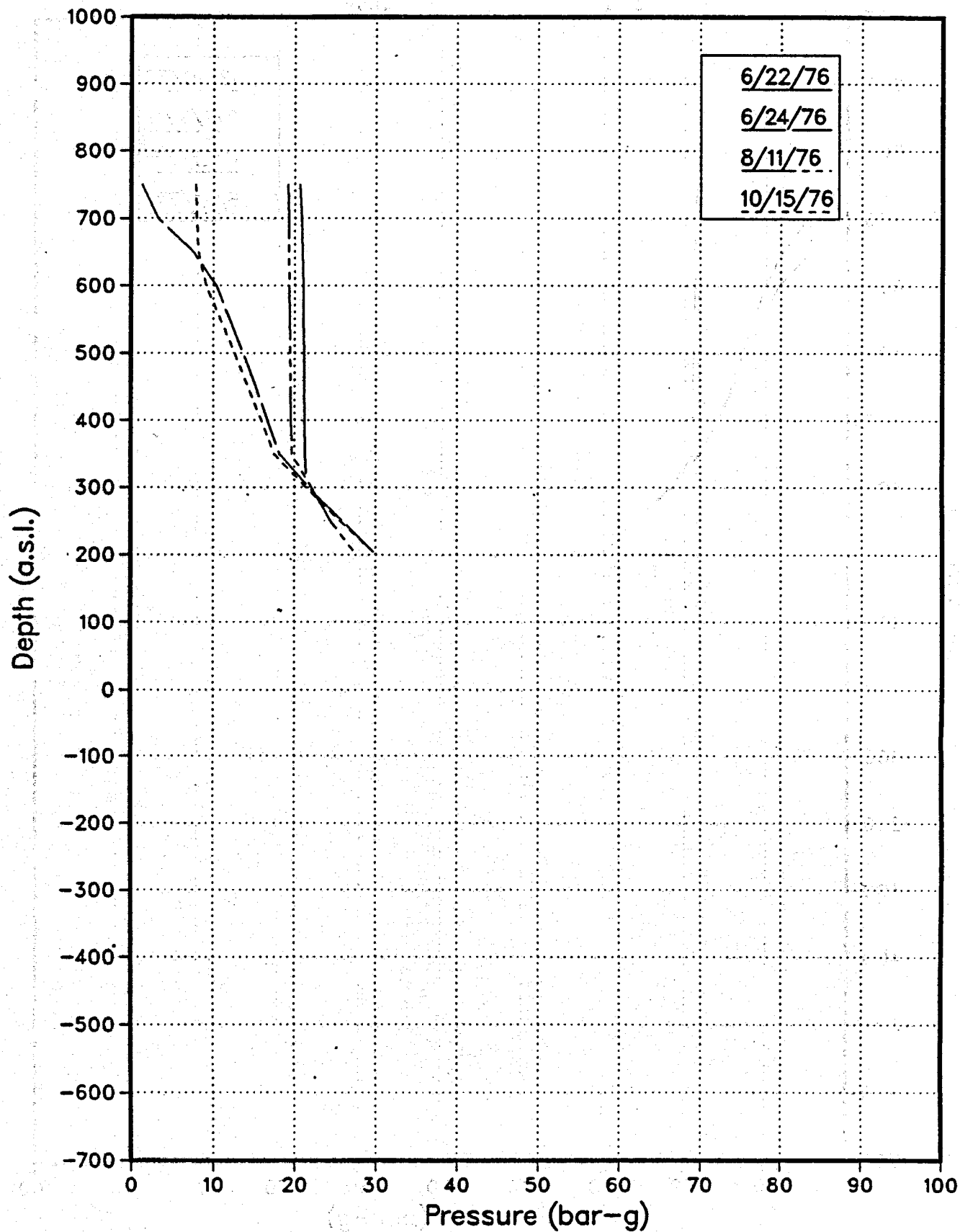


THE UNIVERSITY OF CHICAGO

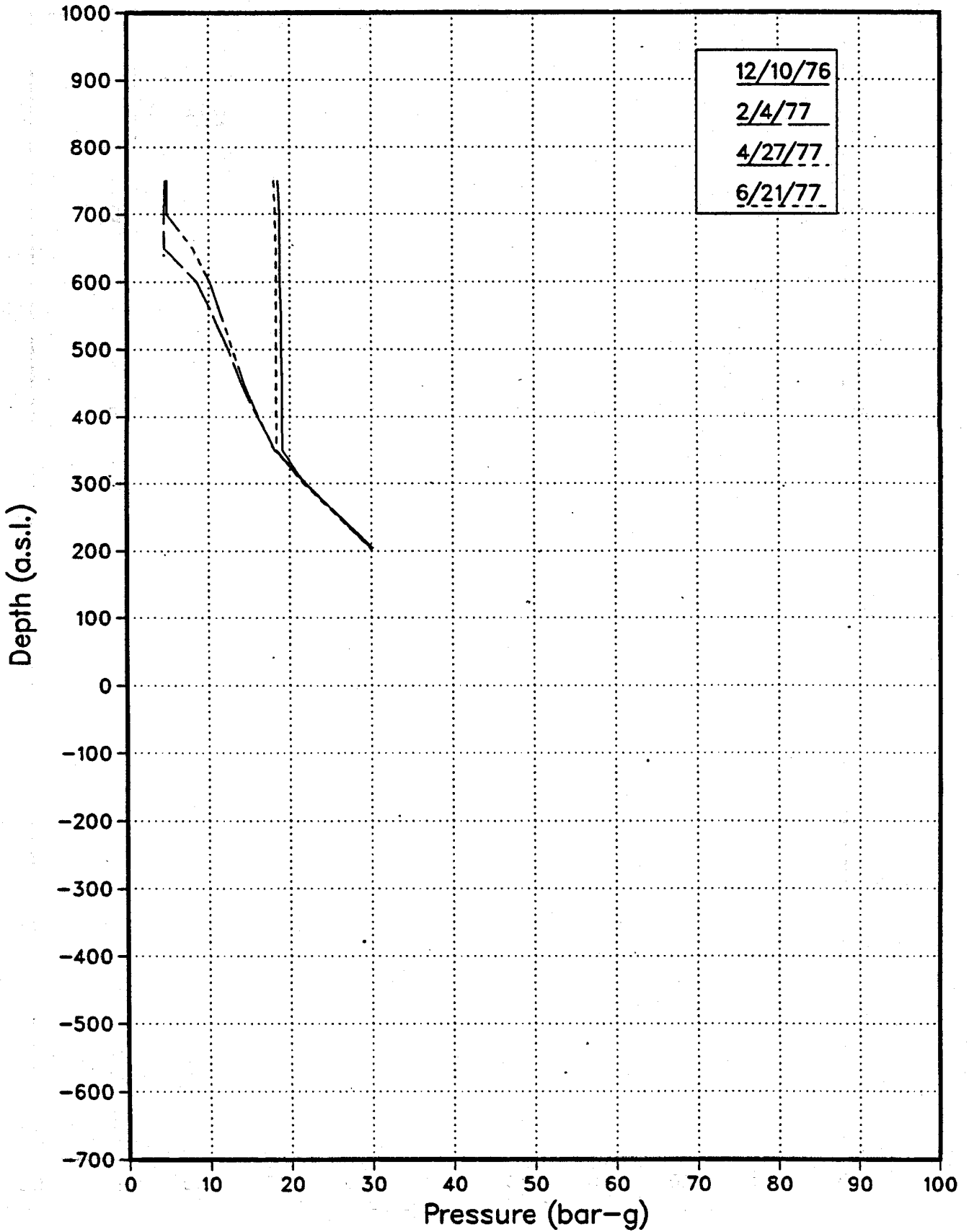
THE UNIVERSITY OF CHICAGO
 DIVISION OF THE PHYSICAL SCIENCES
 DEPARTMENT OF CHEMISTRY
 5708 SOUTH CAMPUS DRIVE
 CHICAGO, ILLINOIS 60637
 TEL: 773-936-3100
 FAX: 773-936-3100
 WWW: WWW.CHEM.UCHICAGO.EDU



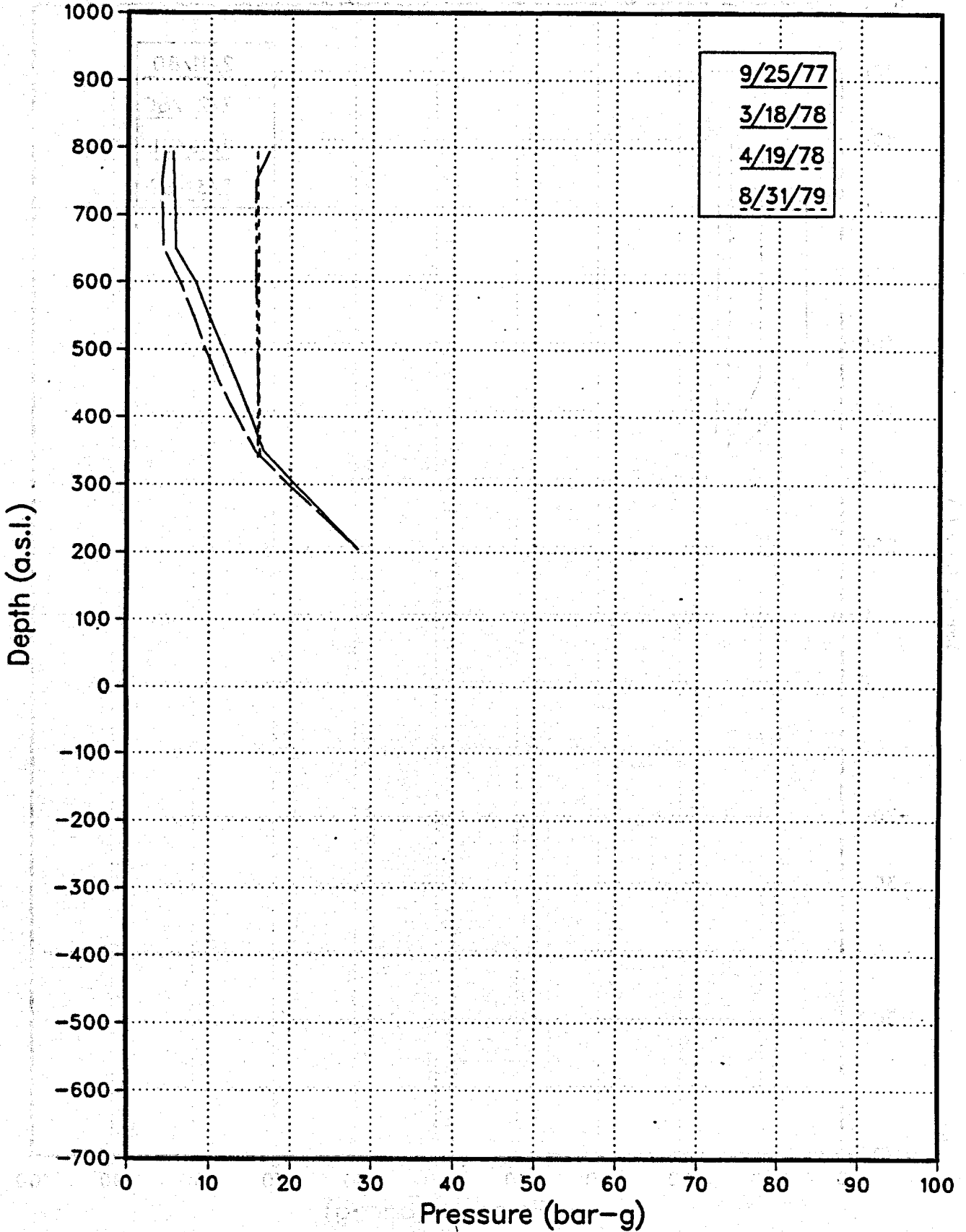
AH20 Pressure Surveys



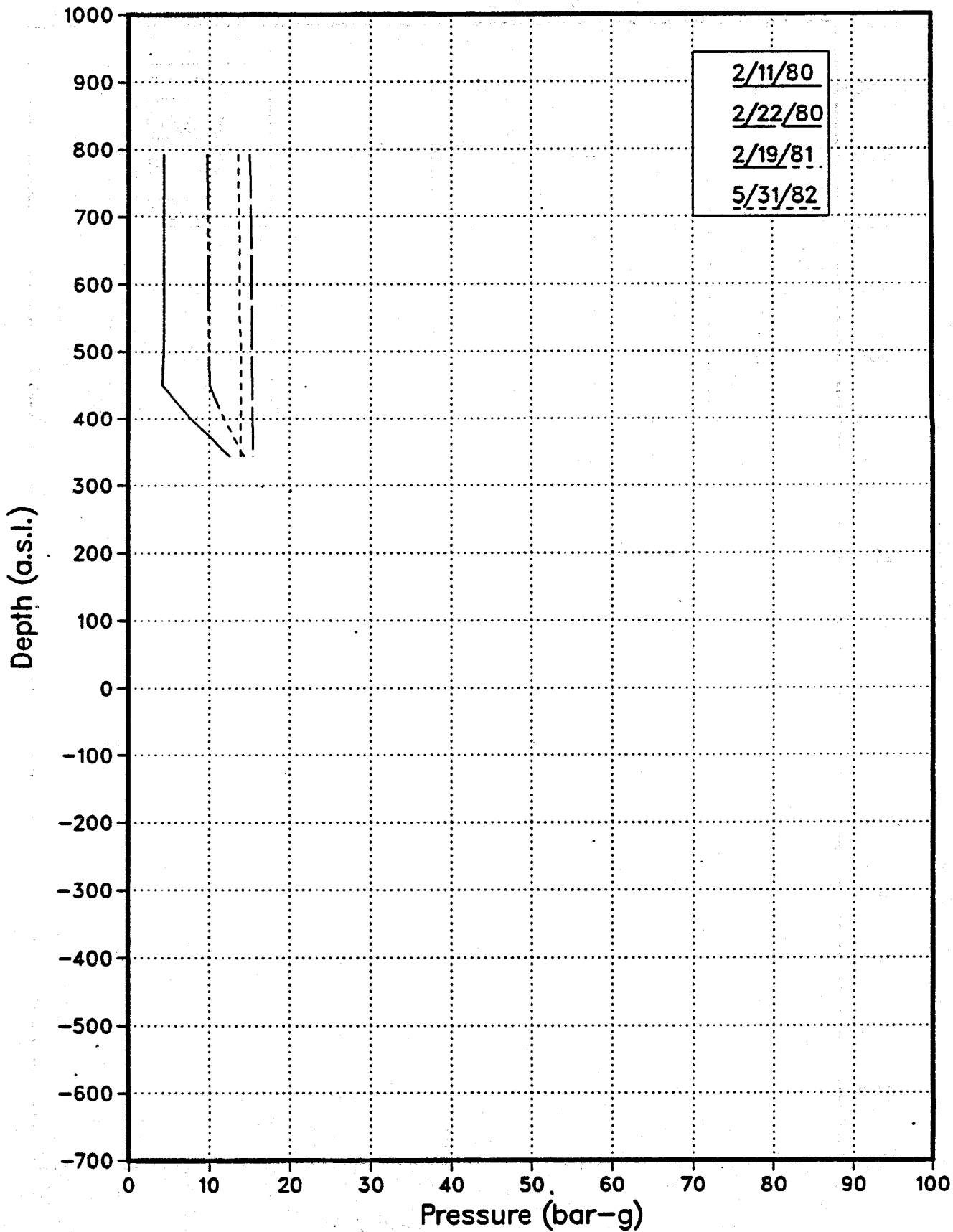
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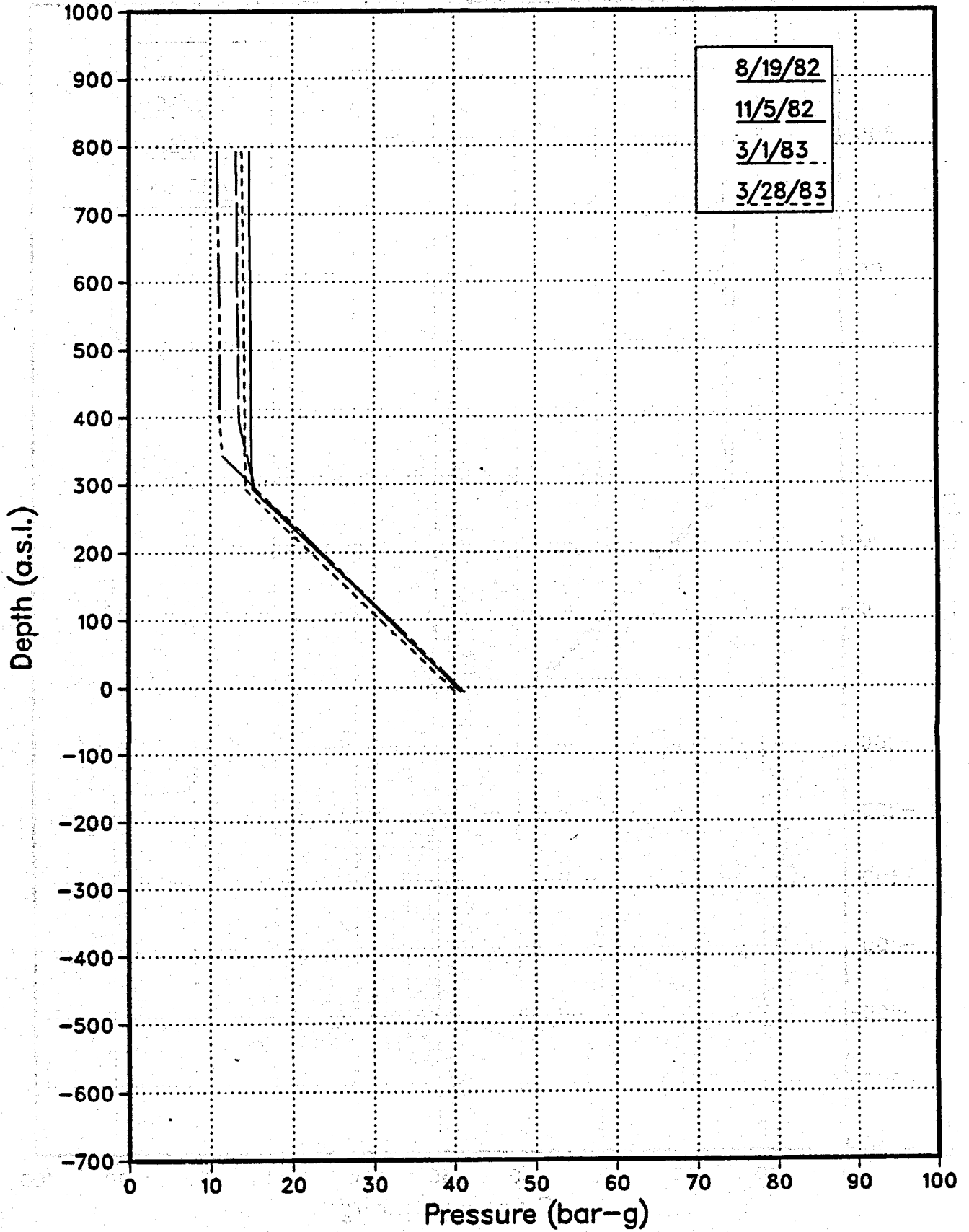
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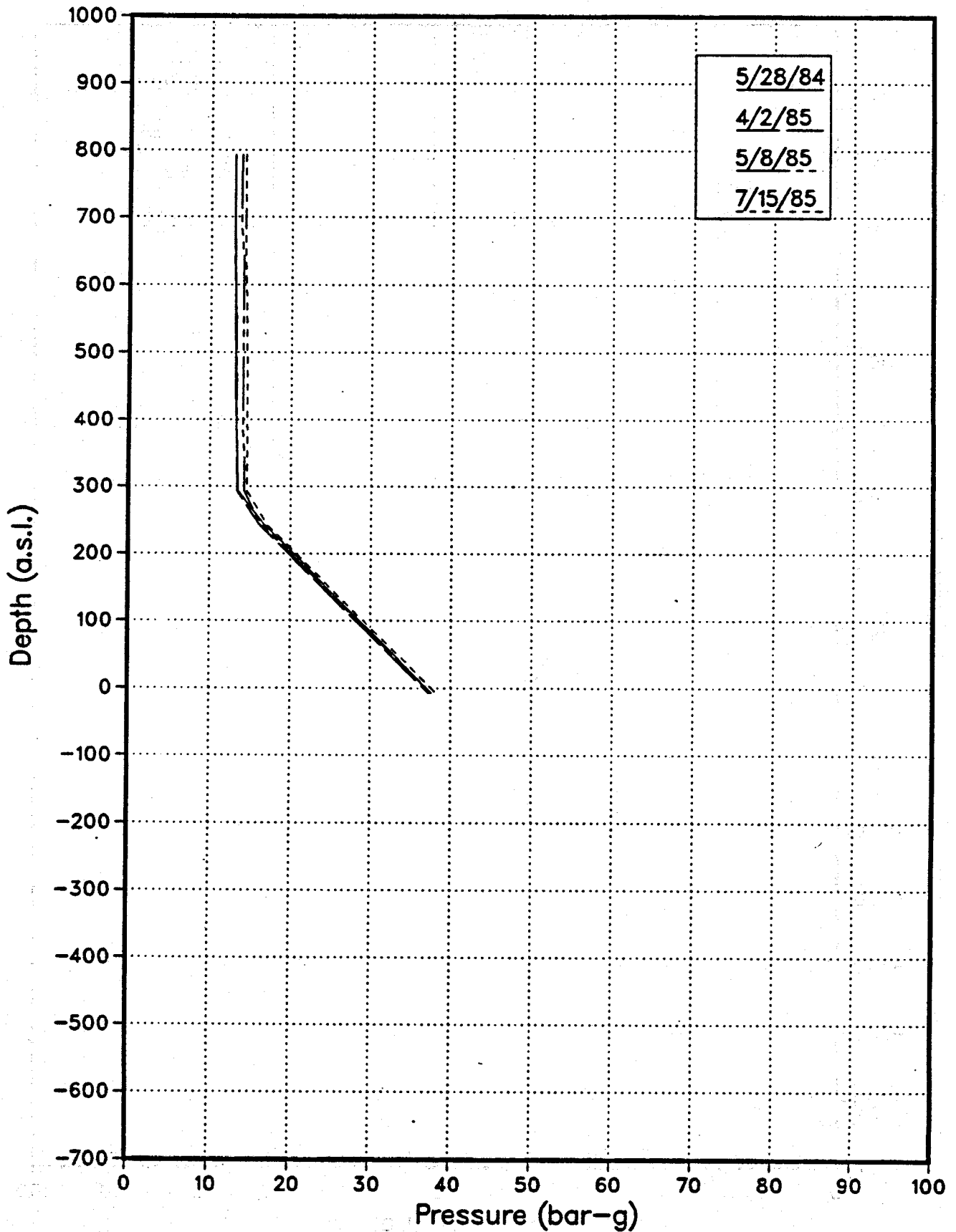
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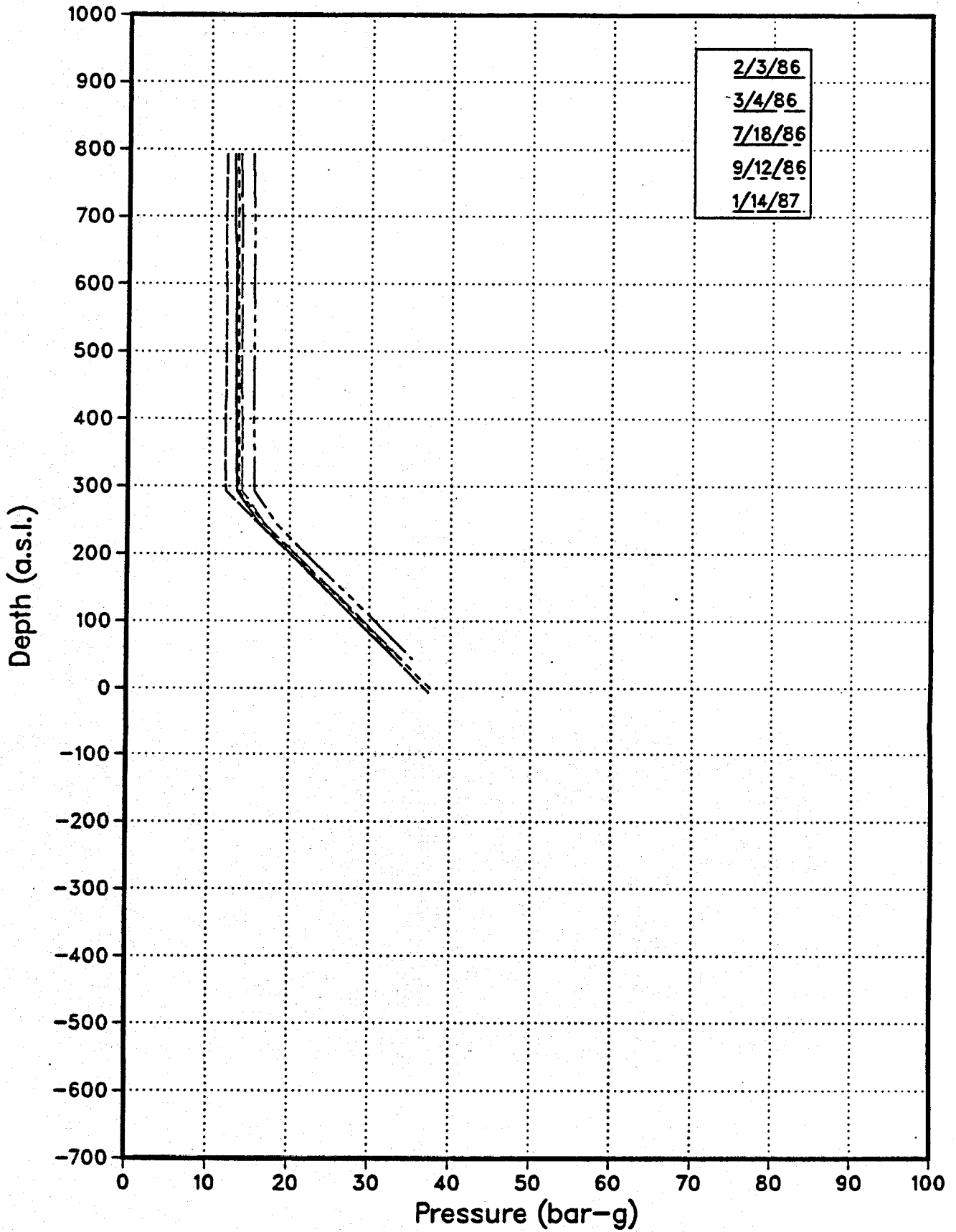
AH20 Pressure Surveys



AH20 Pressure Surveys



AH20 Pressure Surveys



Annual Report of the Board of Directors

The Board of Directors has the honor to present to you the Annual Report of the Corporation for the year ending December 31, 1950. The year has been a period of continued growth and development for the Corporation, and we are pleased to report that our financial position is strong and our operations are expanding.

Our total assets at the end of the year were \$1,234,567, an increase of \$234,567 from the end of the previous year. This increase was primarily due to the sale of certain assets and the receipt of contributions. Our total liabilities at the end of the year were \$567,890, an increase of \$123,456 from the end of the previous year. This increase was primarily due to the purchase of certain assets and the payment of certain liabilities.

Our net assets at the end of the year were \$666,677, an increase of \$111,111 from the end of the previous year. This increase was primarily due to the sale of certain assets and the receipt of contributions. Our net assets at the beginning of the year were \$555,566.

The following table shows the changes in our net assets during the year:

Item	Amount
Net assets at beginning of year	\$555,566
Receipt of contributions	\$100,000
Income from investments	\$50,000
Expenses for operations	(\$100,000)
Net assets at end of year	\$666,677

The following table shows the changes in our total assets during the year:

Item	Amount
Total assets at beginning of year	\$1,000,000
Receipt of contributions	\$100,000
Income from investments	\$50,000
Expenses for operations	(\$100,000)
Net assets at end of year	\$666,677
Other assets	\$567,890
Total assets at end of year	\$1,234,567

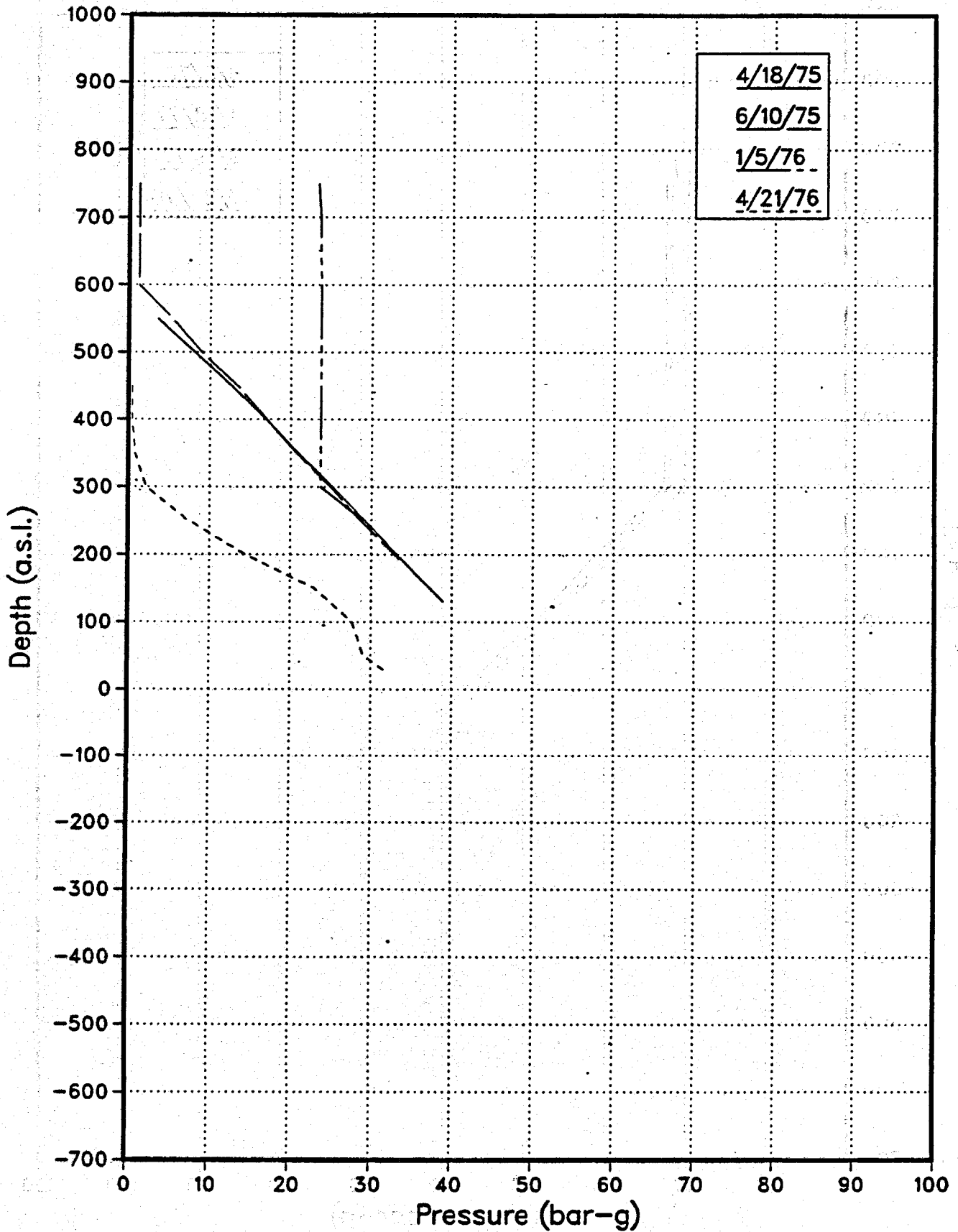
The following table shows the changes in our total liabilities during the year:

Item	Amount
Total liabilities at beginning of year	\$444,434
Receipt of contributions	\$100,000
Income from investments	\$50,000
Expenses for operations	(\$100,000)
Net assets at end of year	\$666,677
Other liabilities	\$123,456
Total liabilities at end of year	\$567,890

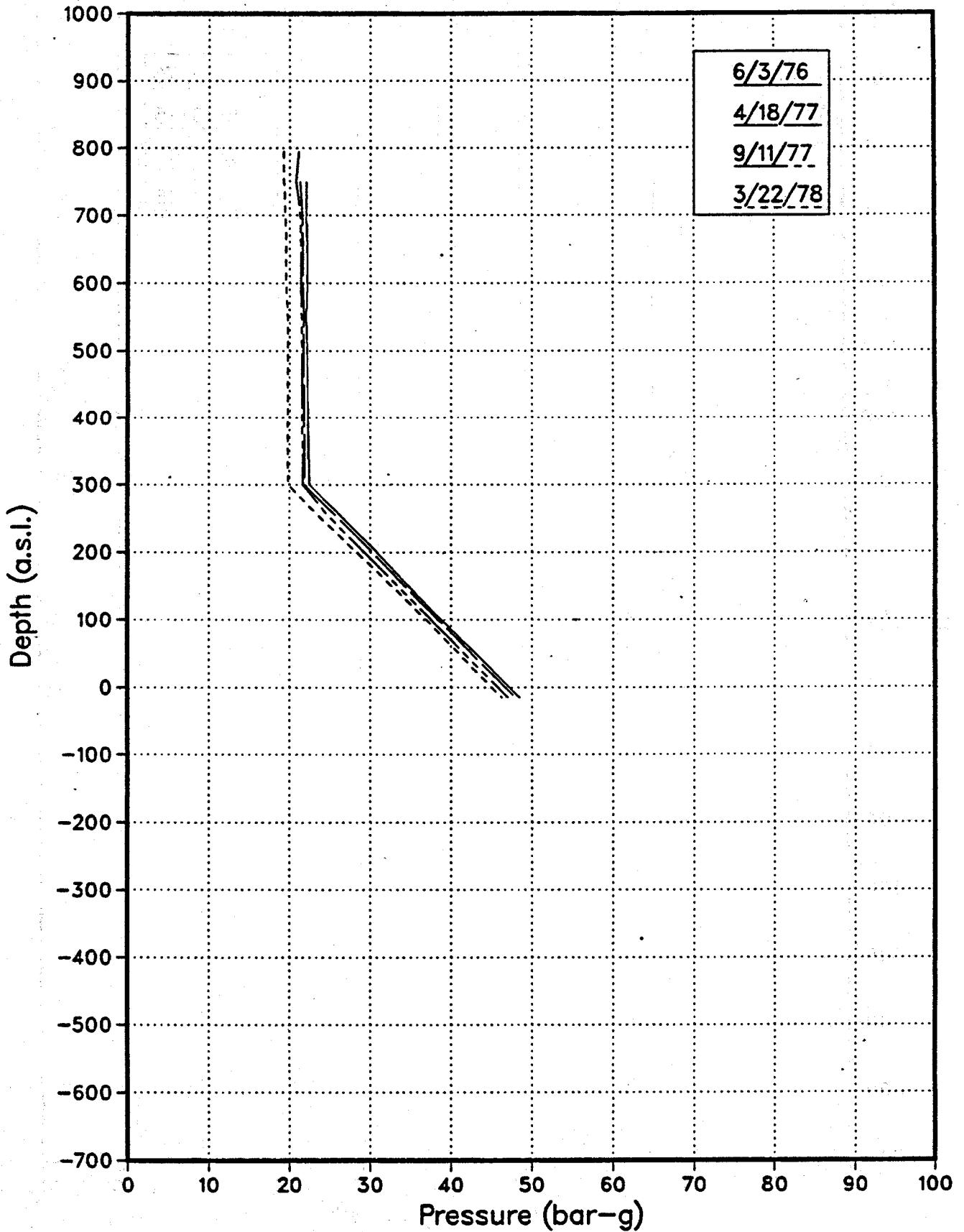
The following table shows the changes in our net assets during the year:

Item	Amount
Net assets at beginning of year	\$555,566
Receipt of contributions	\$100,000
Income from investments	\$50,000
Expenses for operations	(\$100,000)
Net assets at end of year	\$666,677

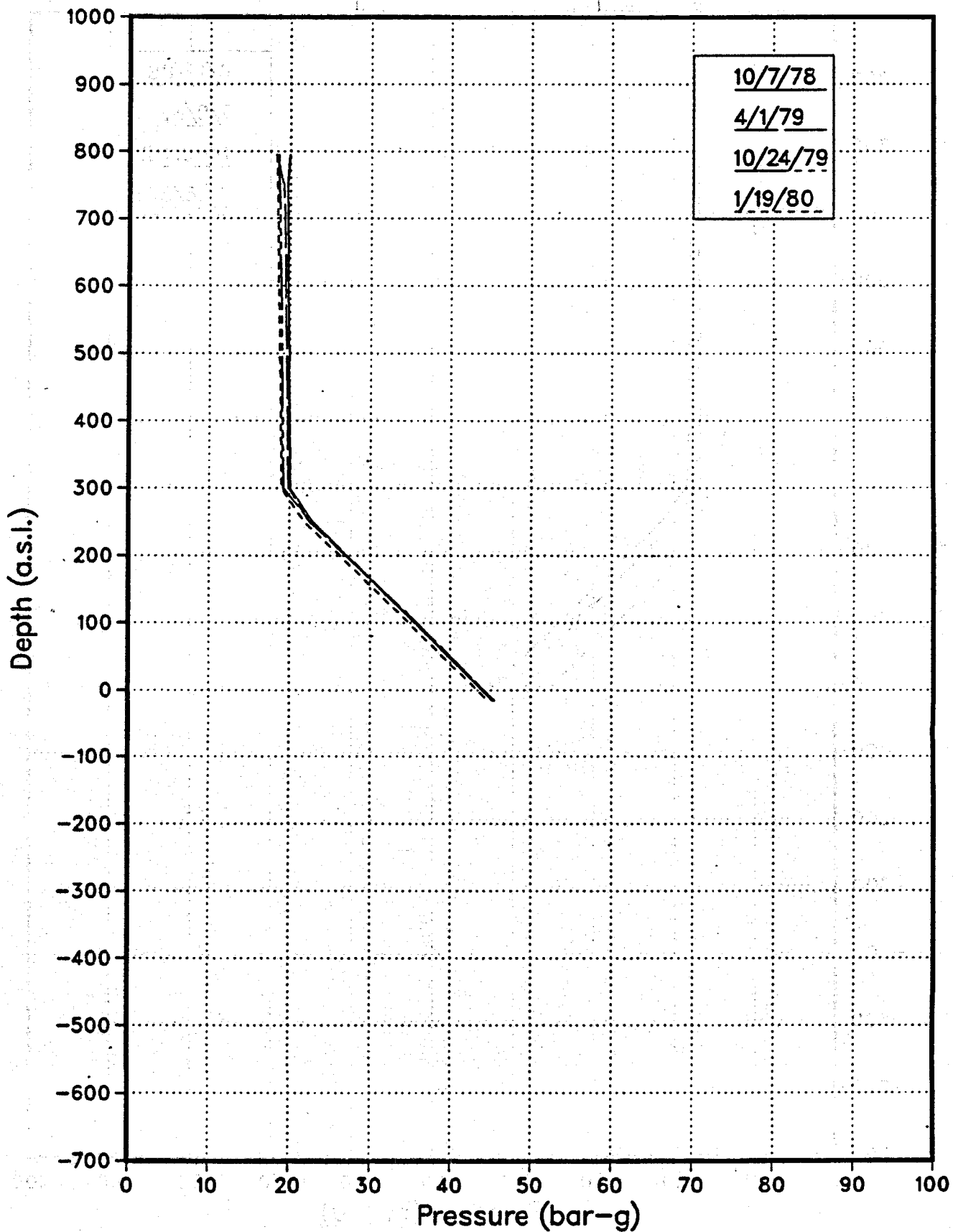
AH21 Pressure Surveys



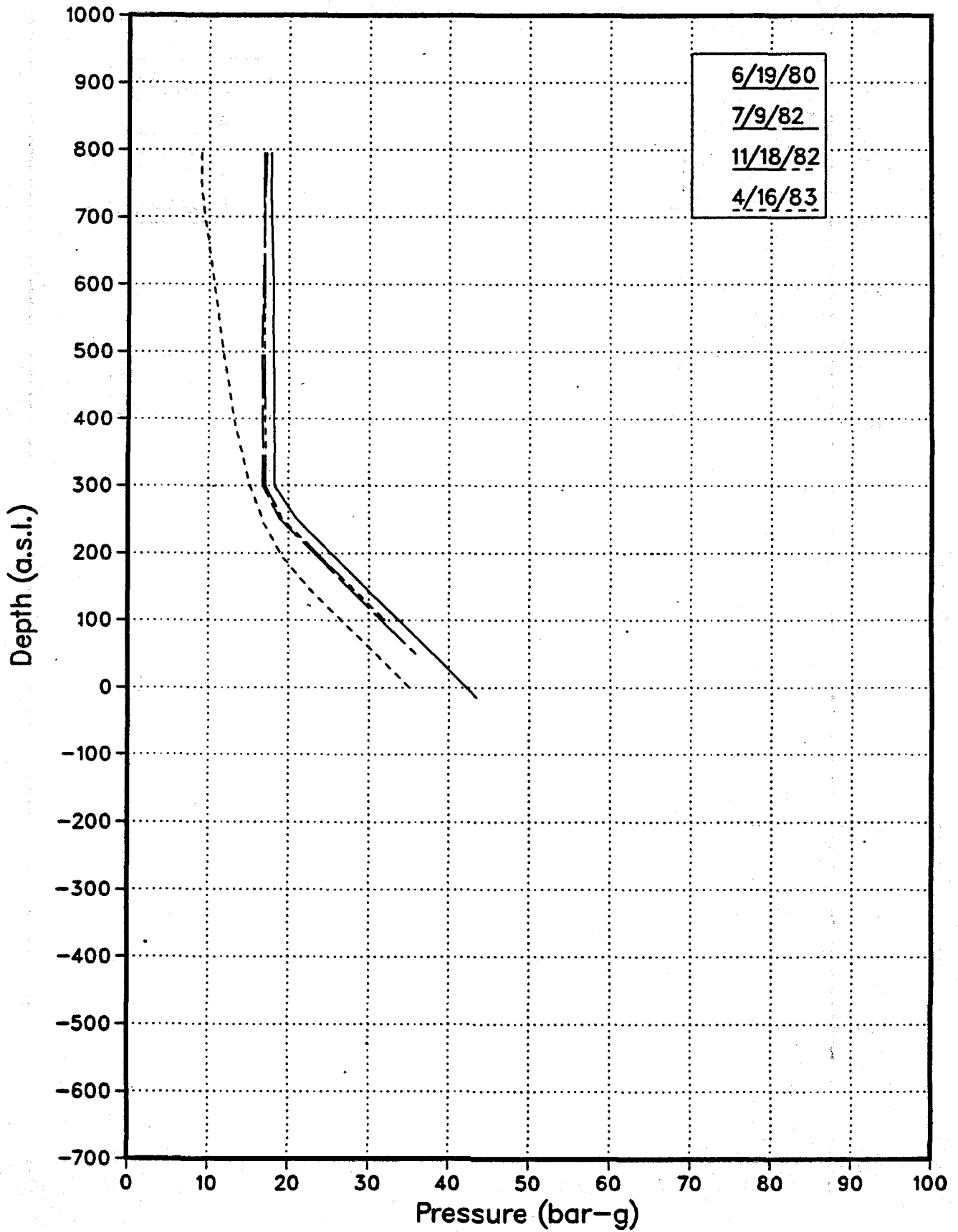
AH21 Pressure Surveys



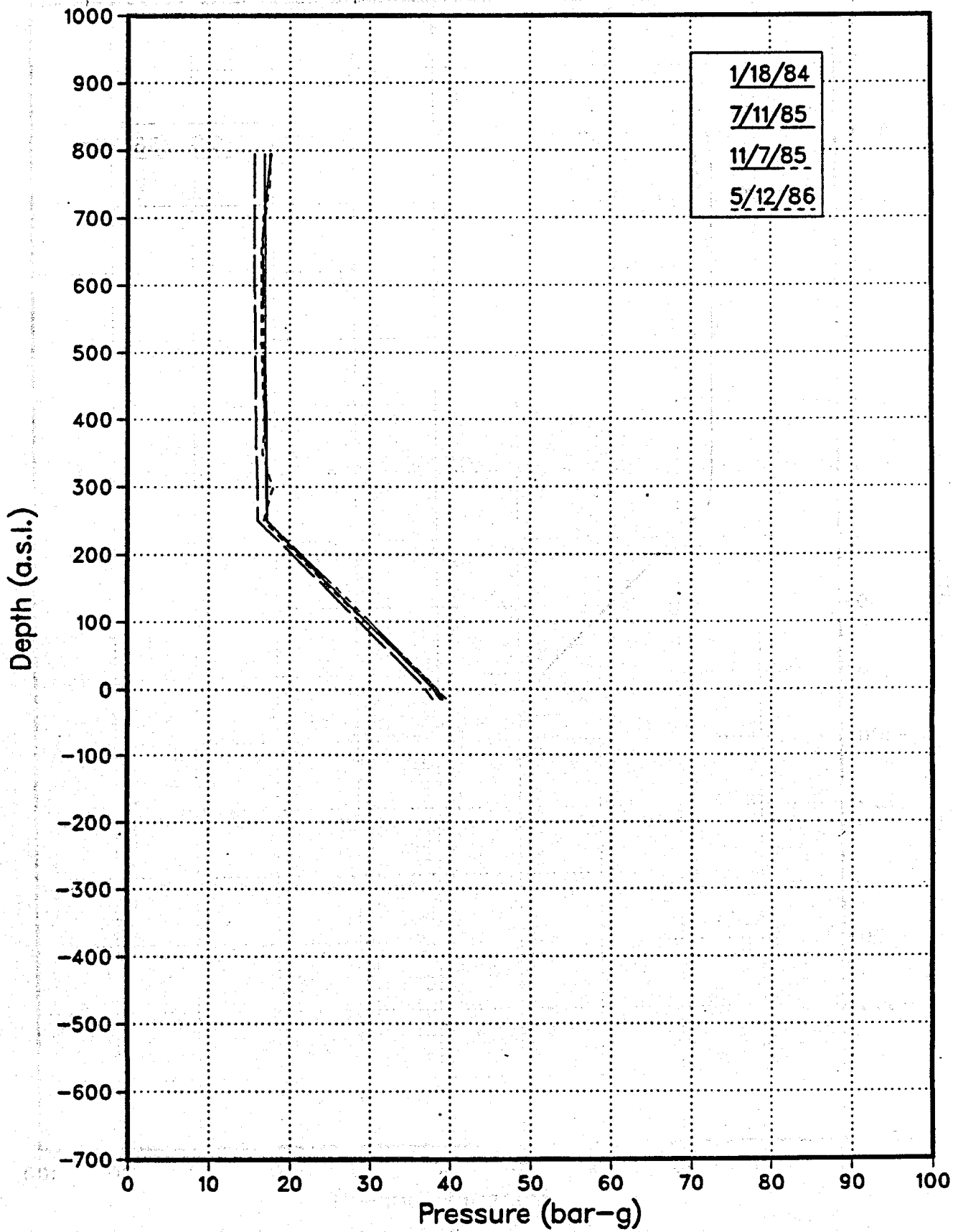
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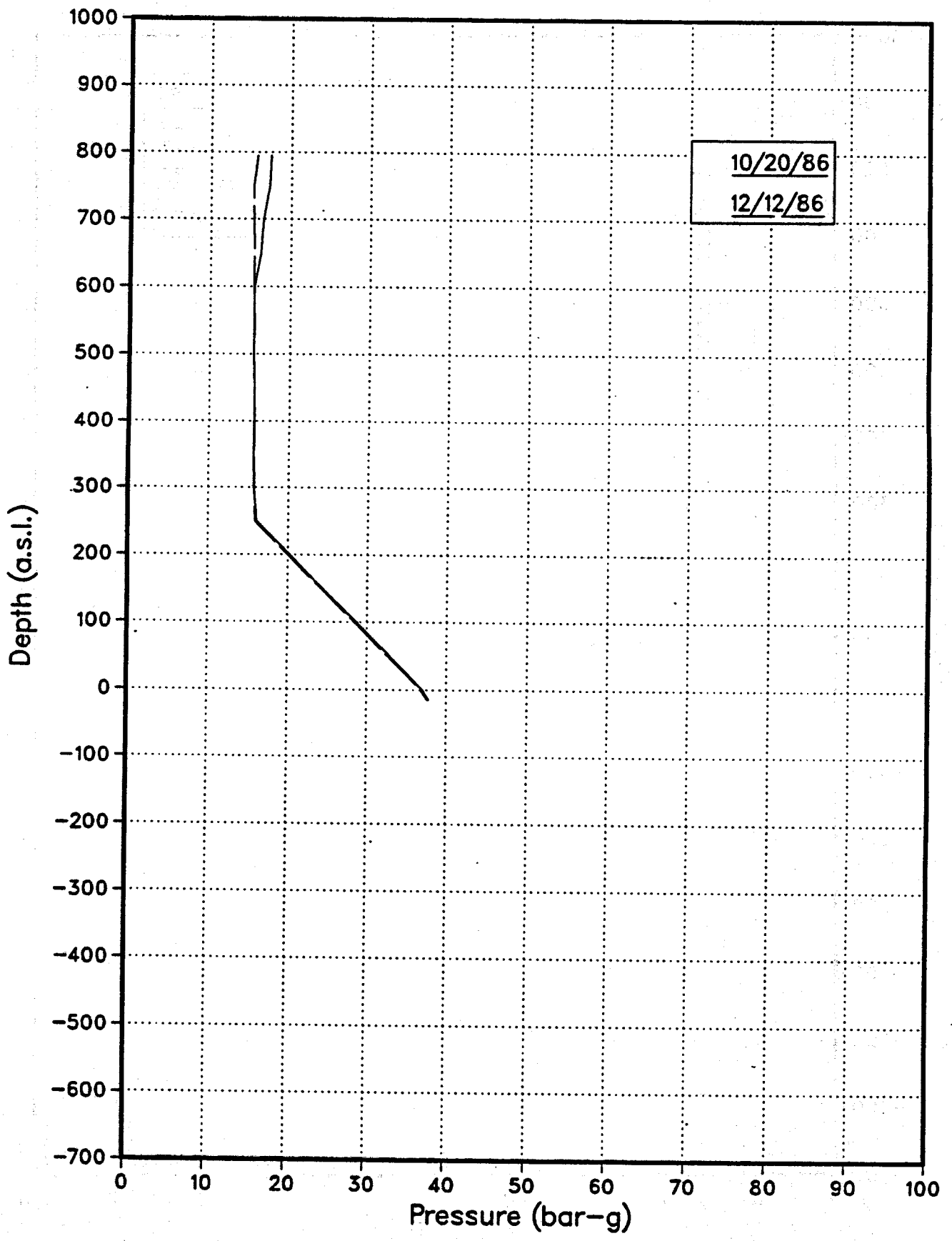
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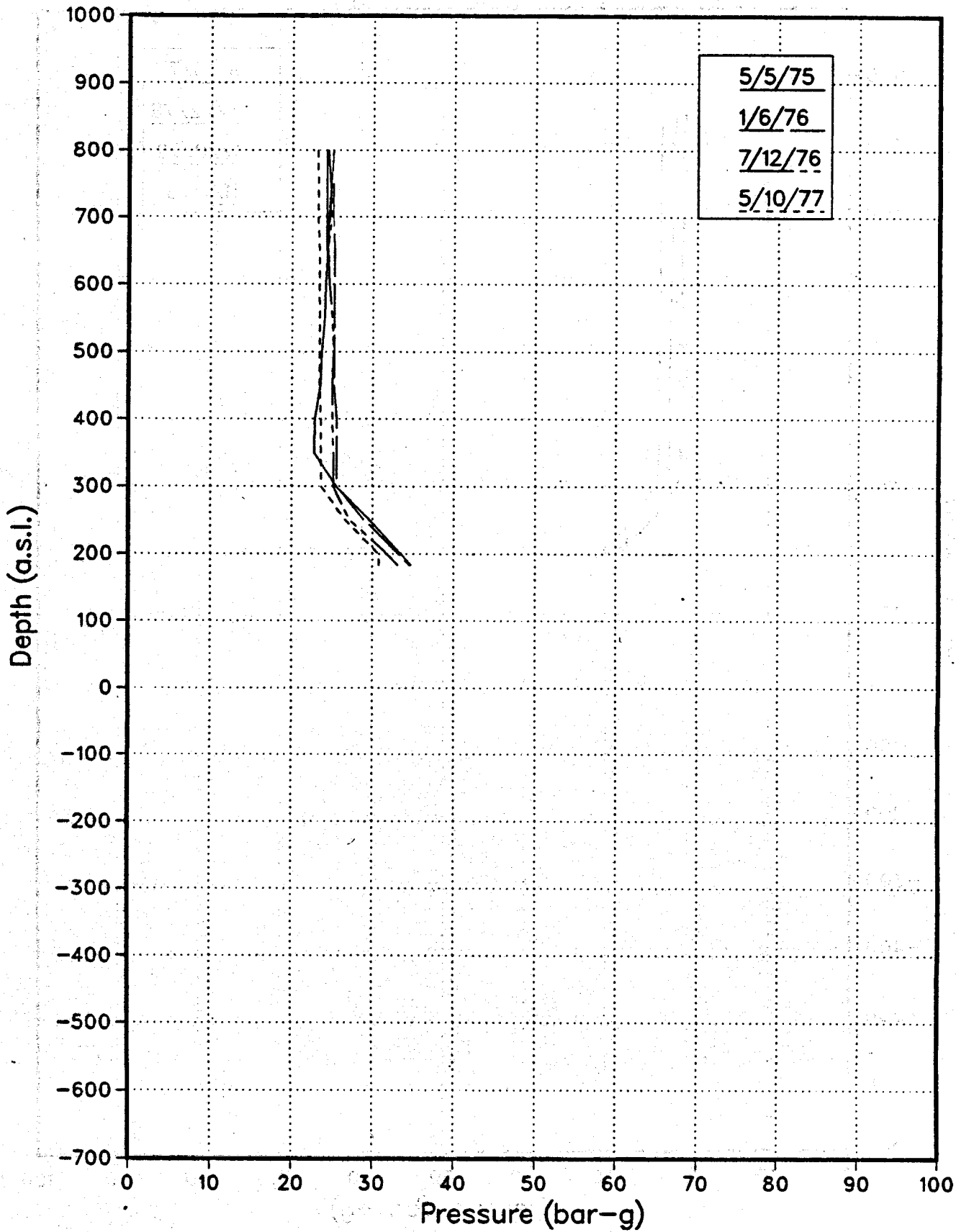
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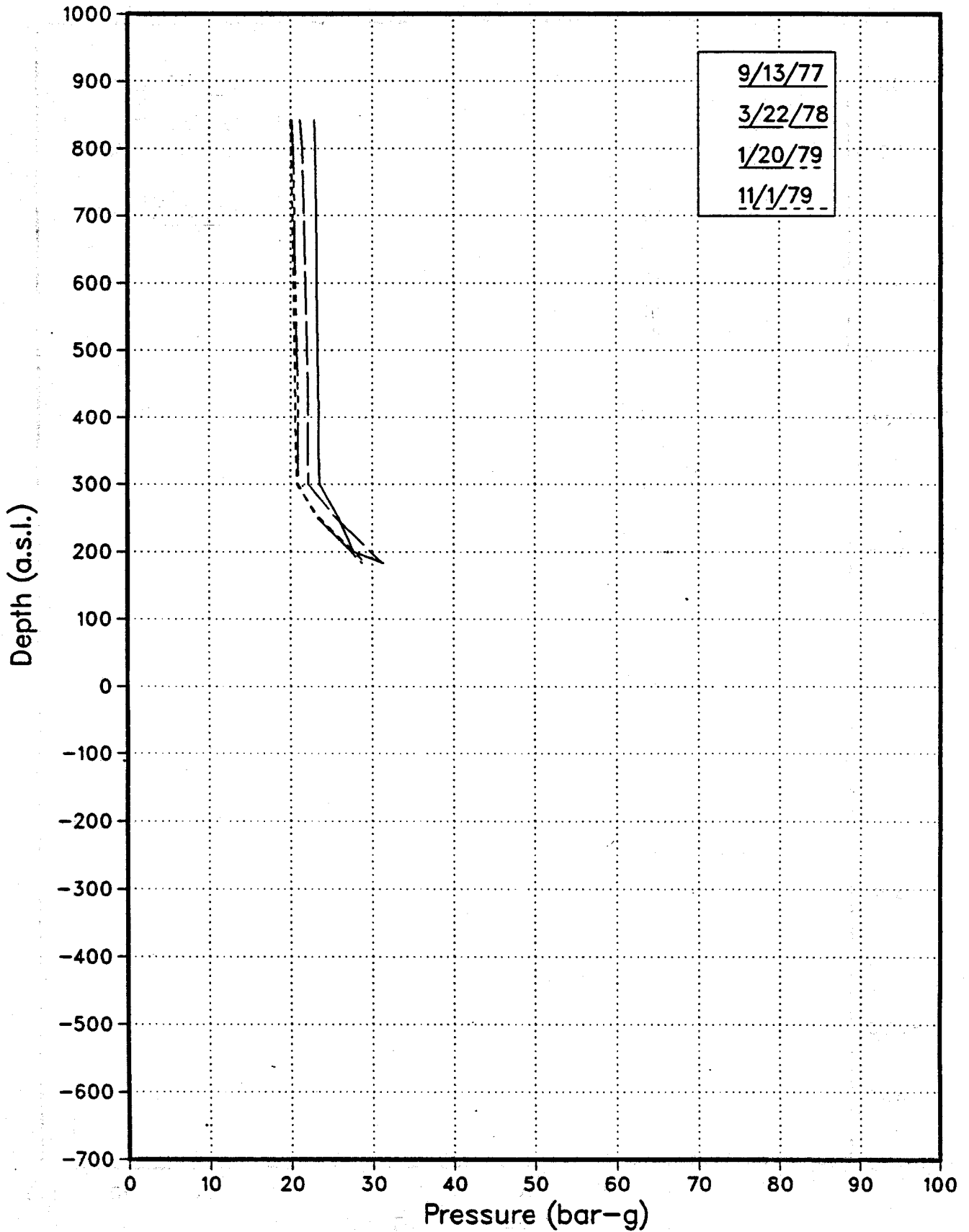
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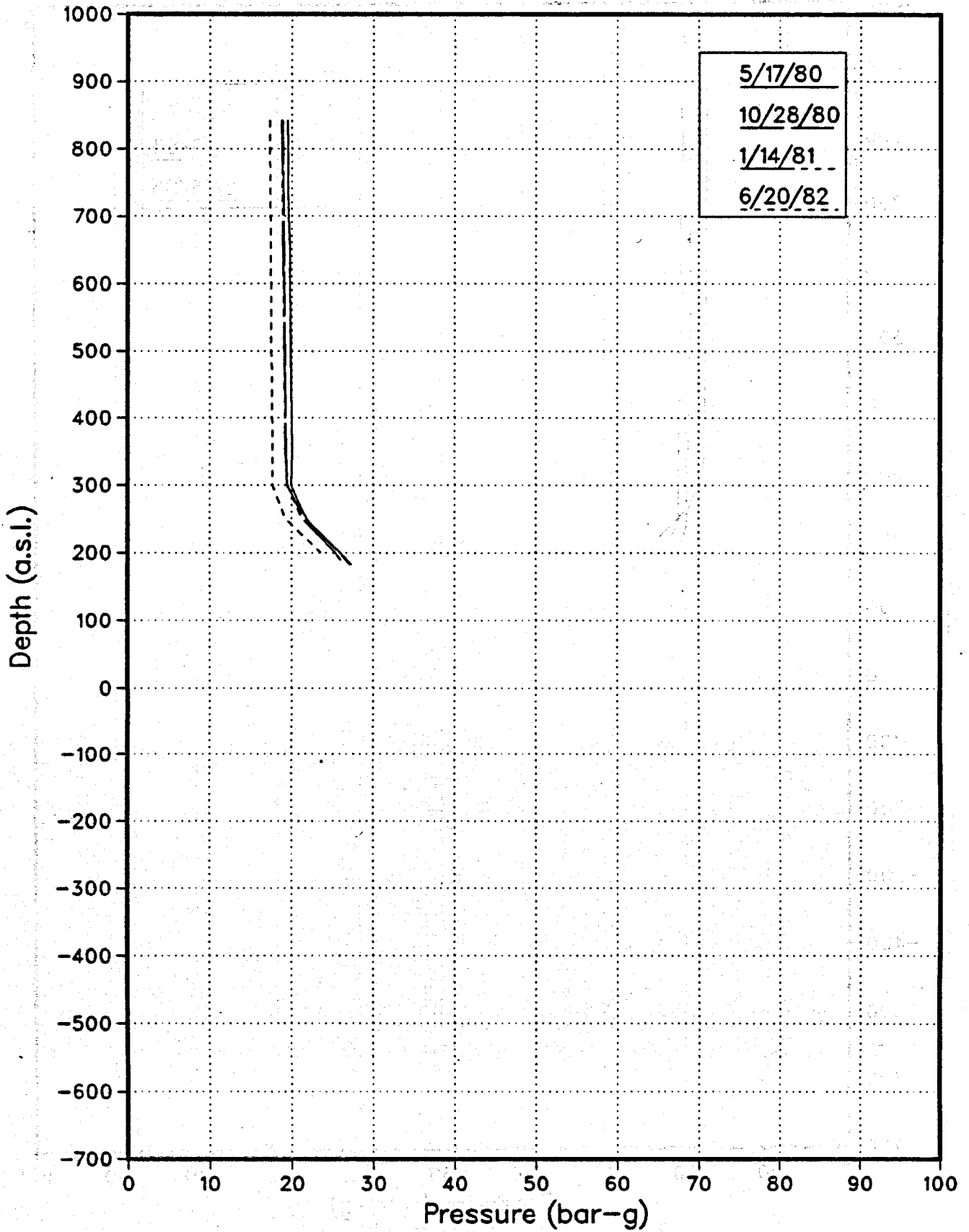
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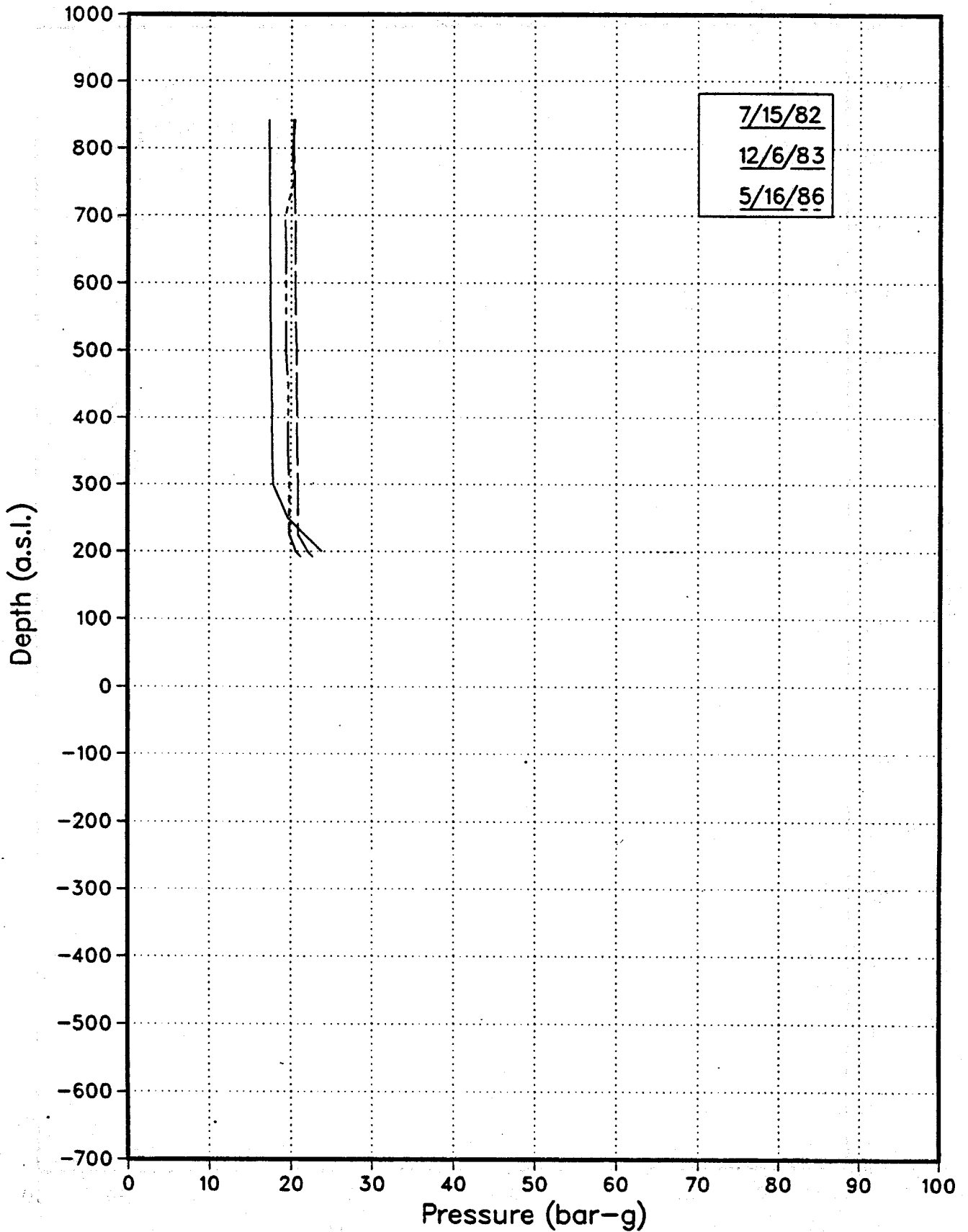
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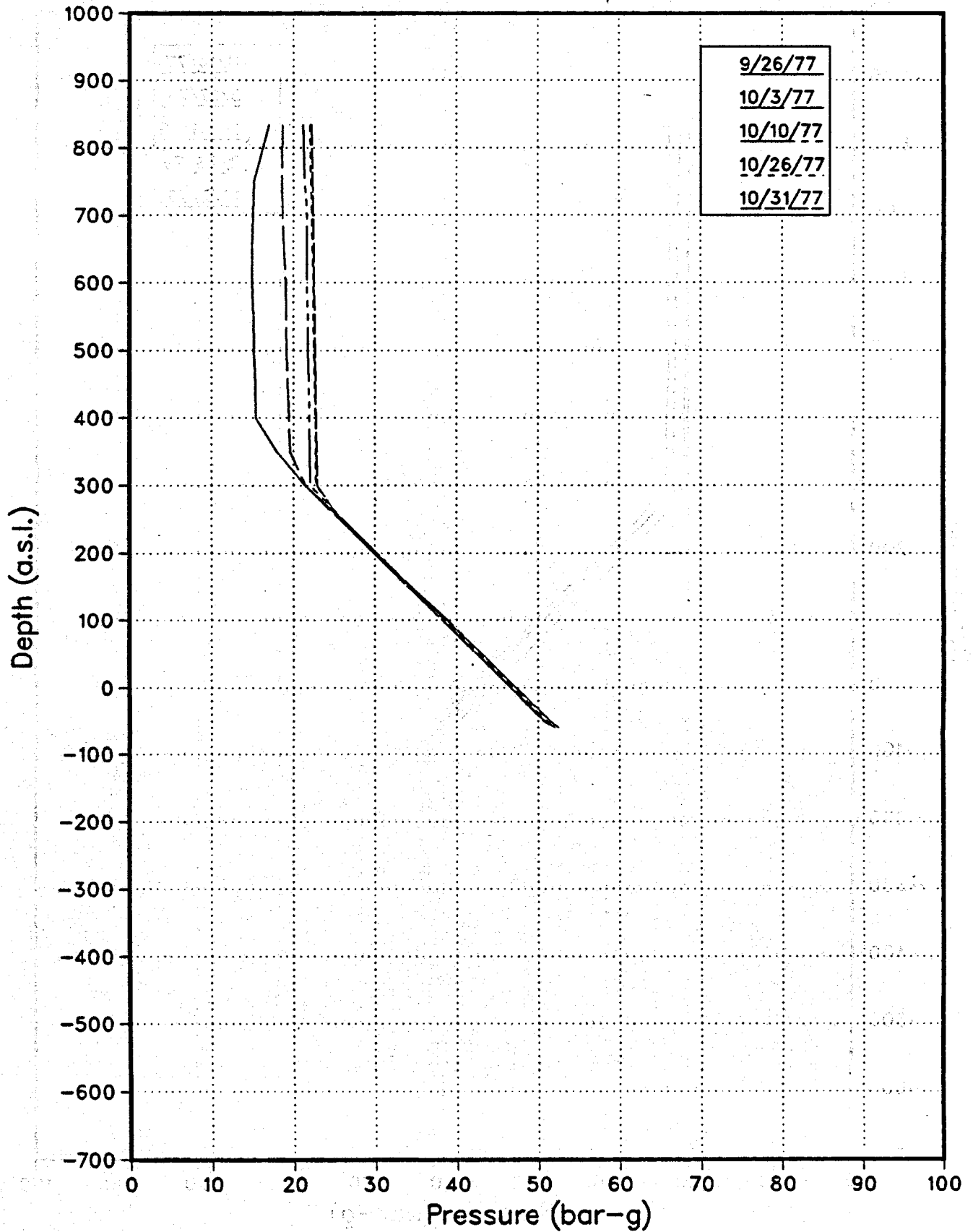
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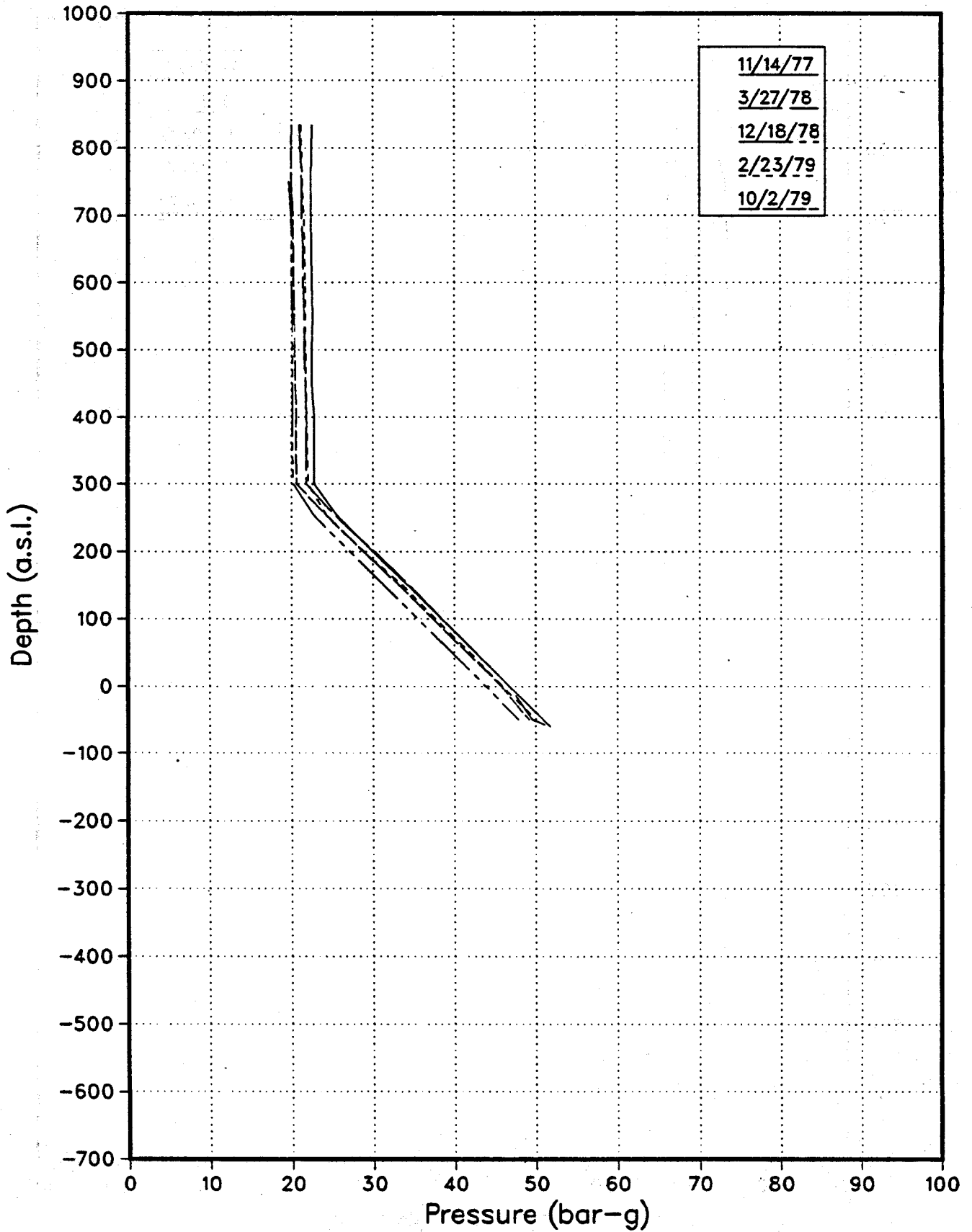
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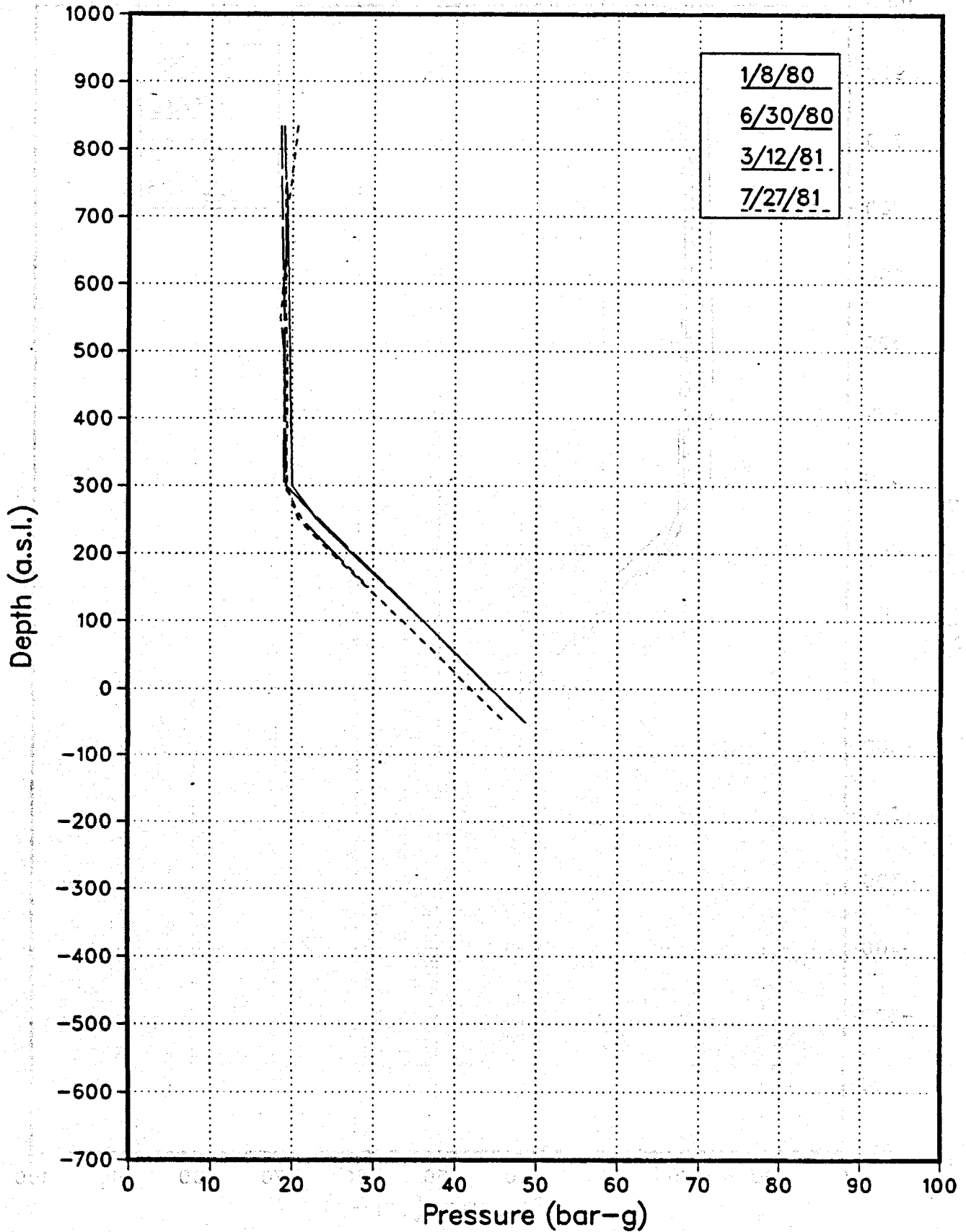
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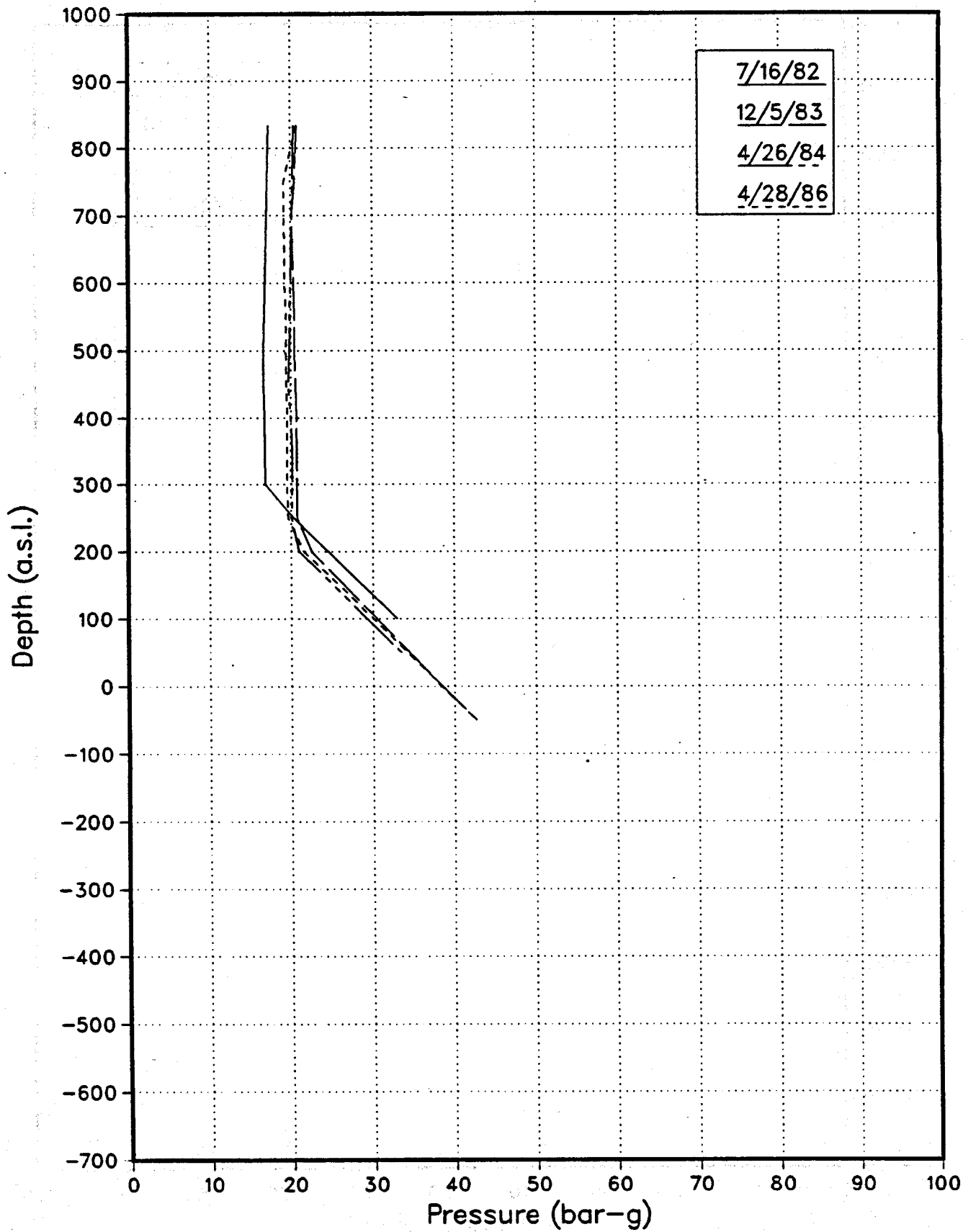
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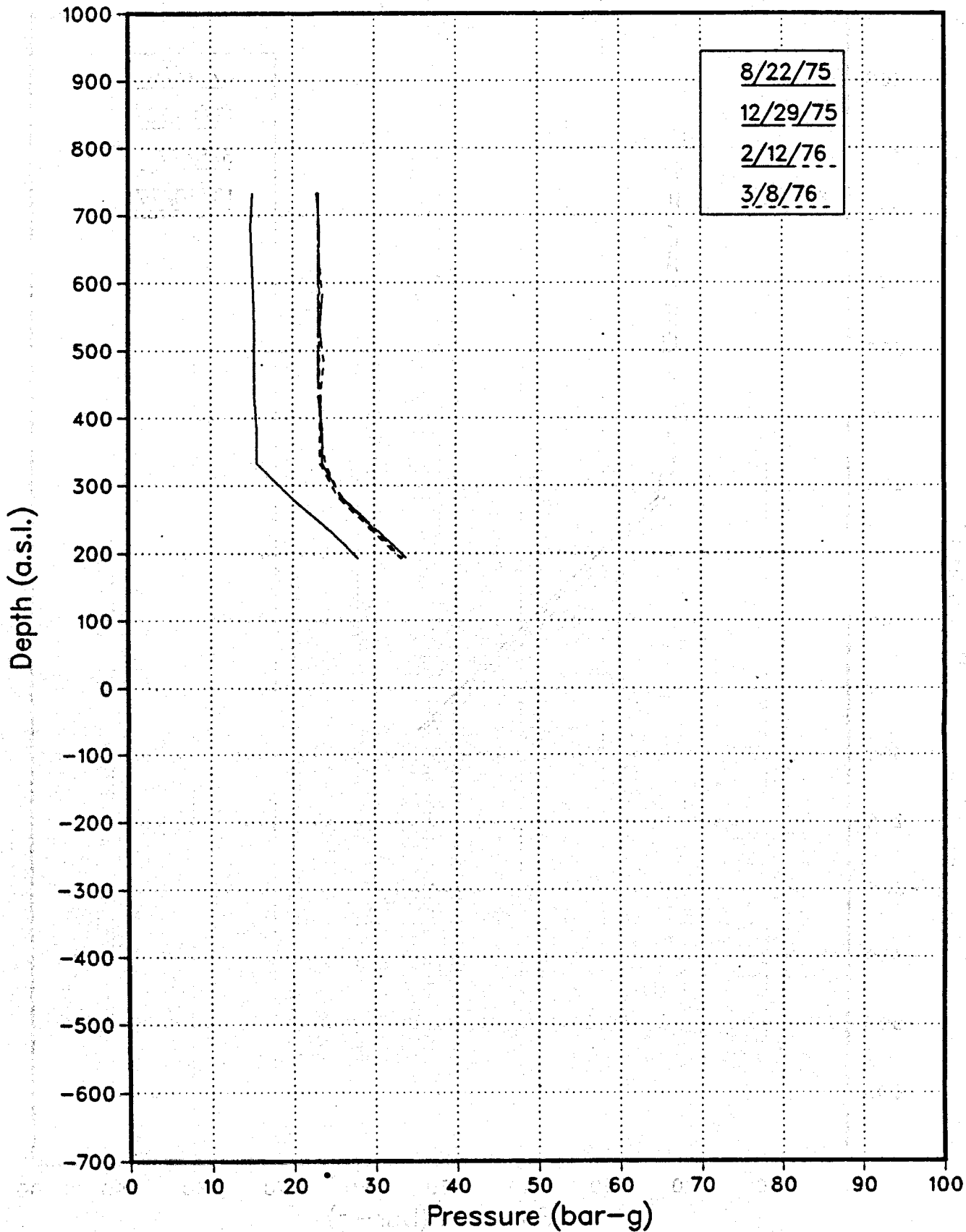
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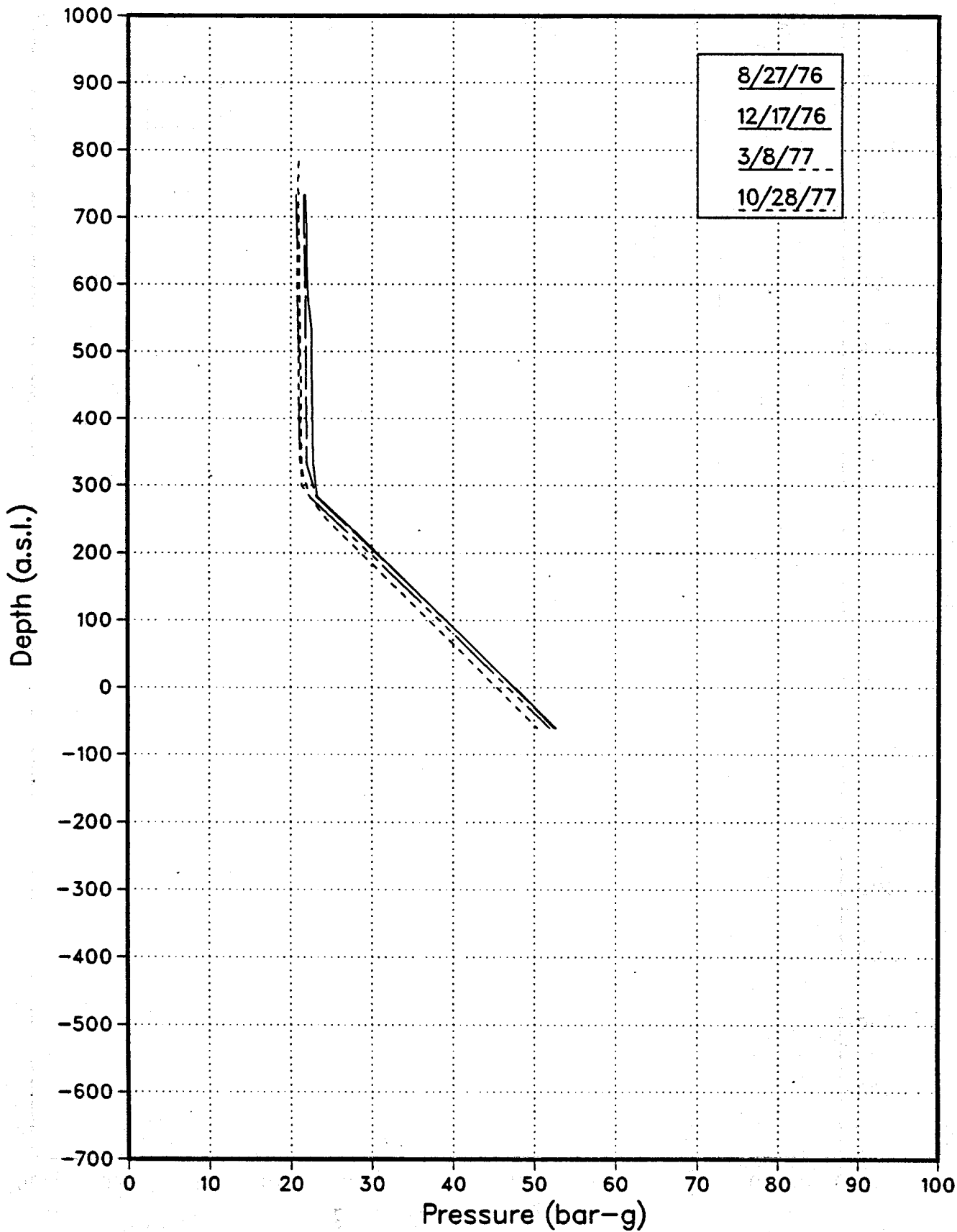
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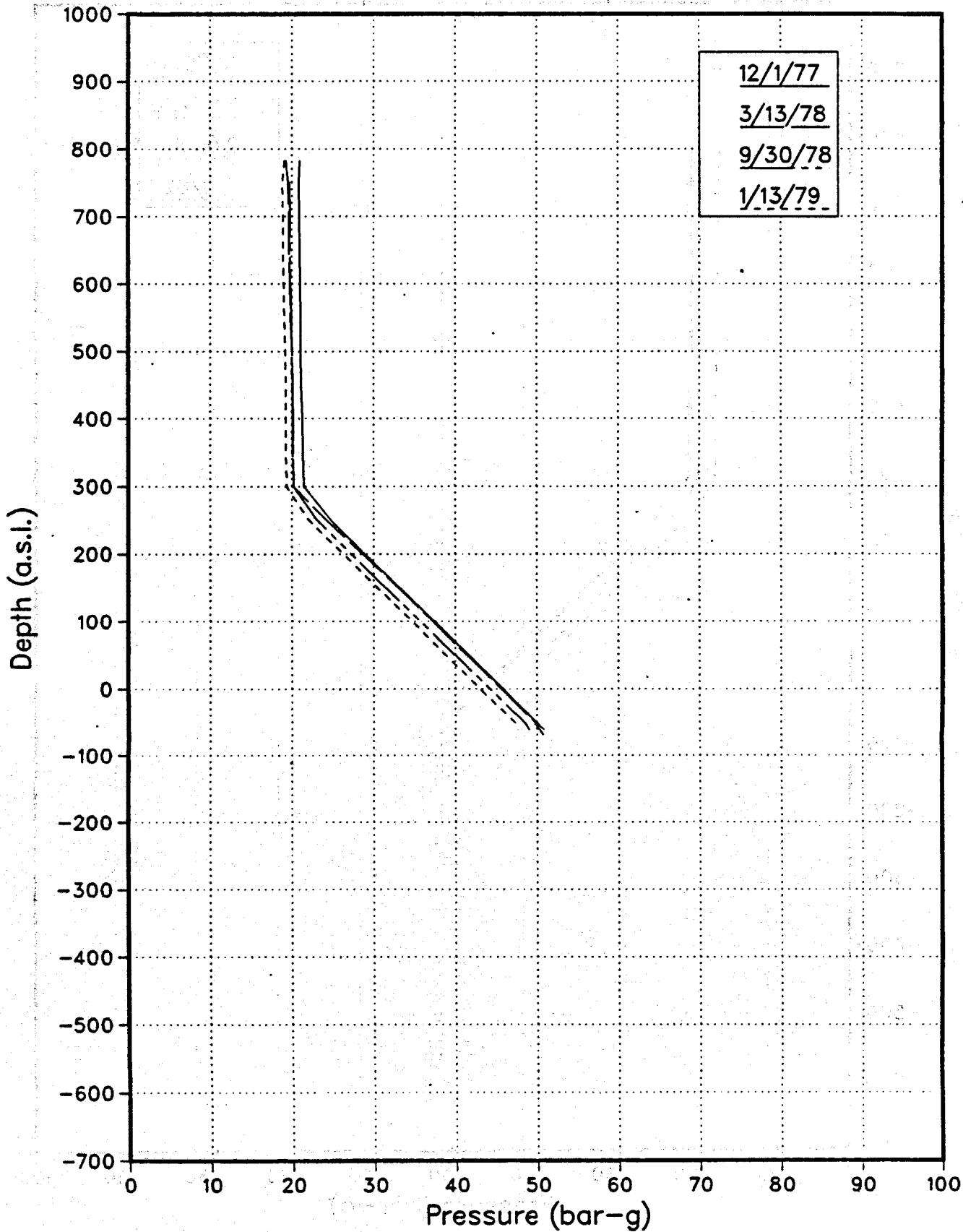
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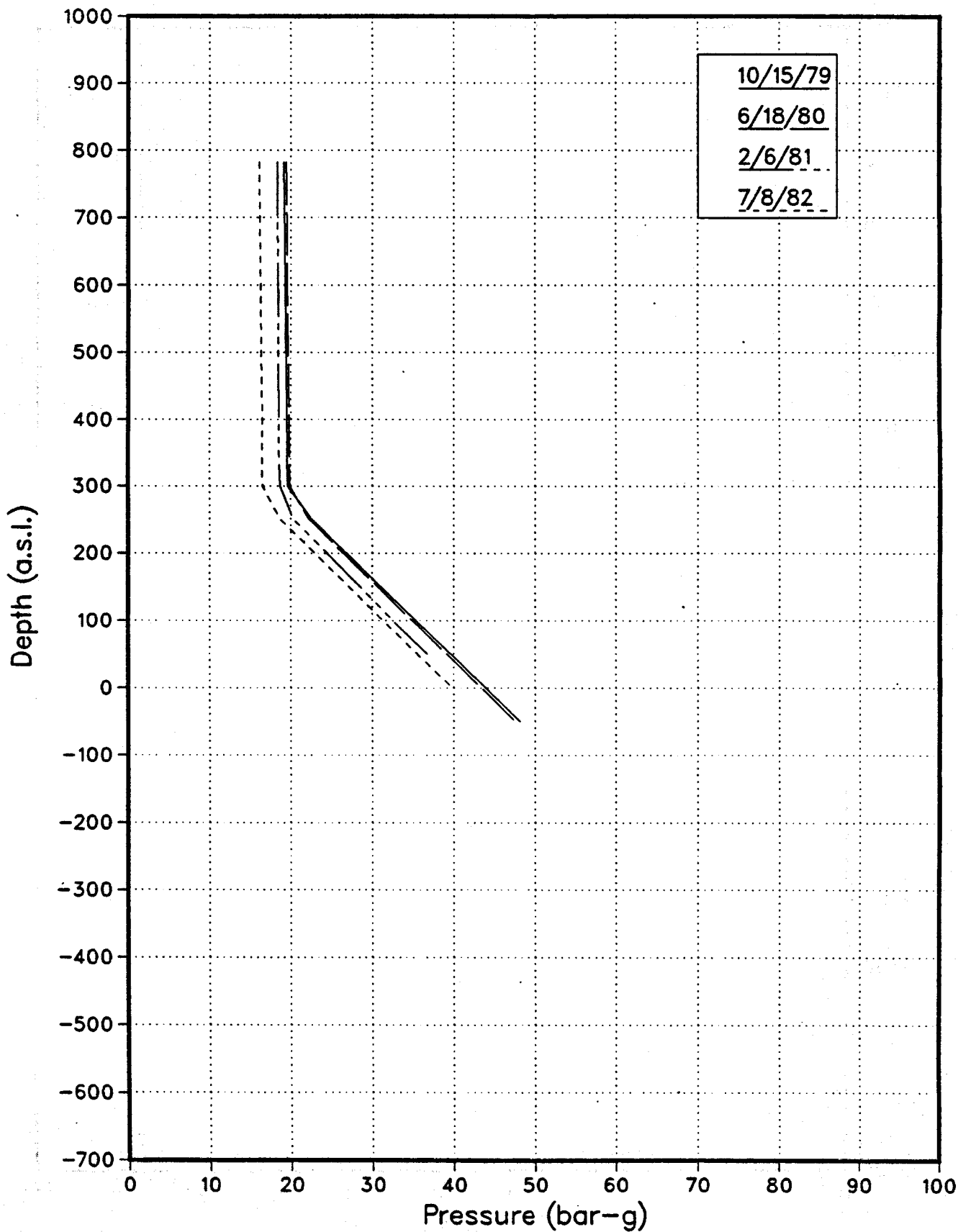
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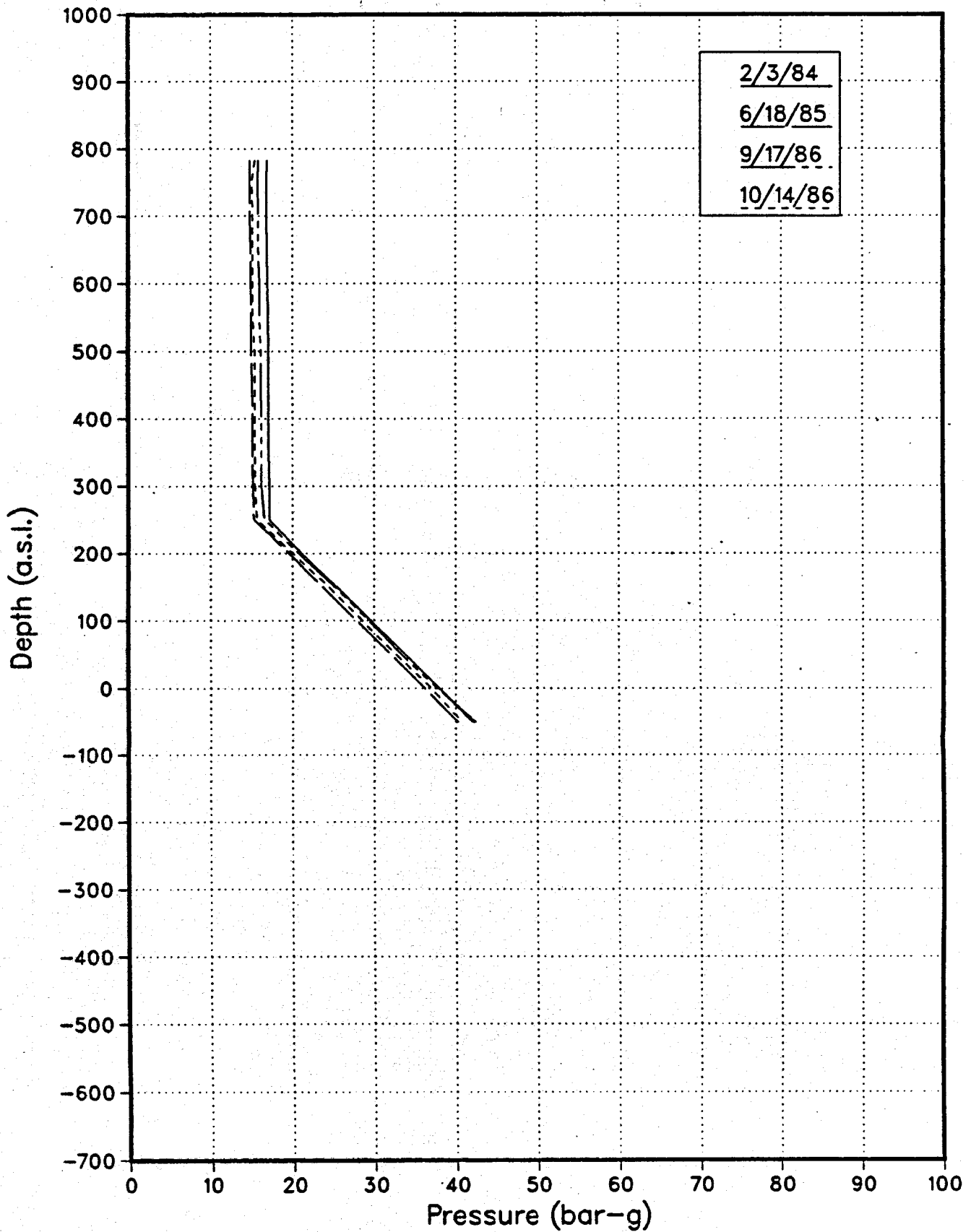
AH24 Pressure Surveys



AH24 Pressure Surveys



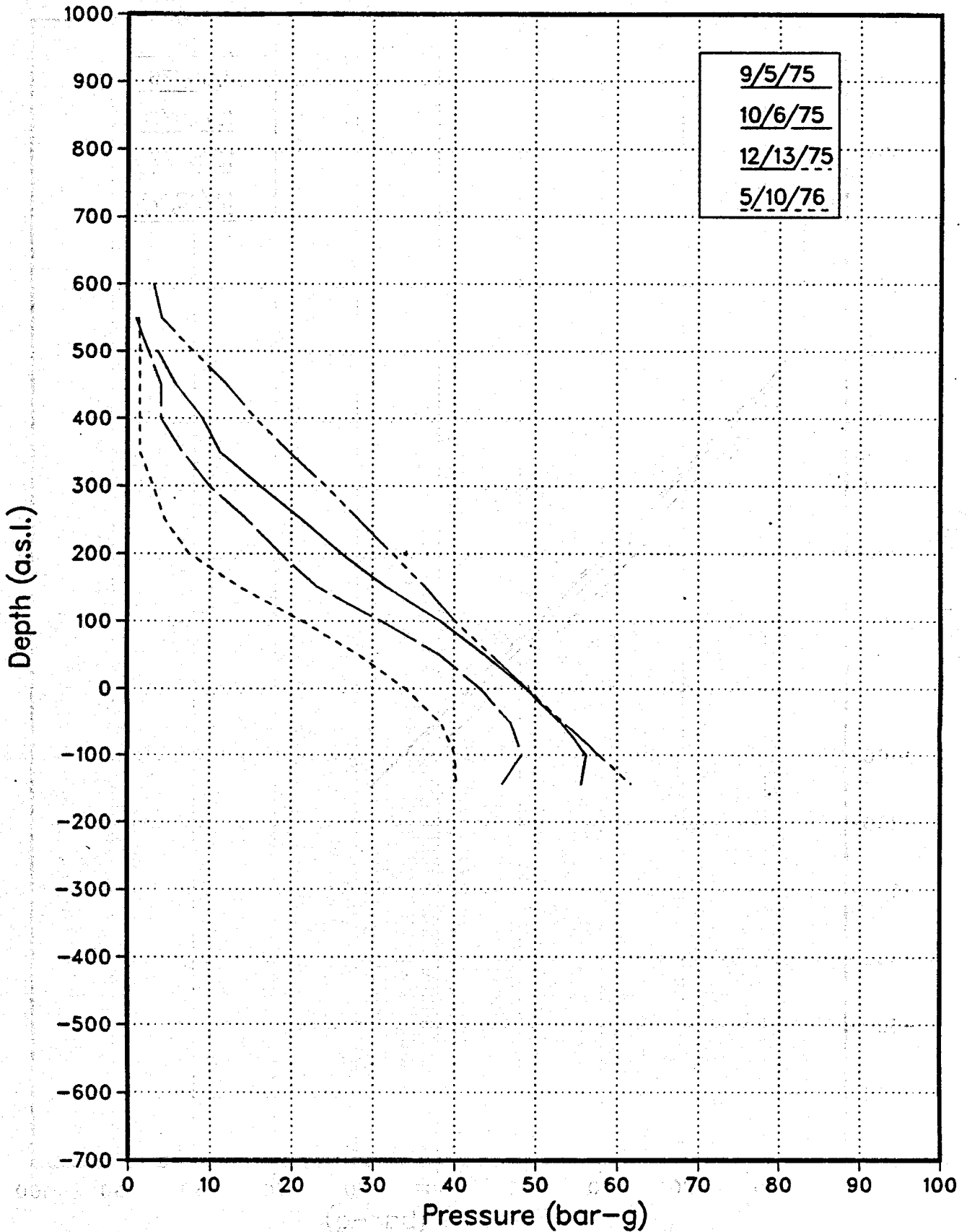
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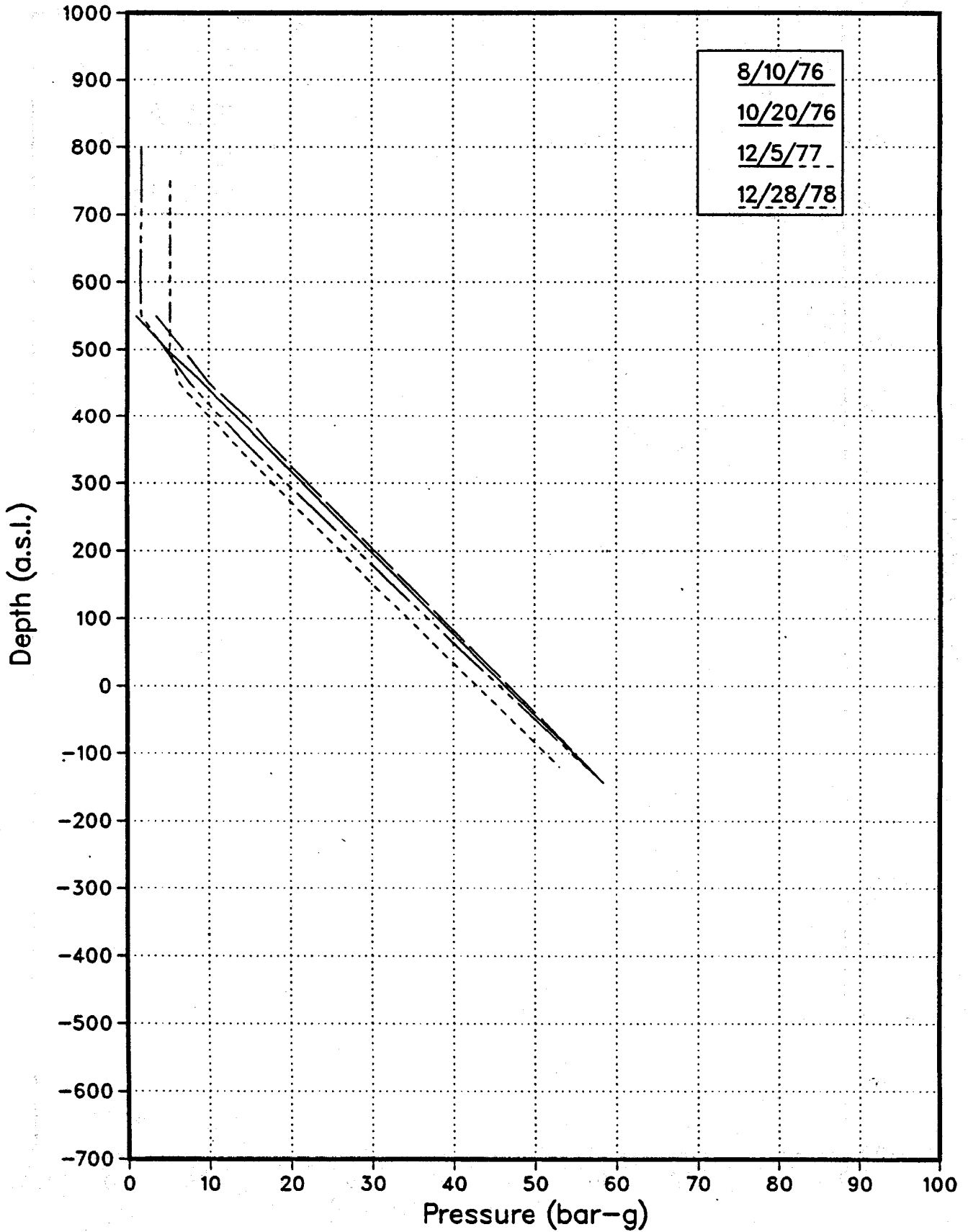
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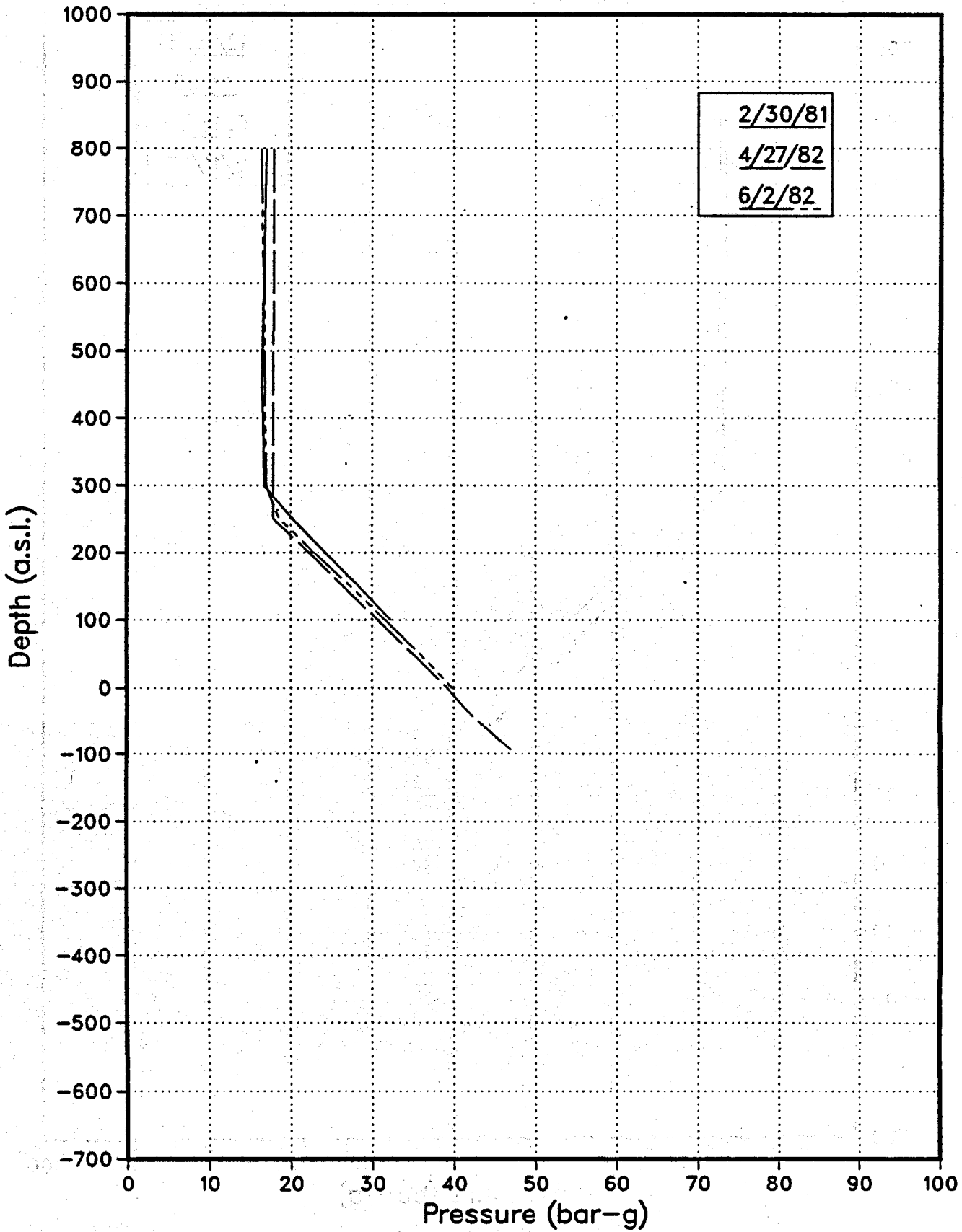
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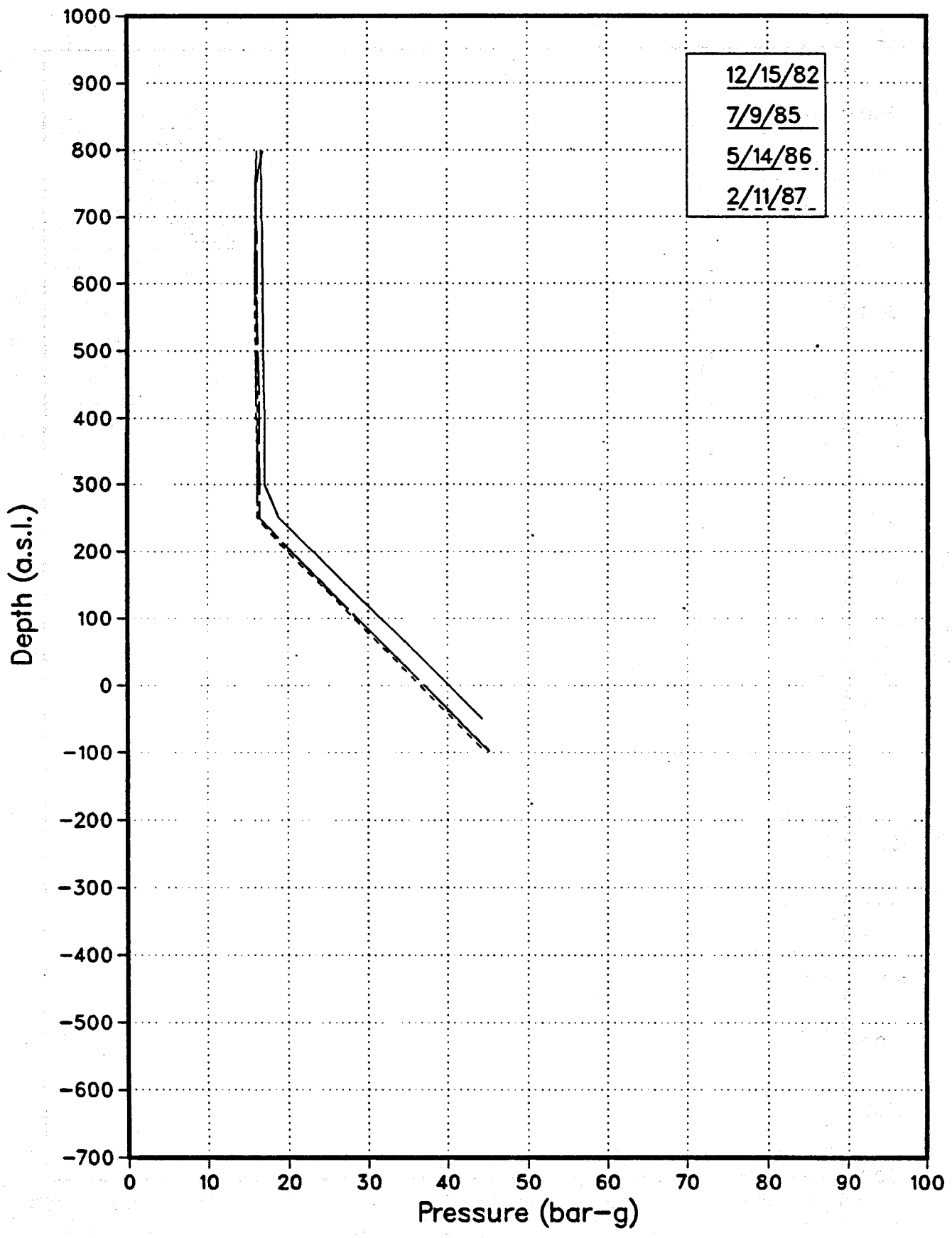
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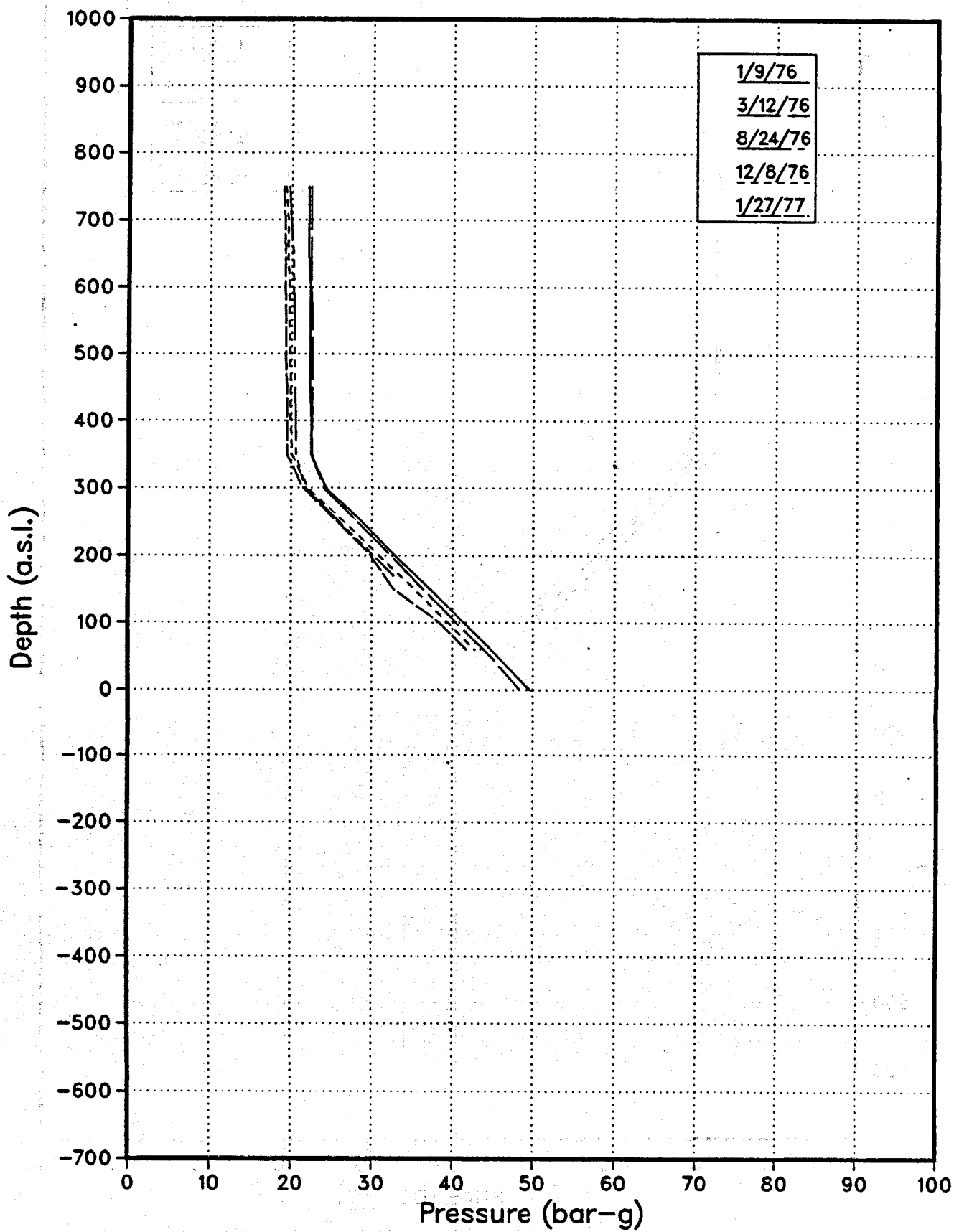
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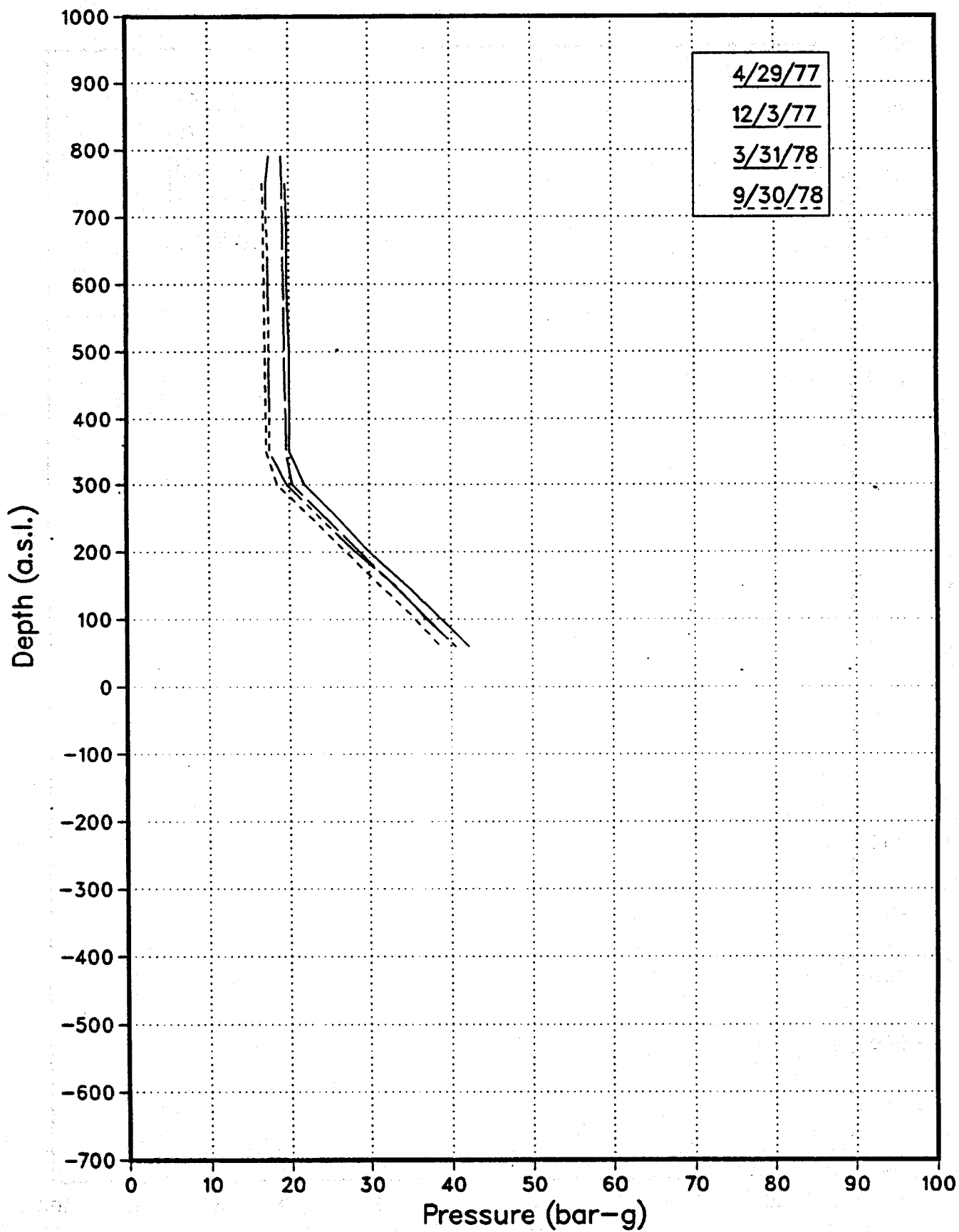
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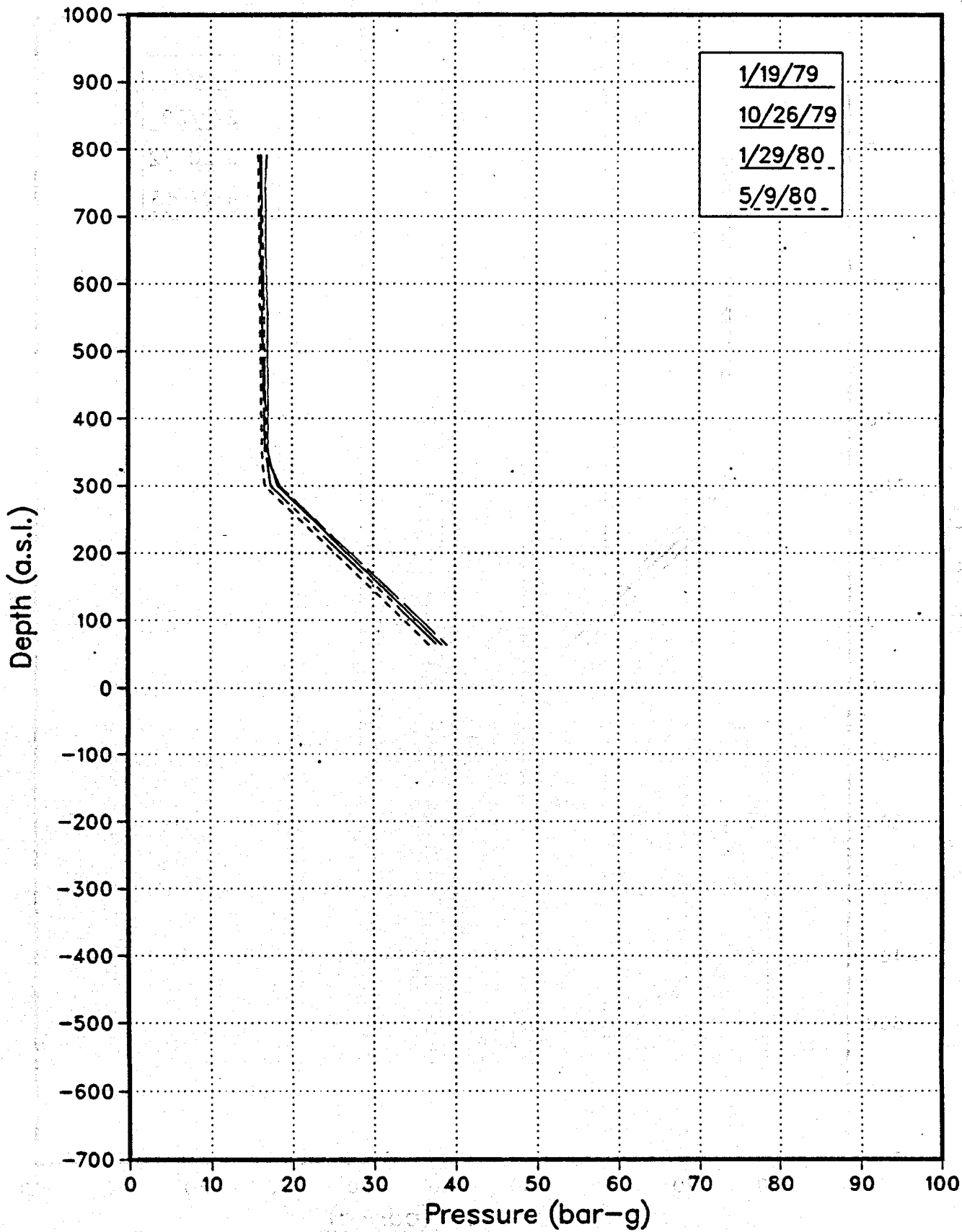
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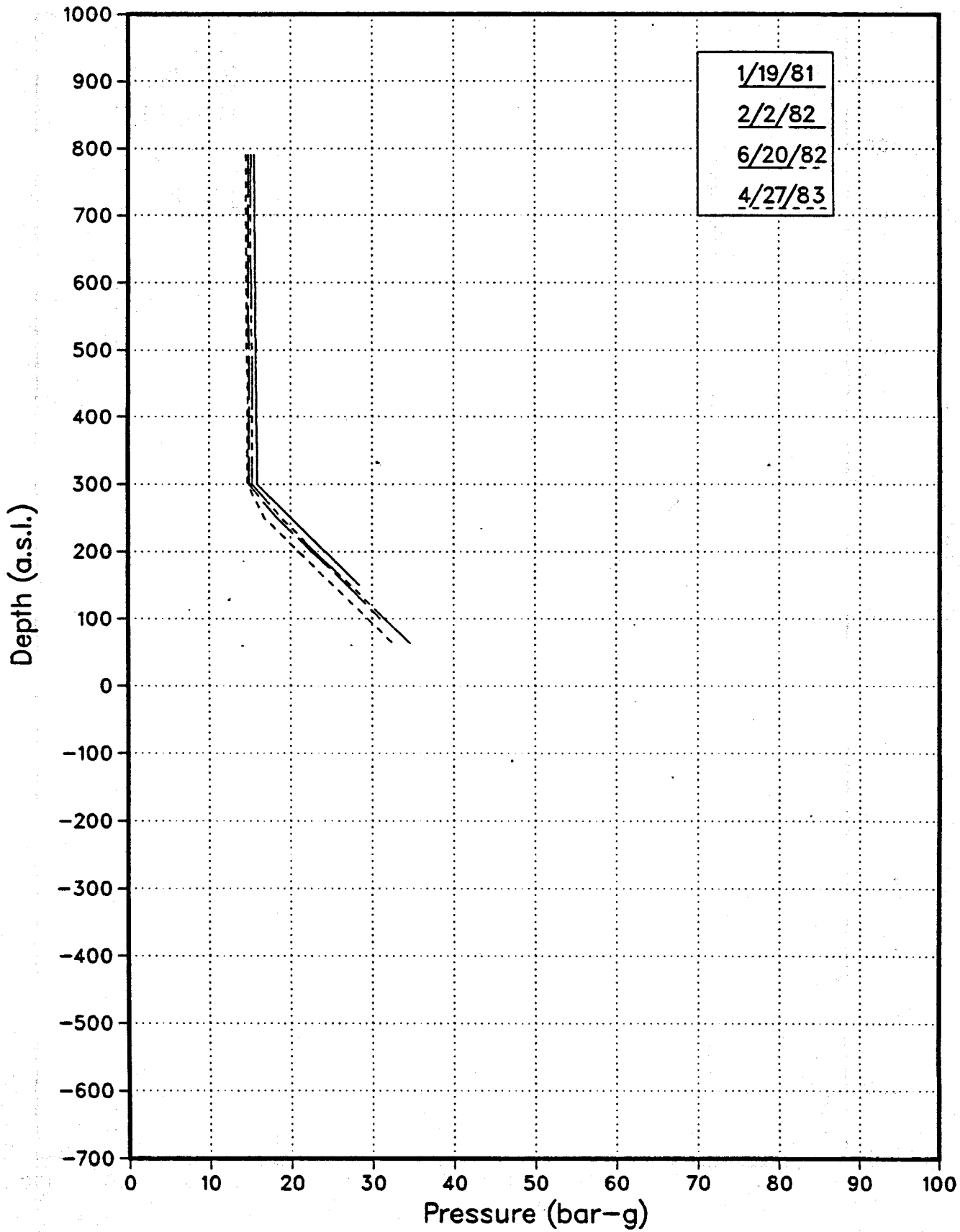
AH26 Pressure Surveys



AH26 Pressure Surveys

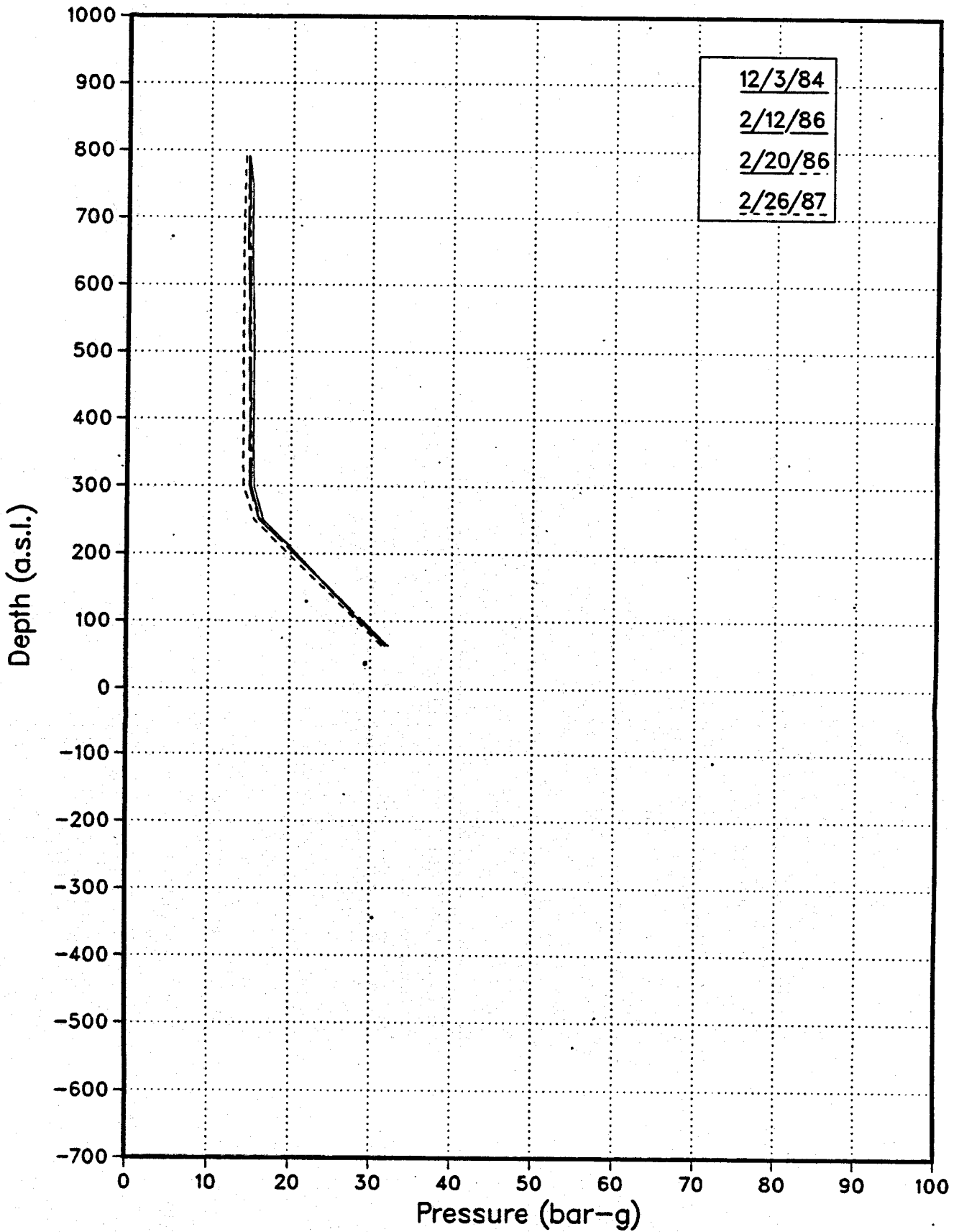


AH26 Pressure Surveys



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AH26 Pressure Surveys

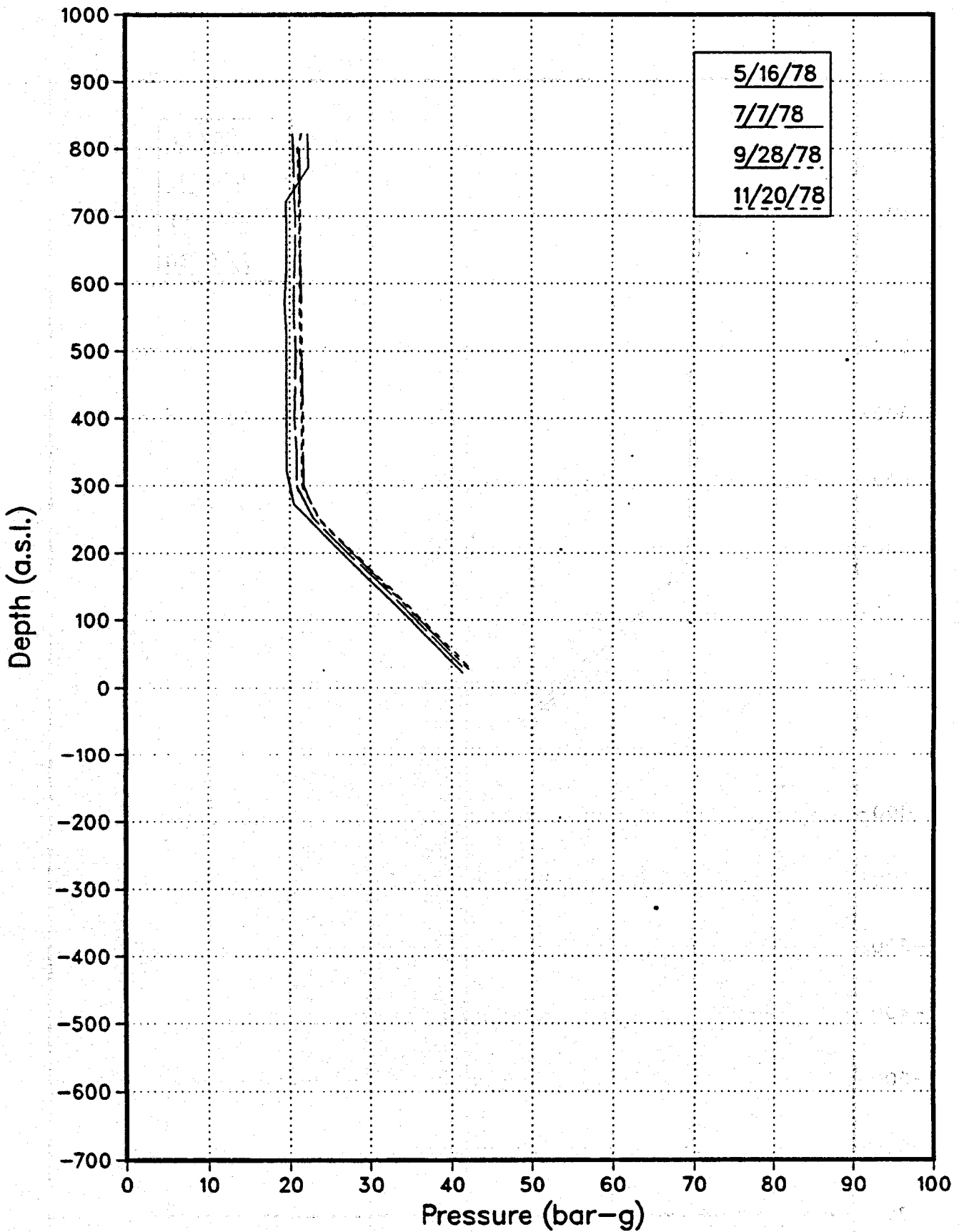


CONFIDENTIAL

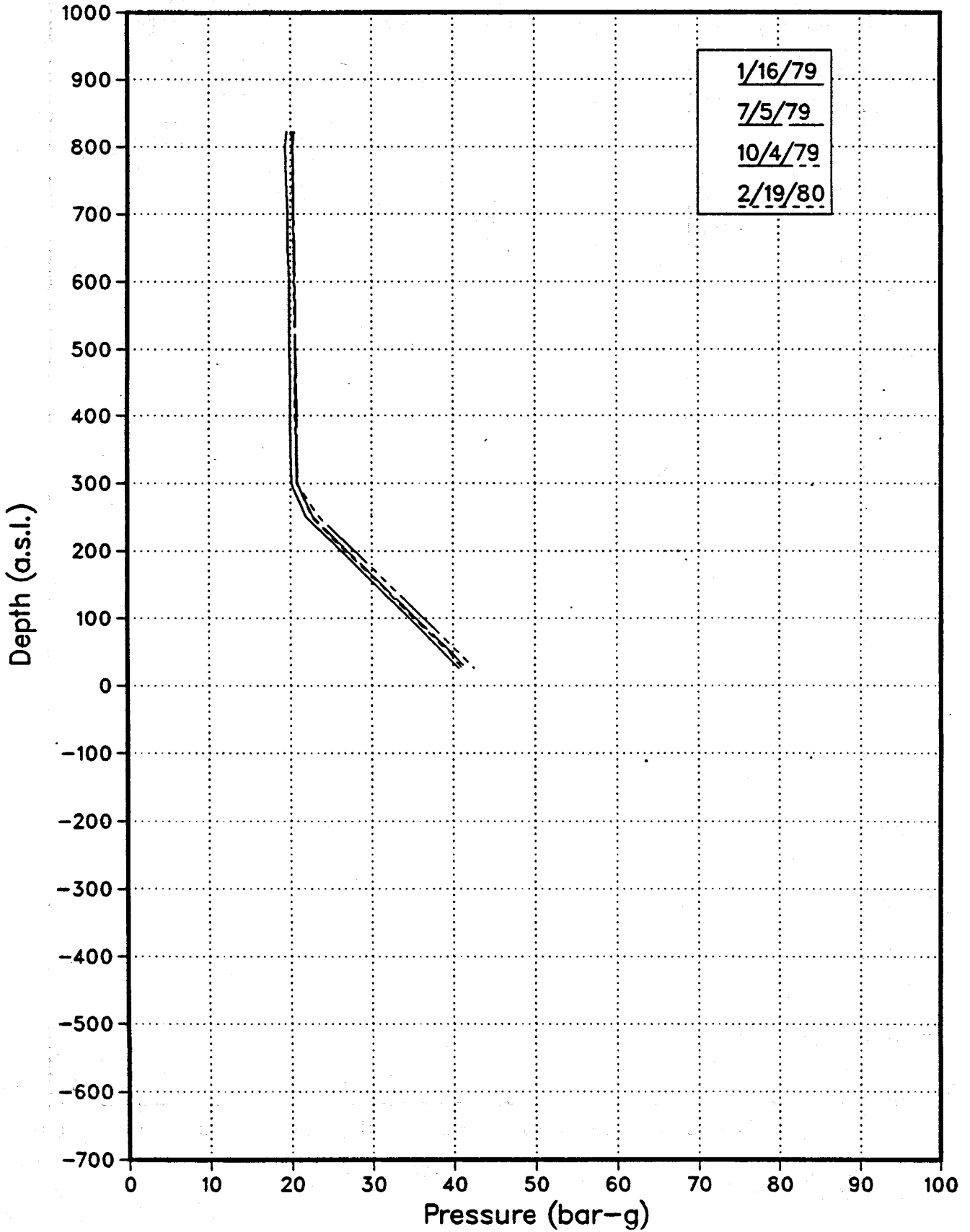
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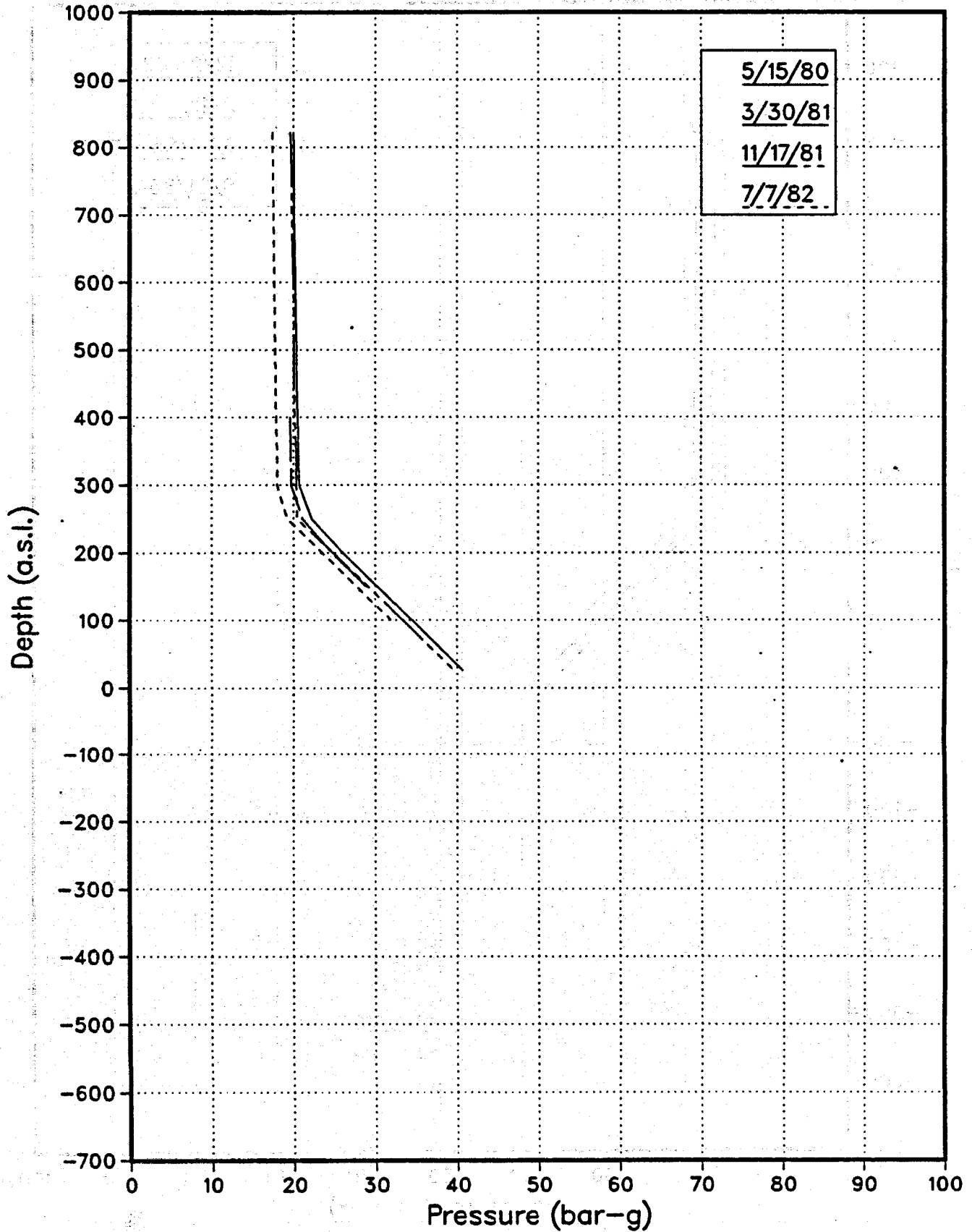
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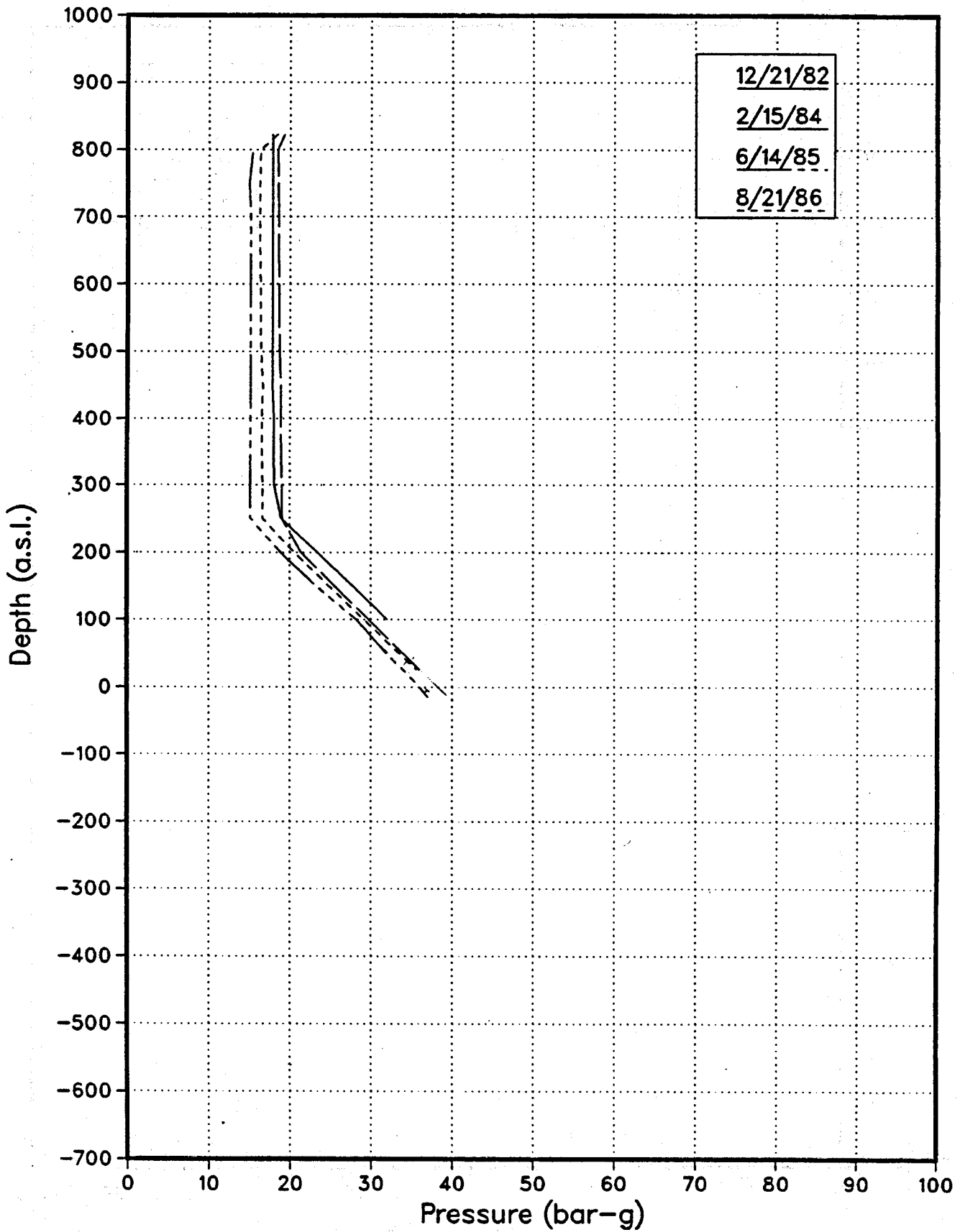
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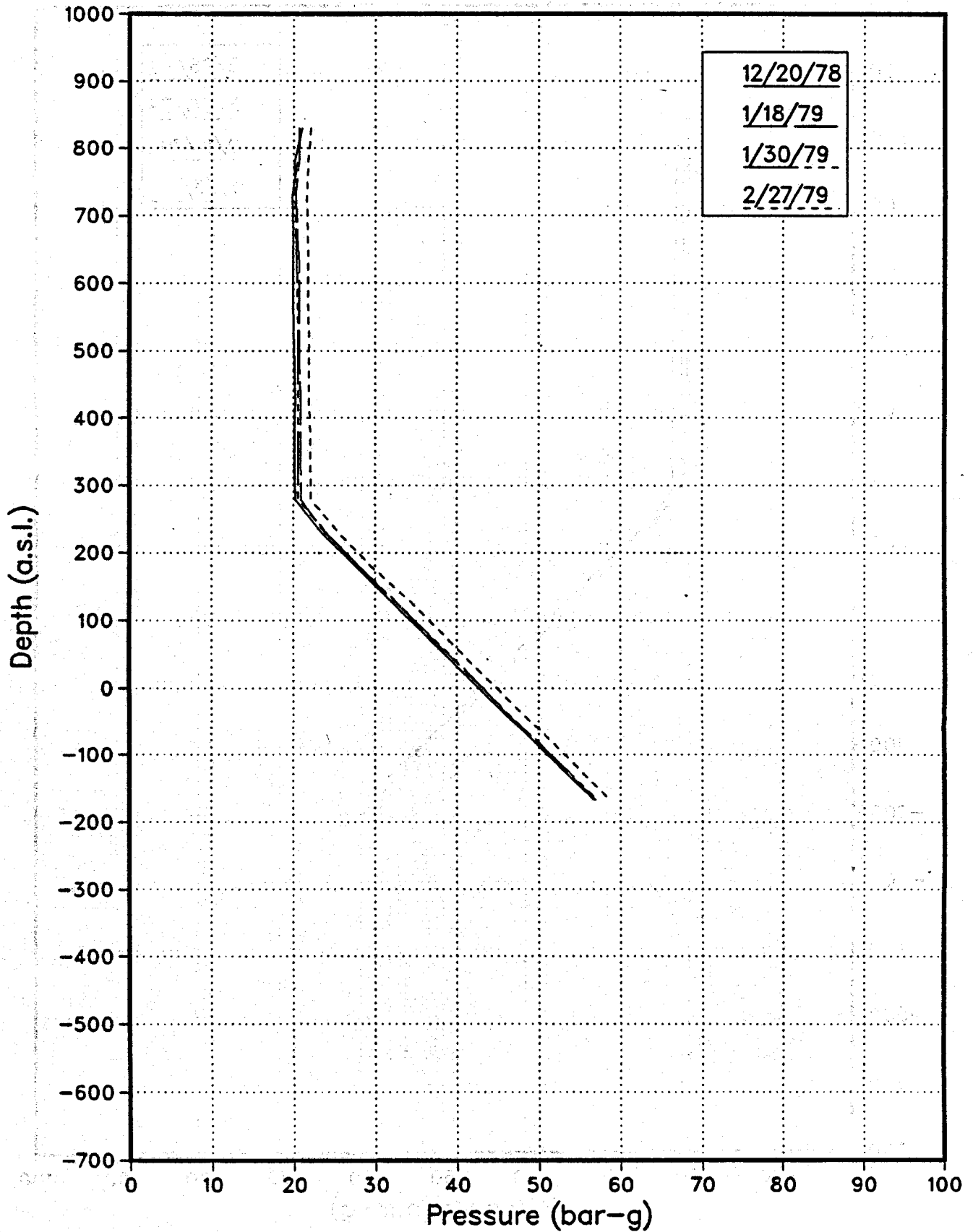
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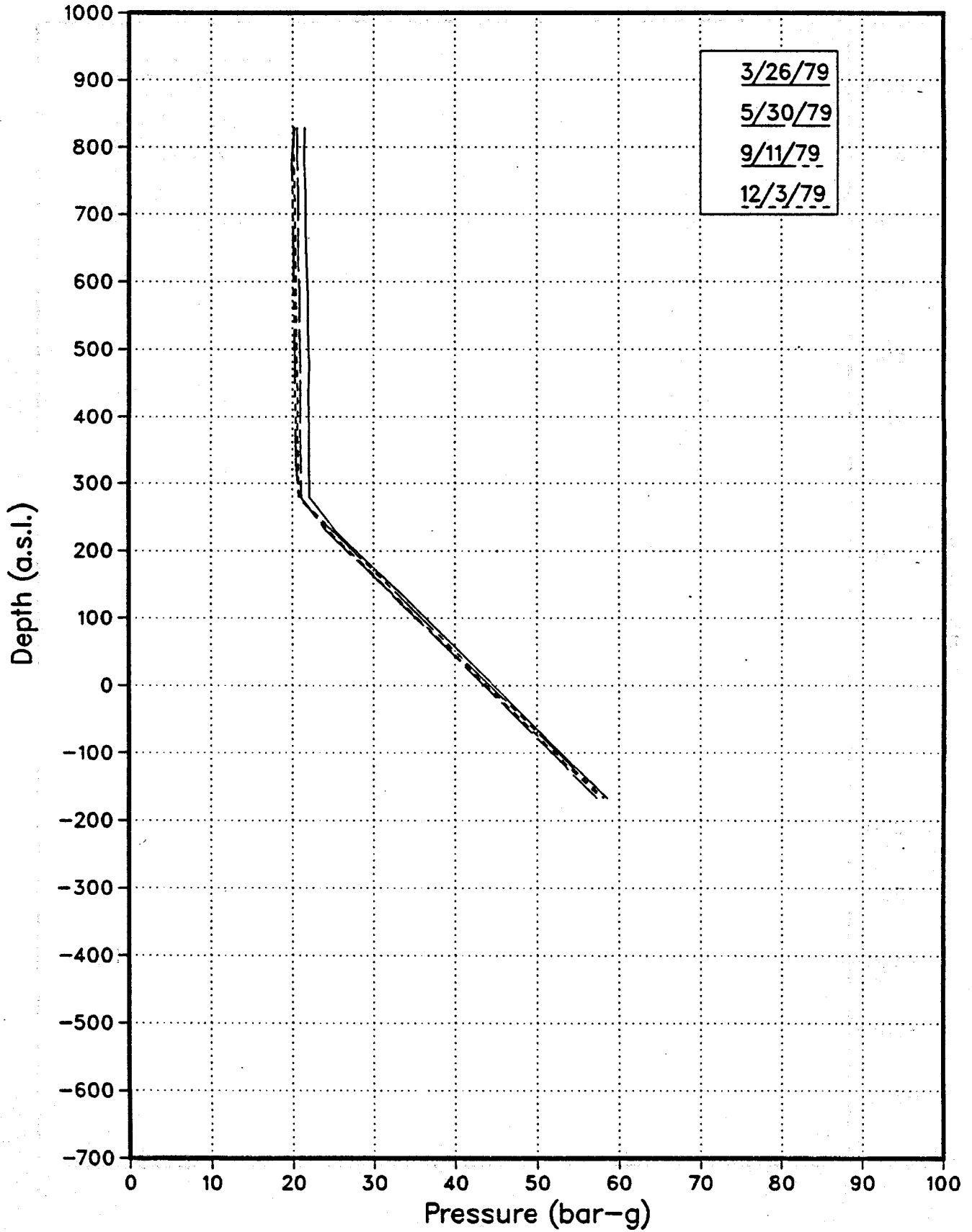
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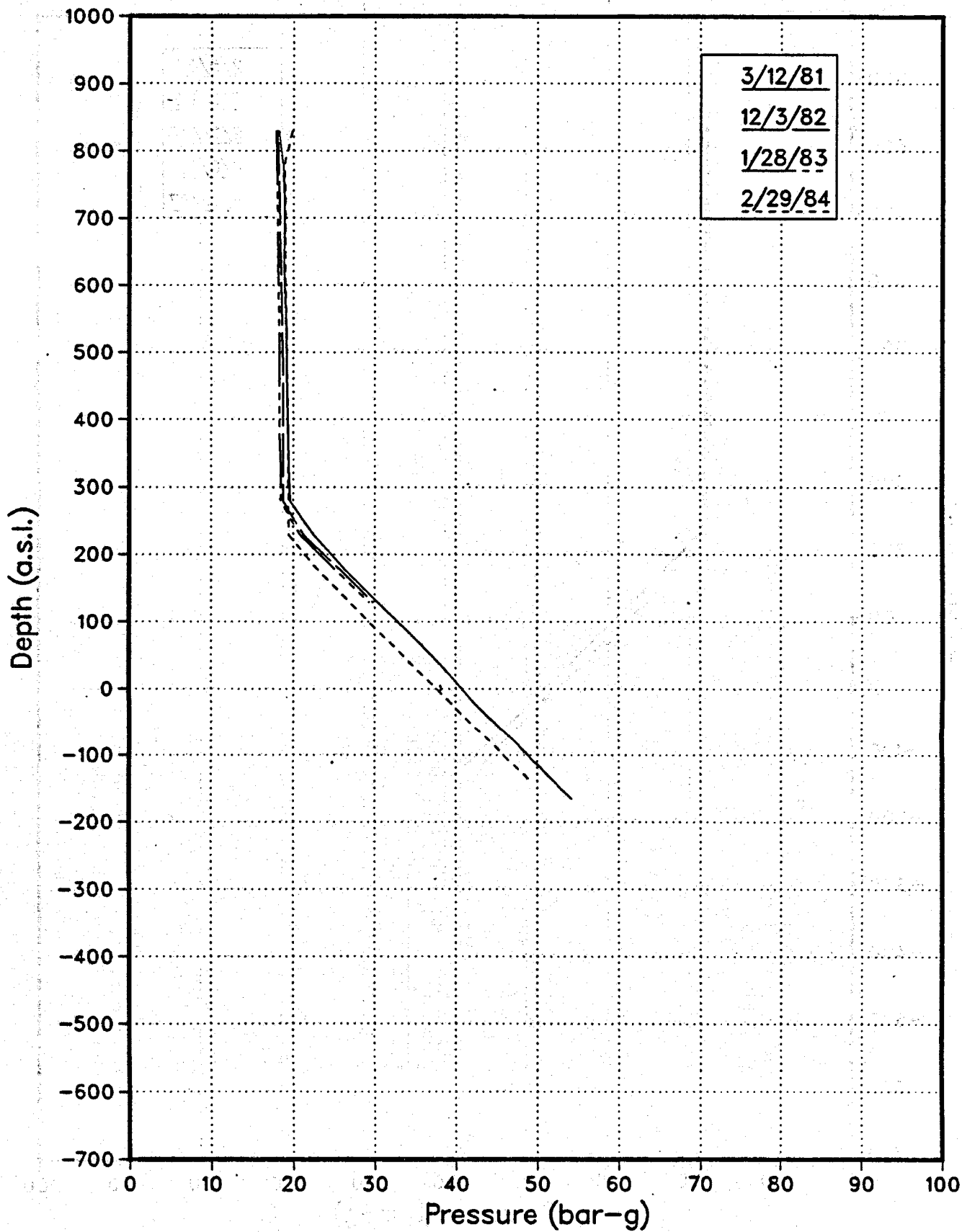
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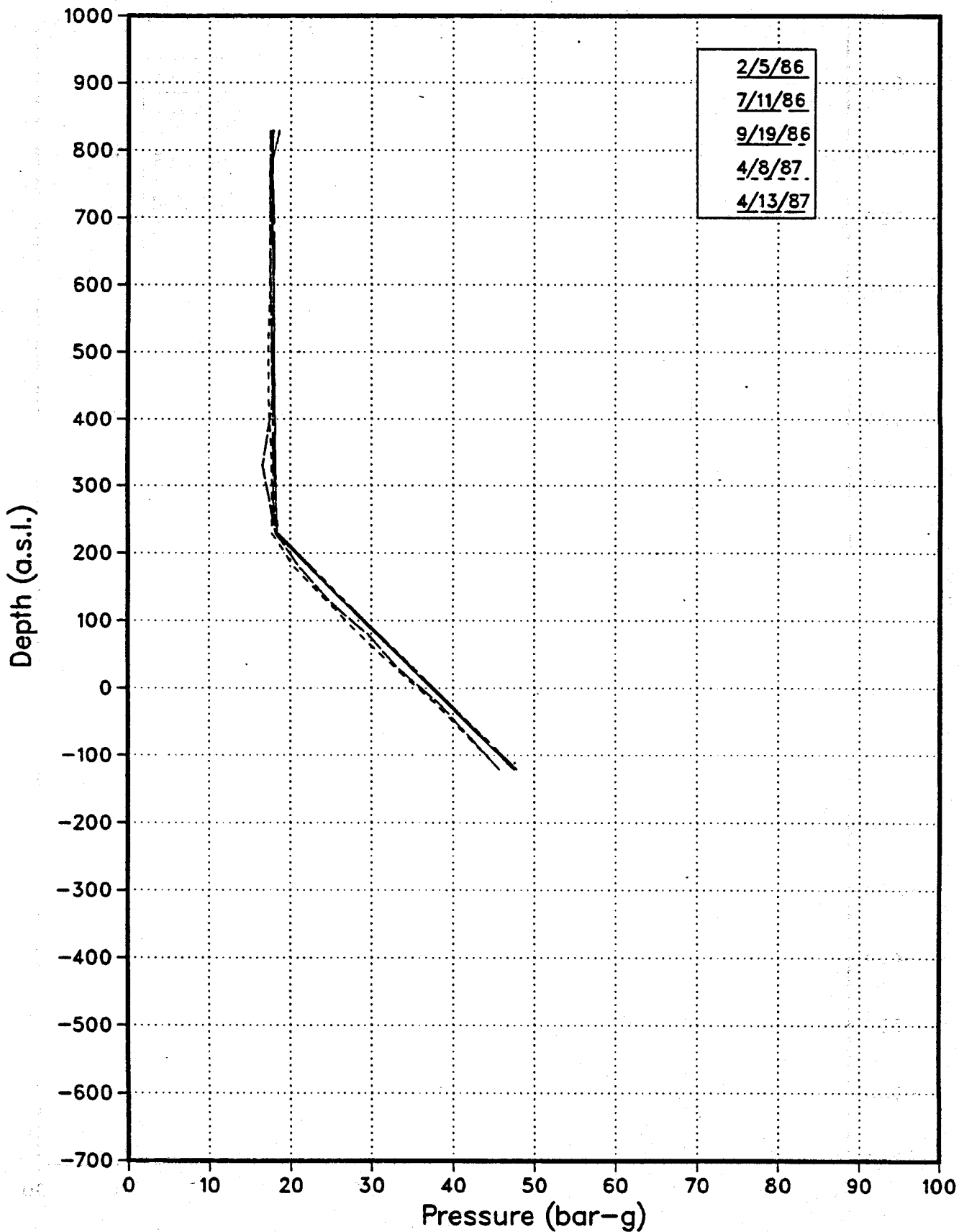
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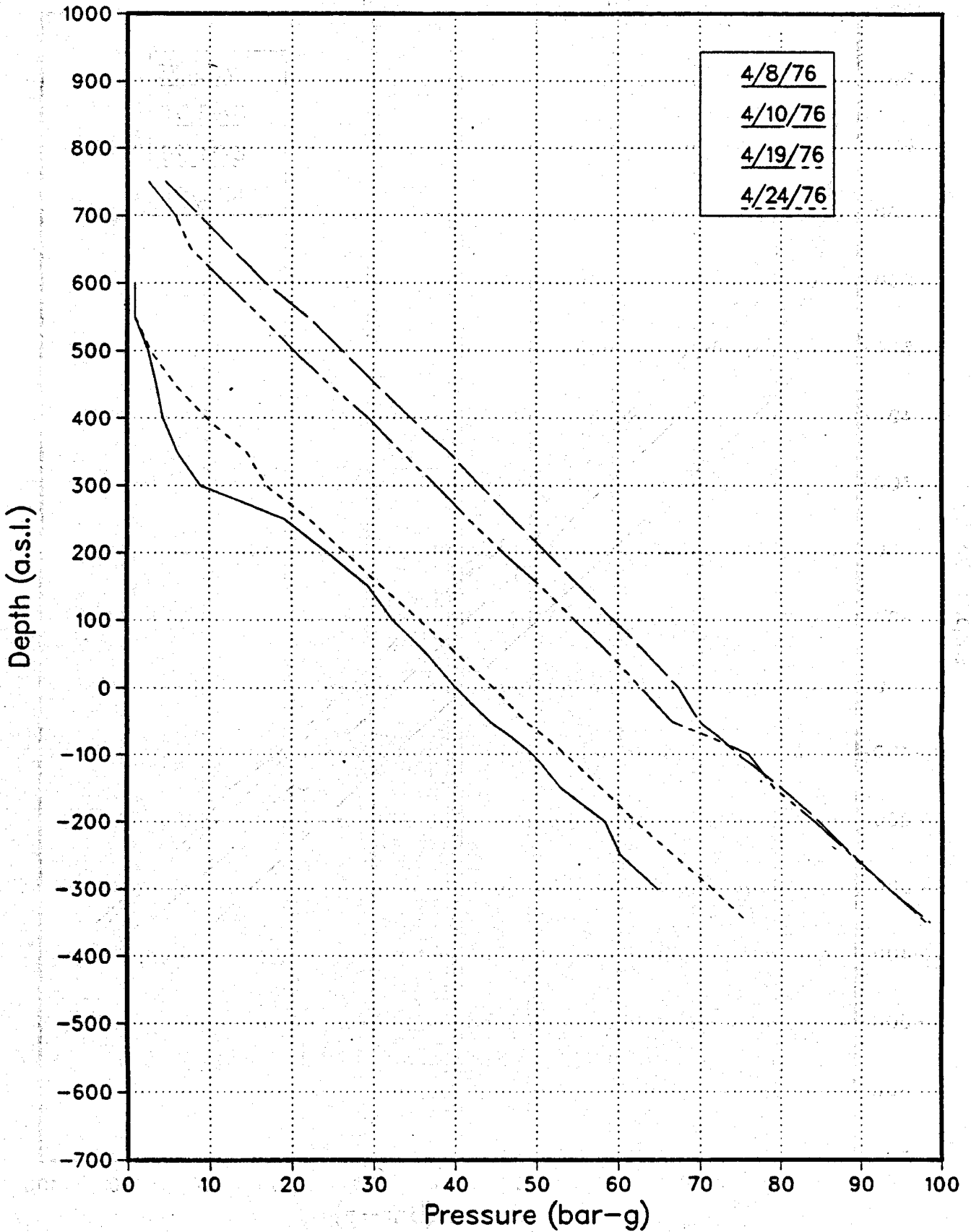
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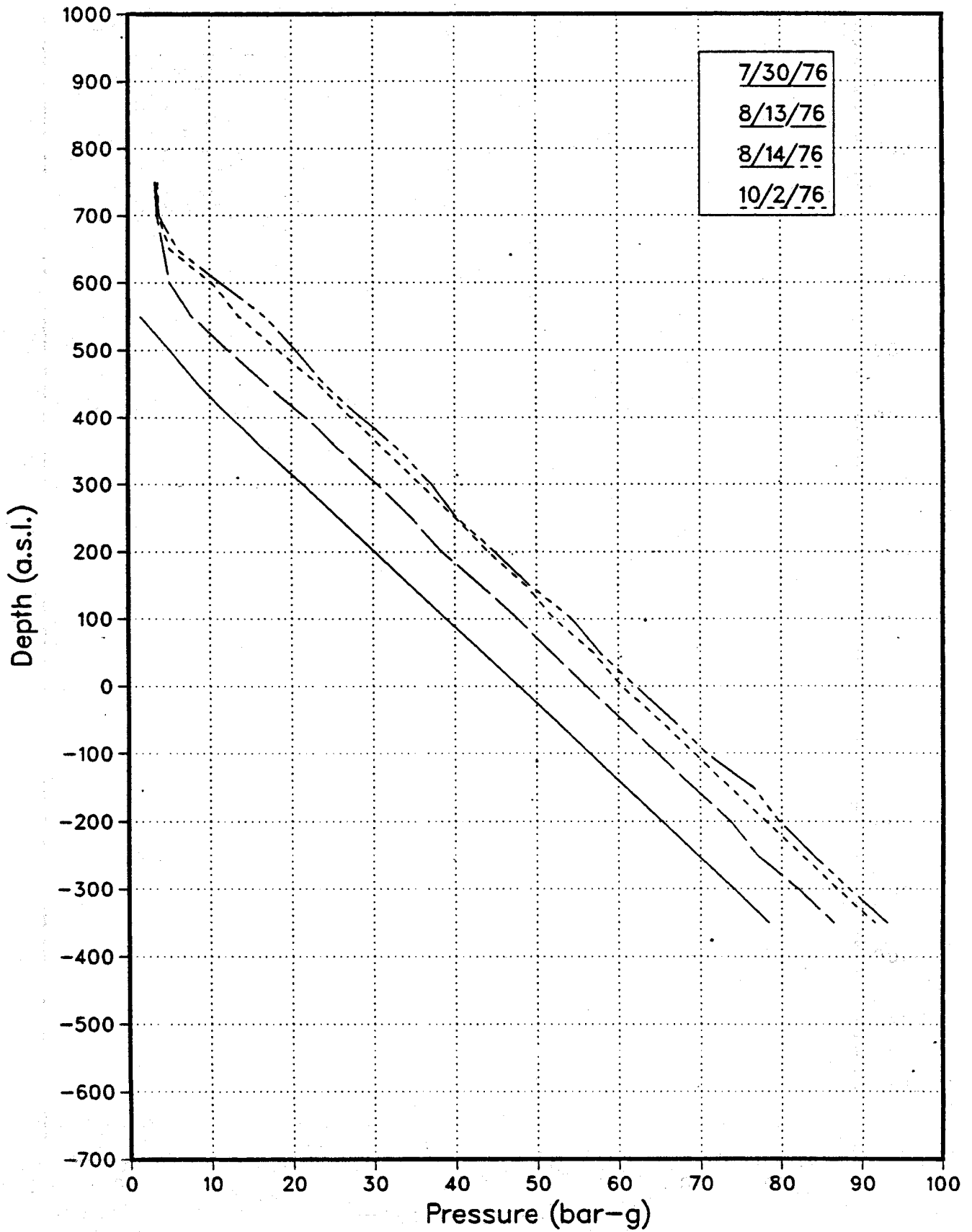
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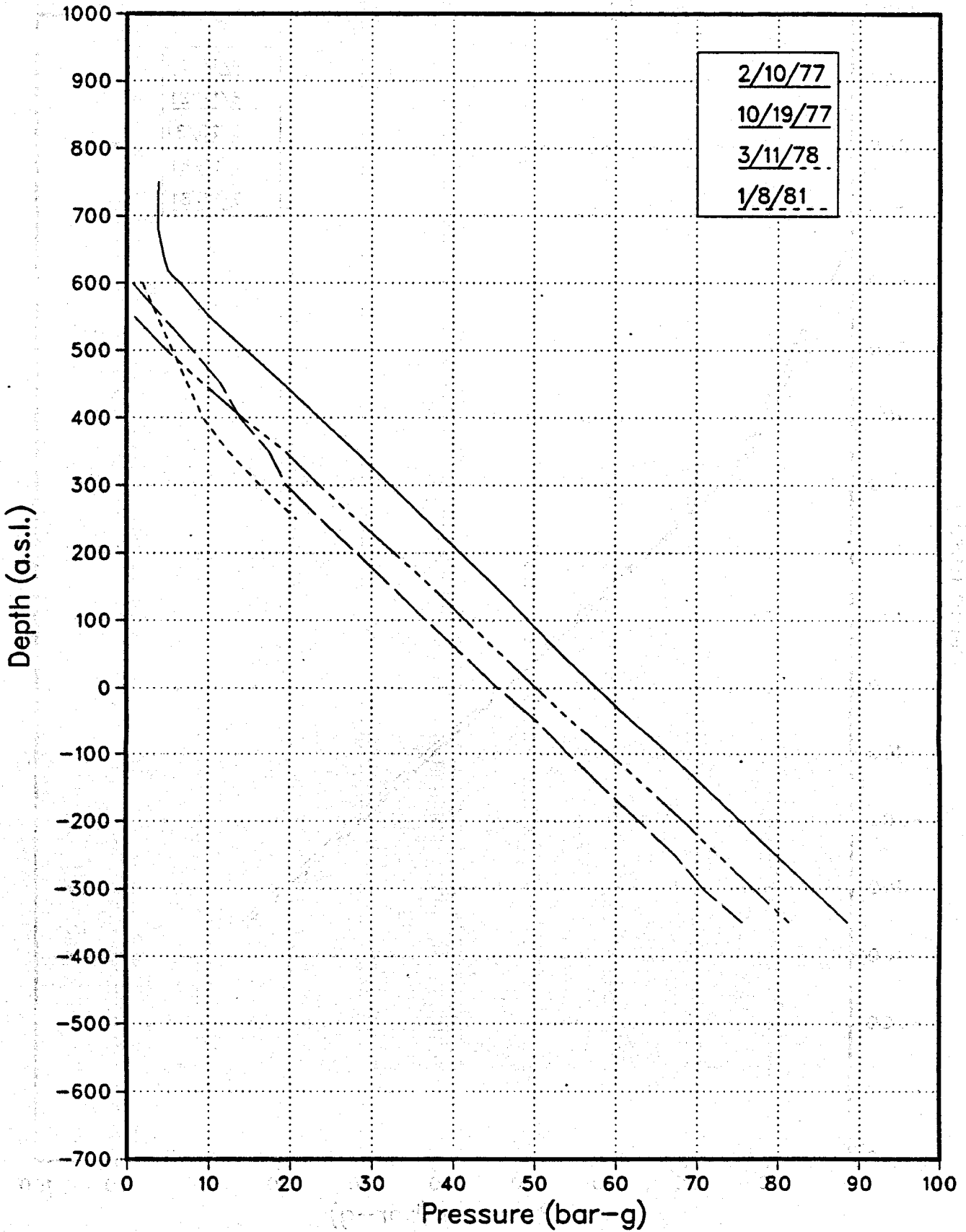
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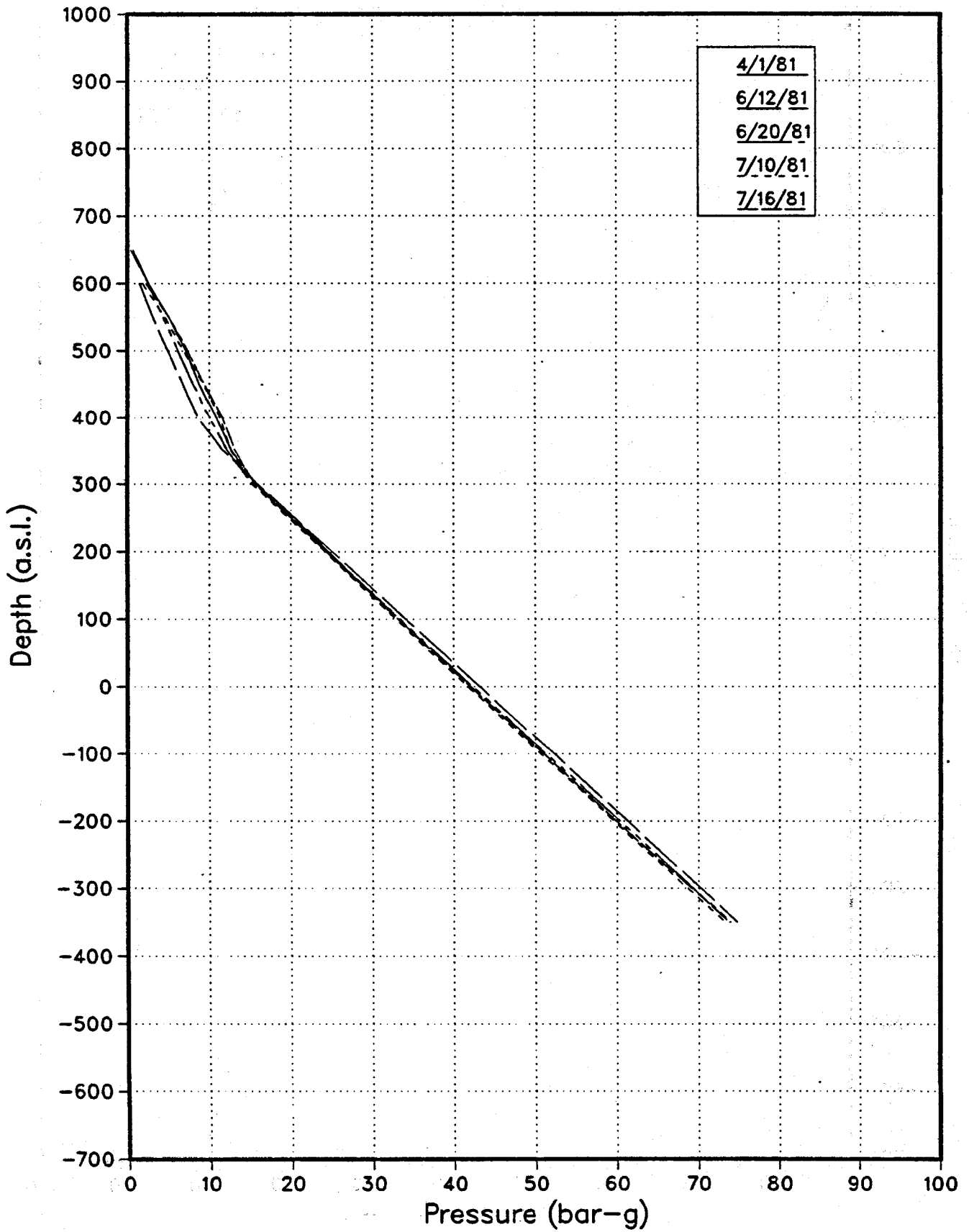
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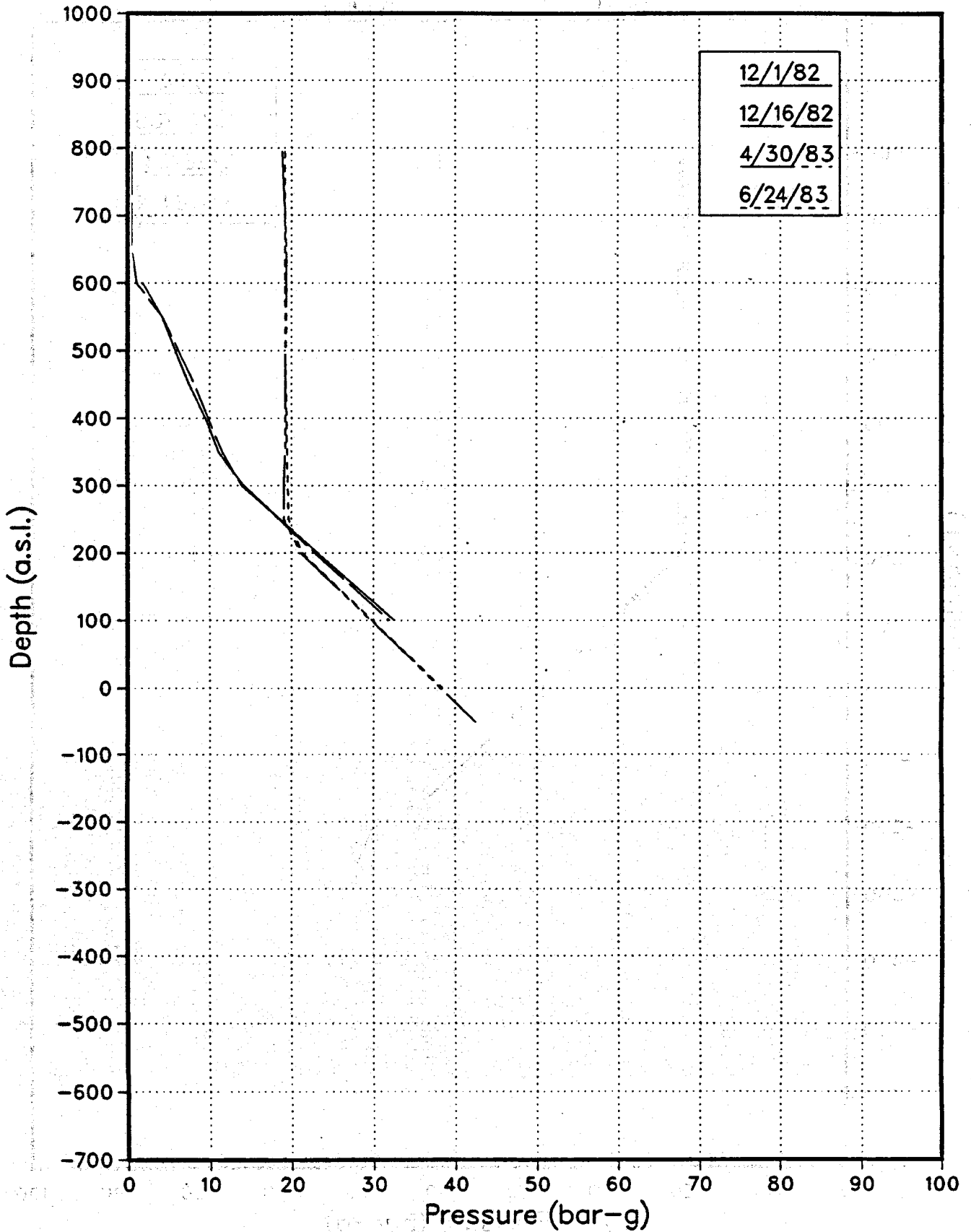
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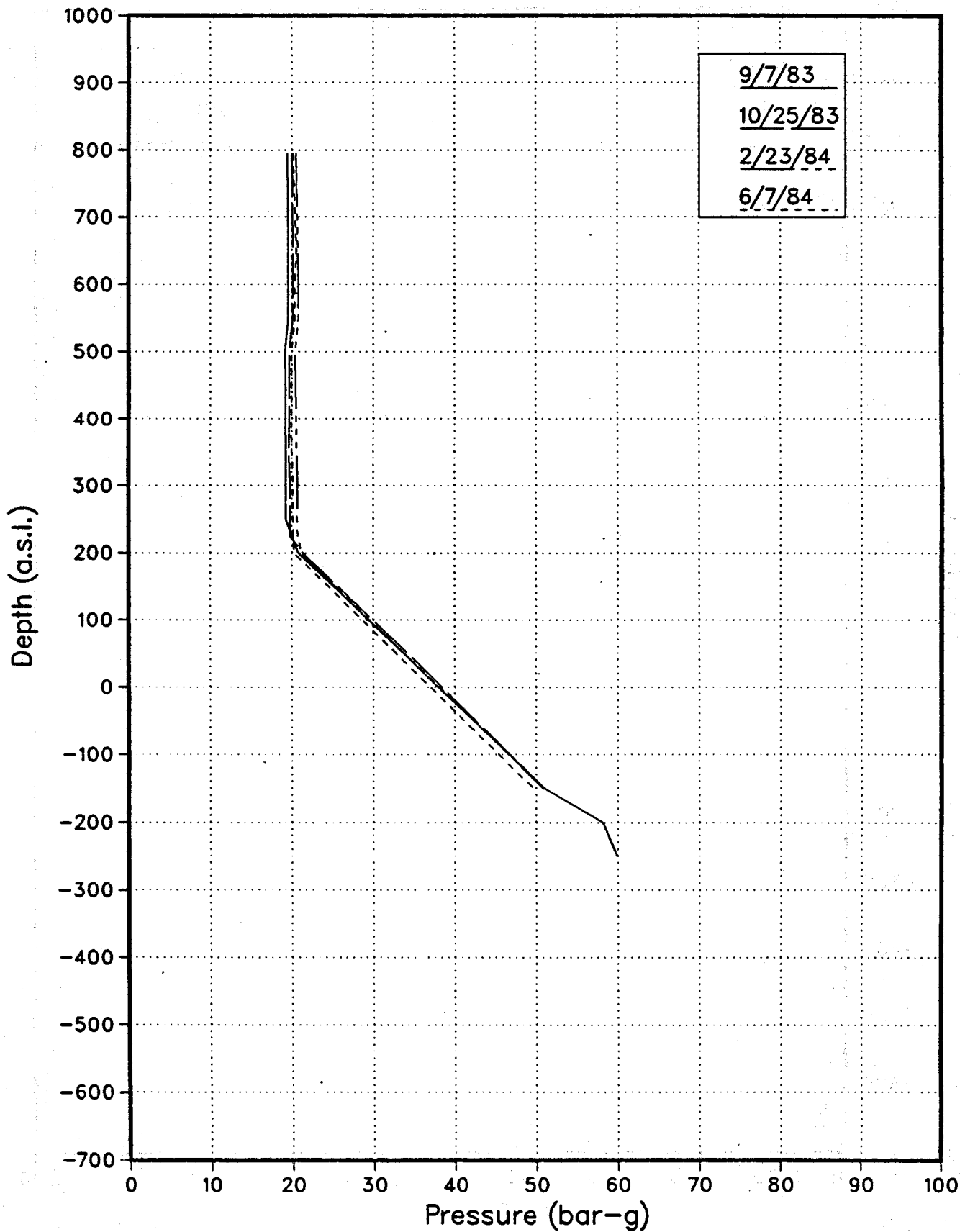
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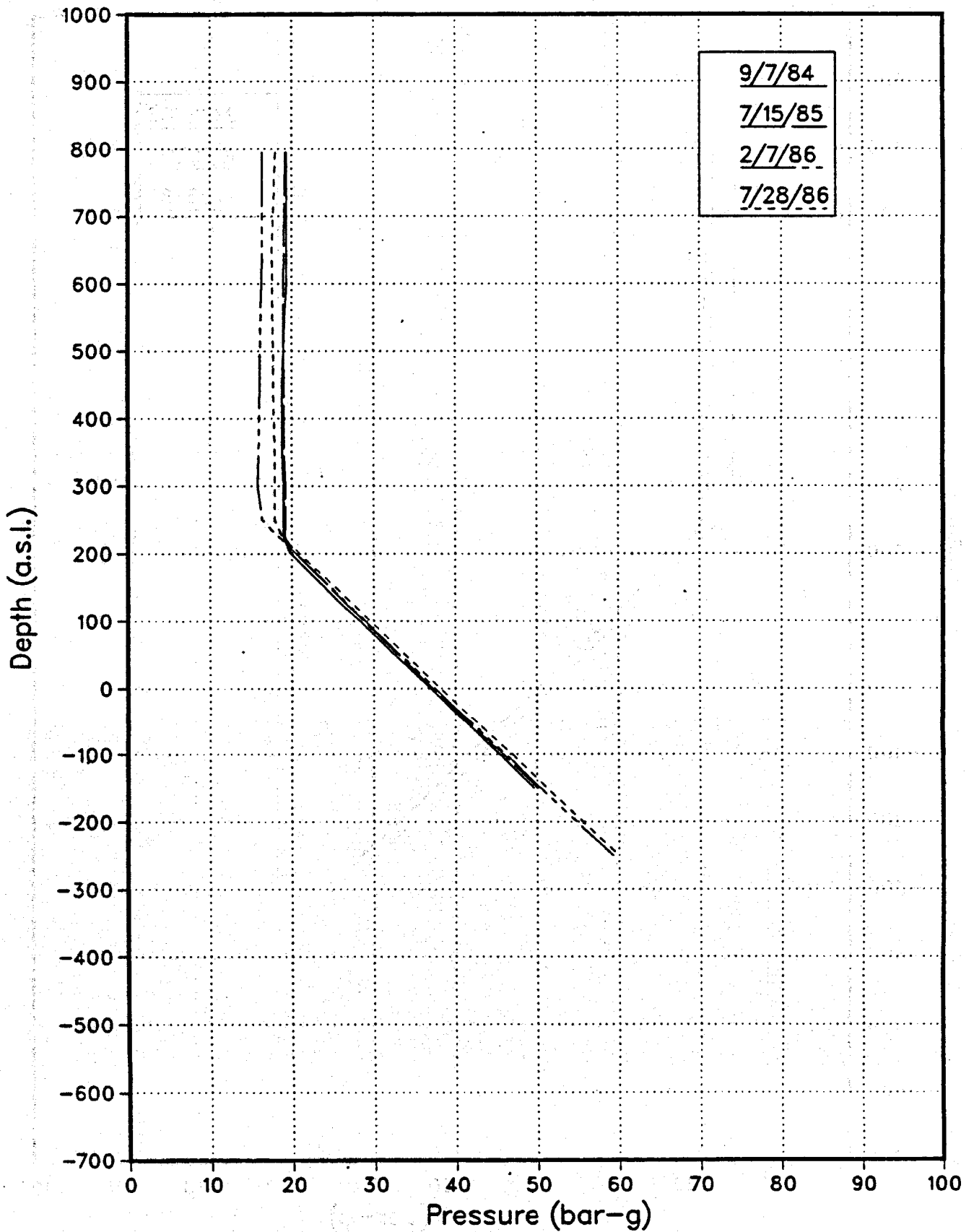
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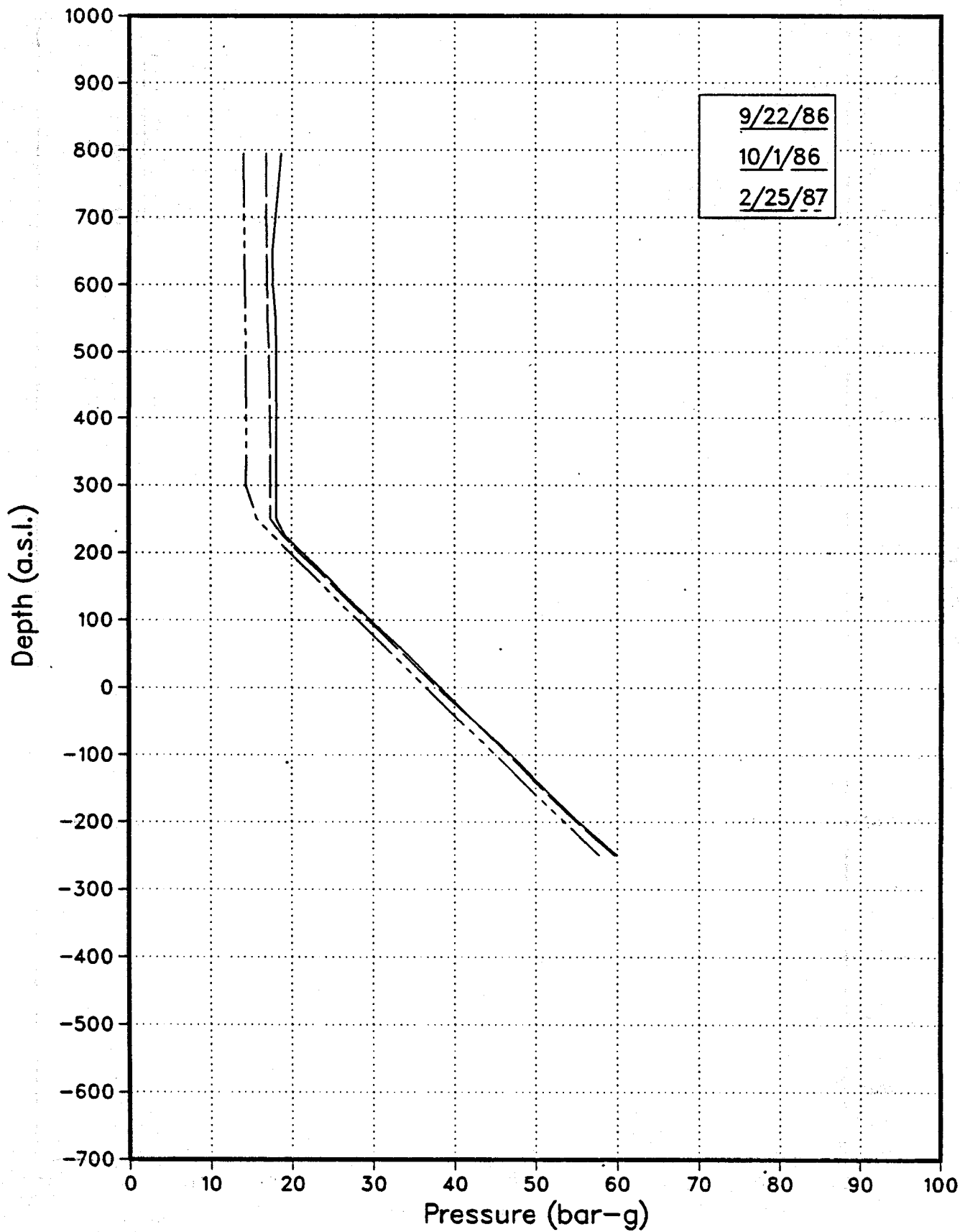
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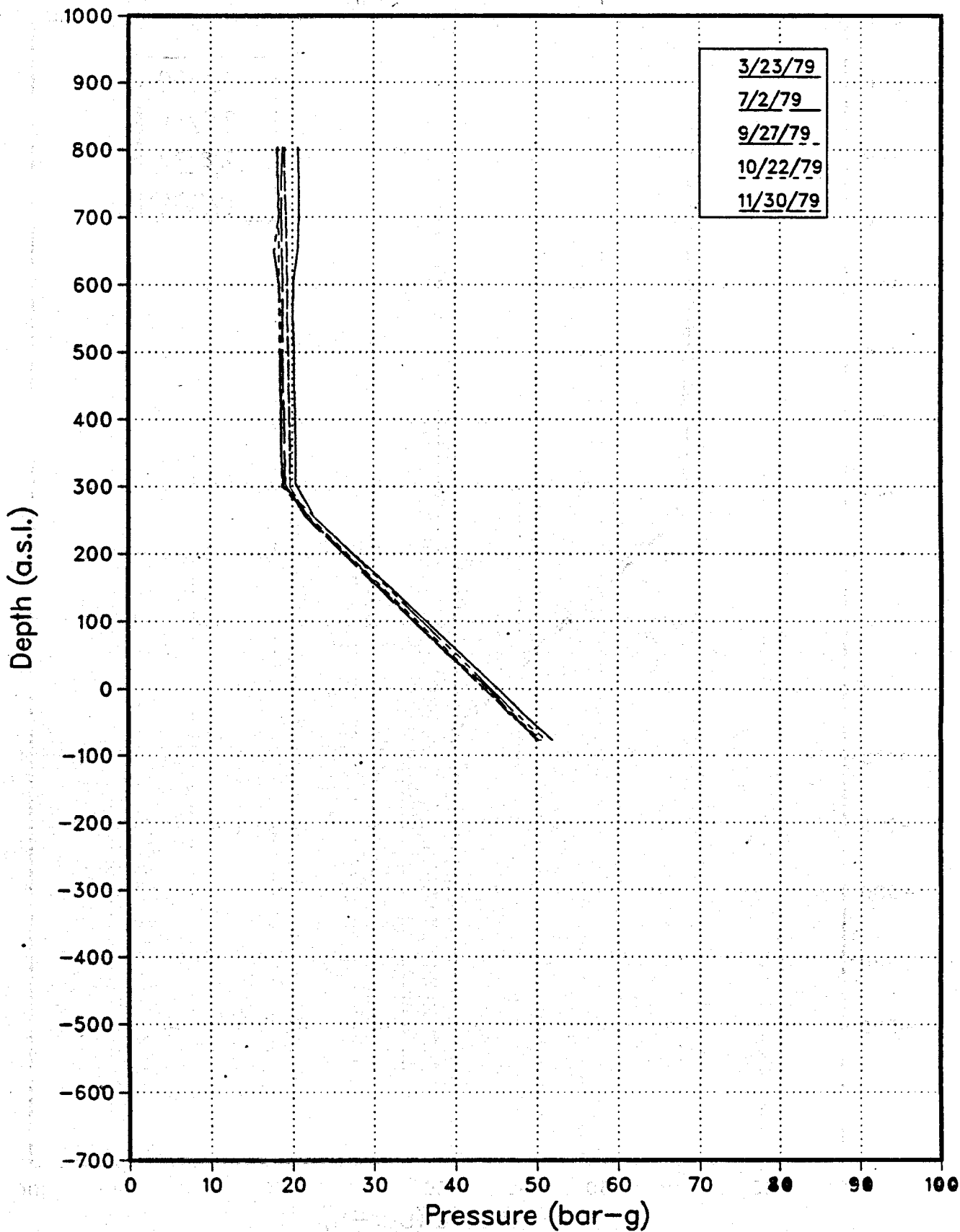
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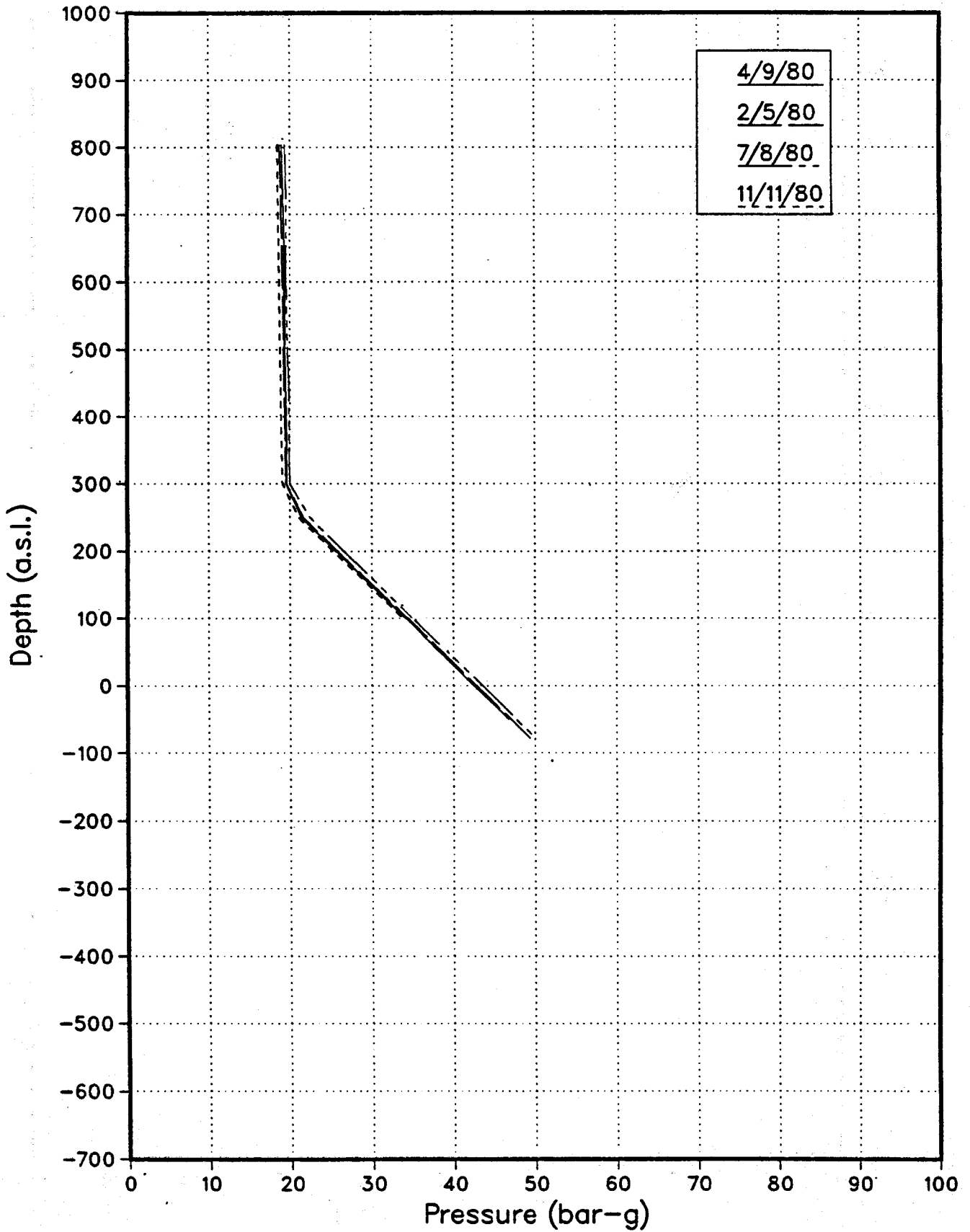
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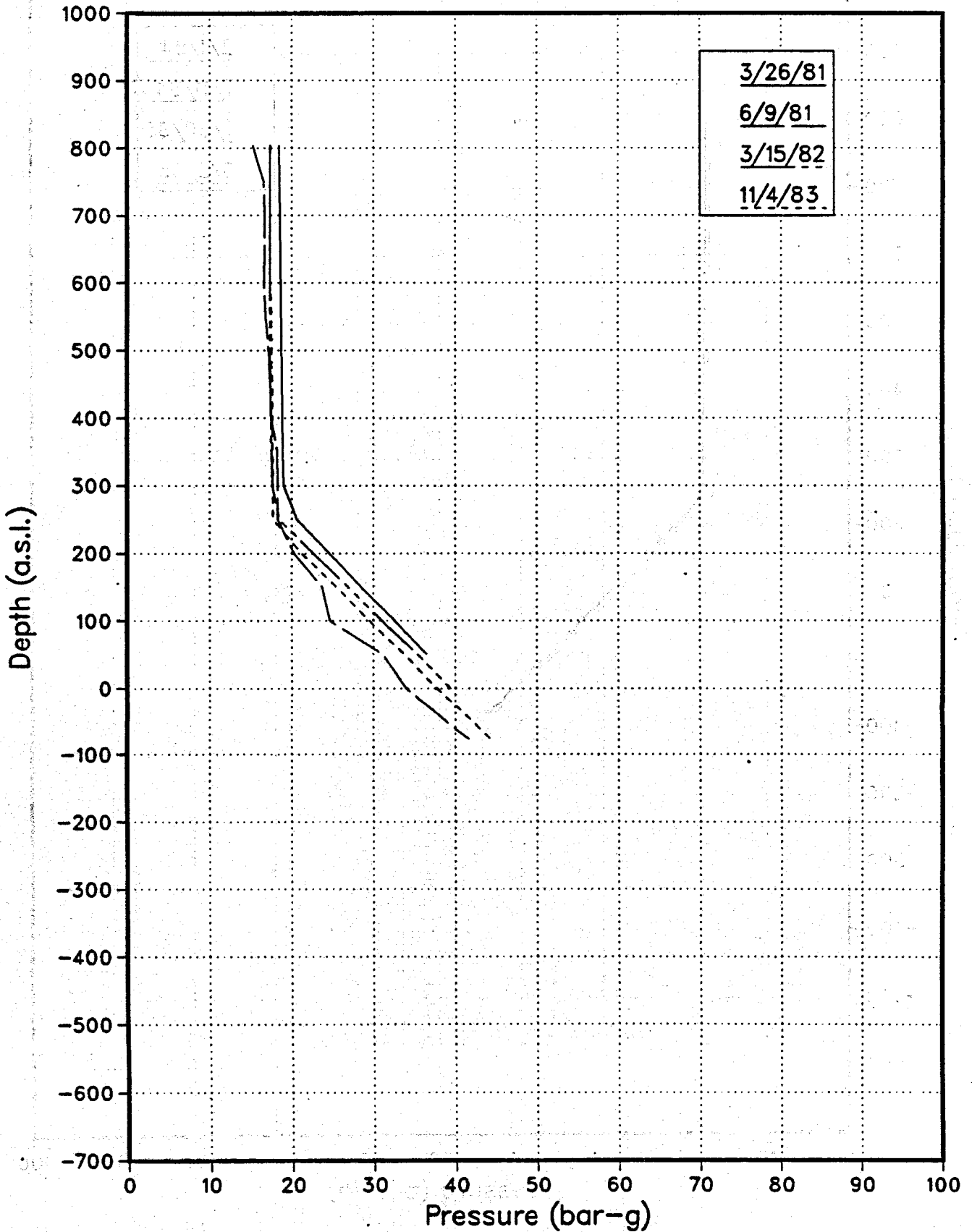
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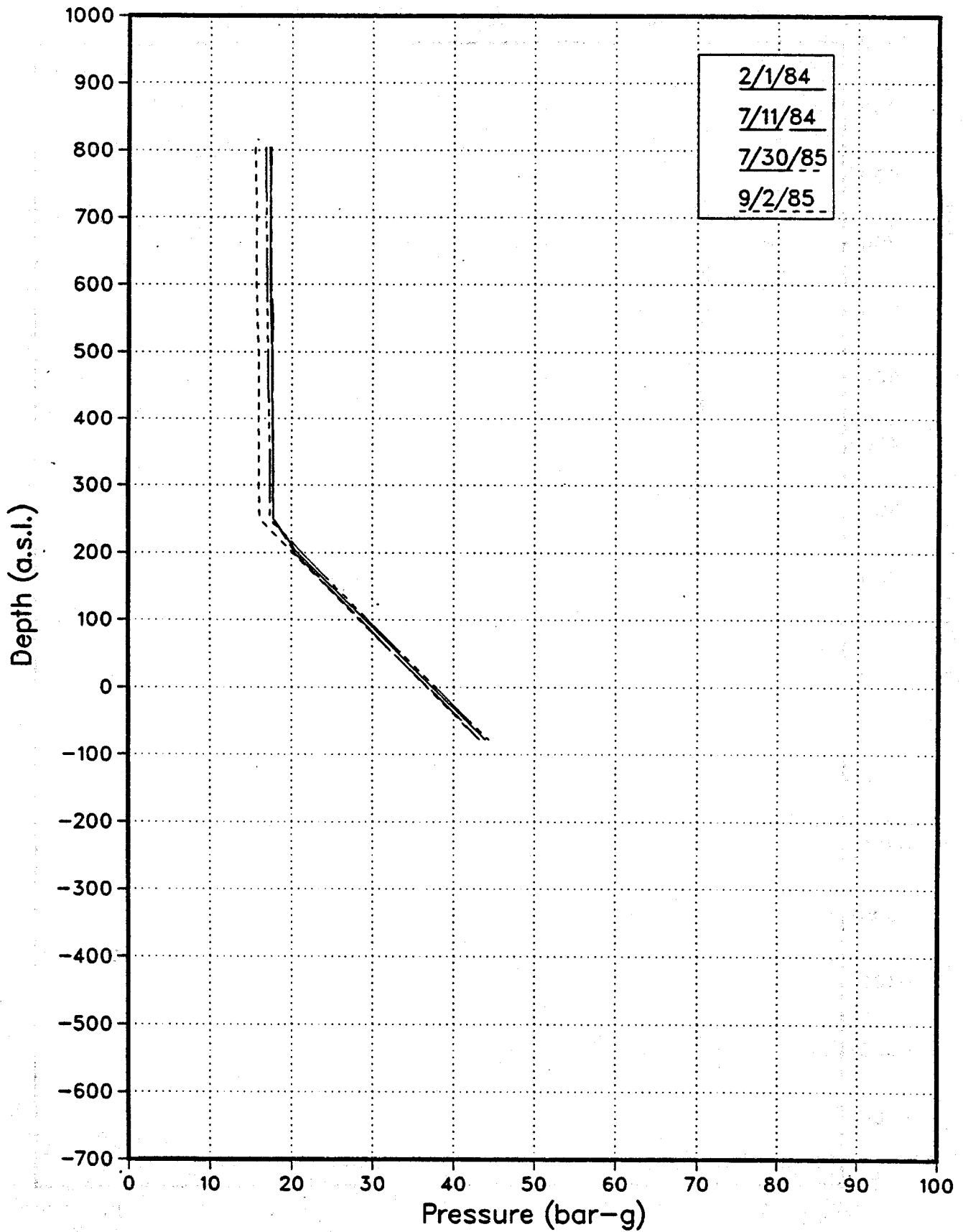
AH30 Pressure Surveys



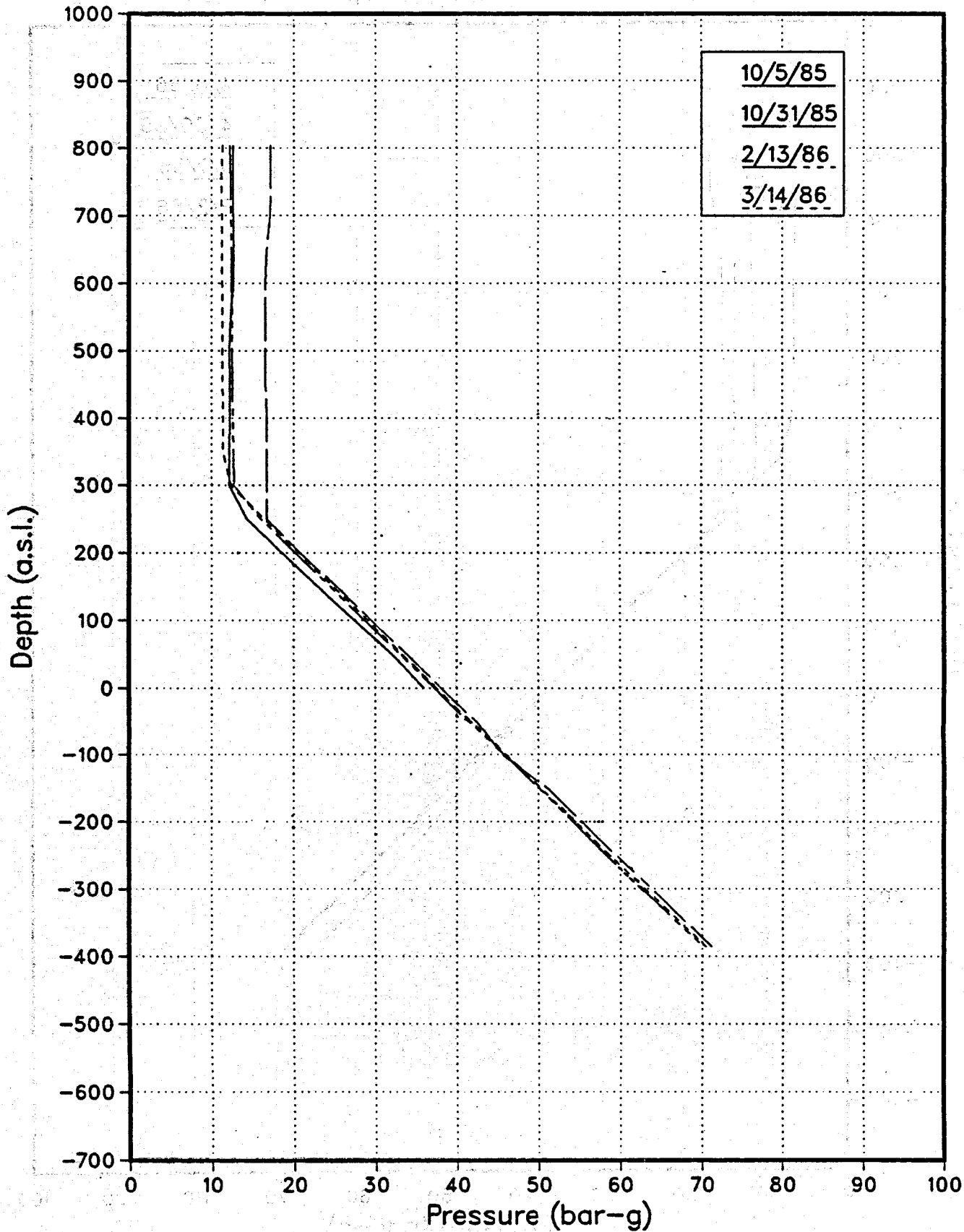
AH30 Pressure Surveys



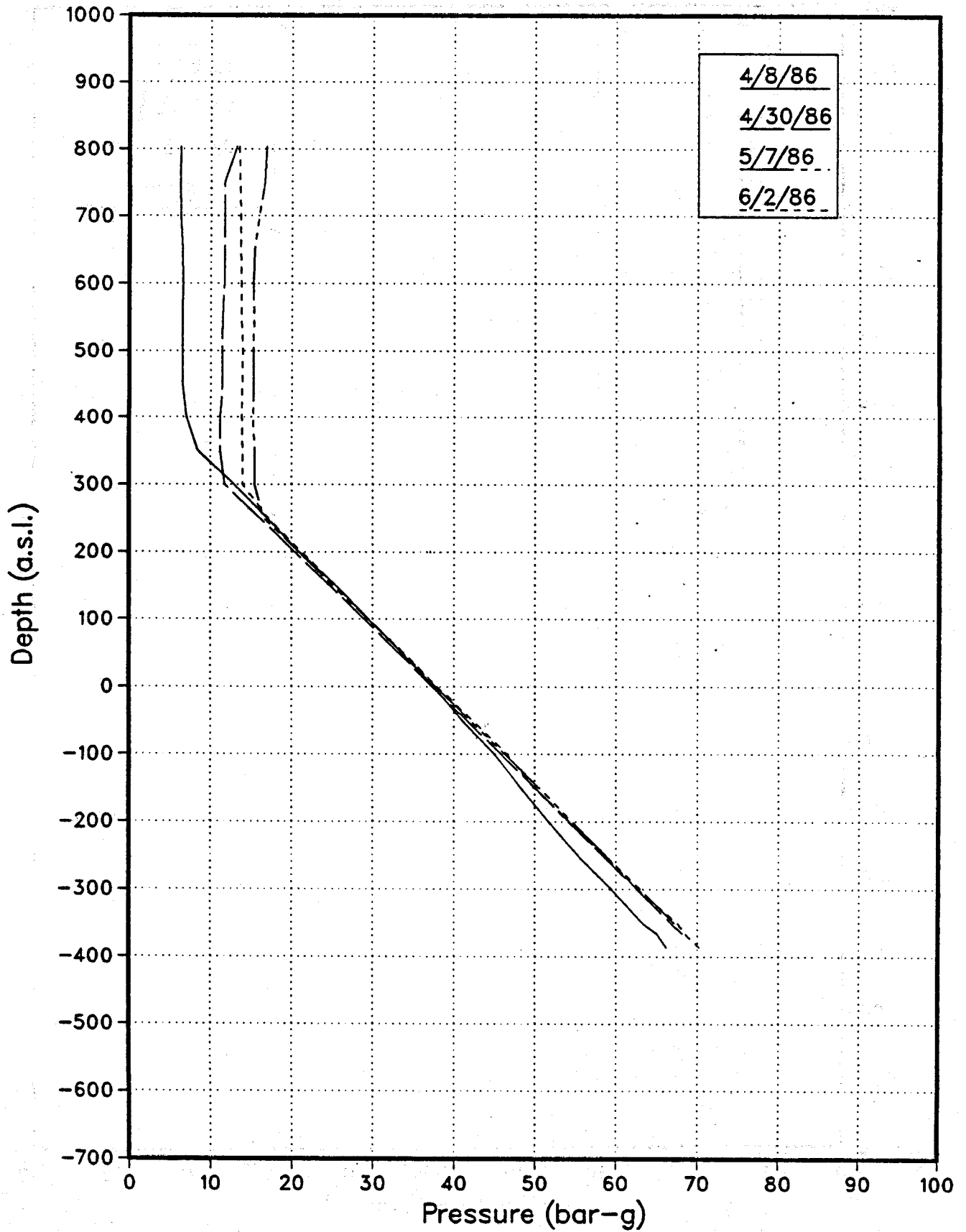
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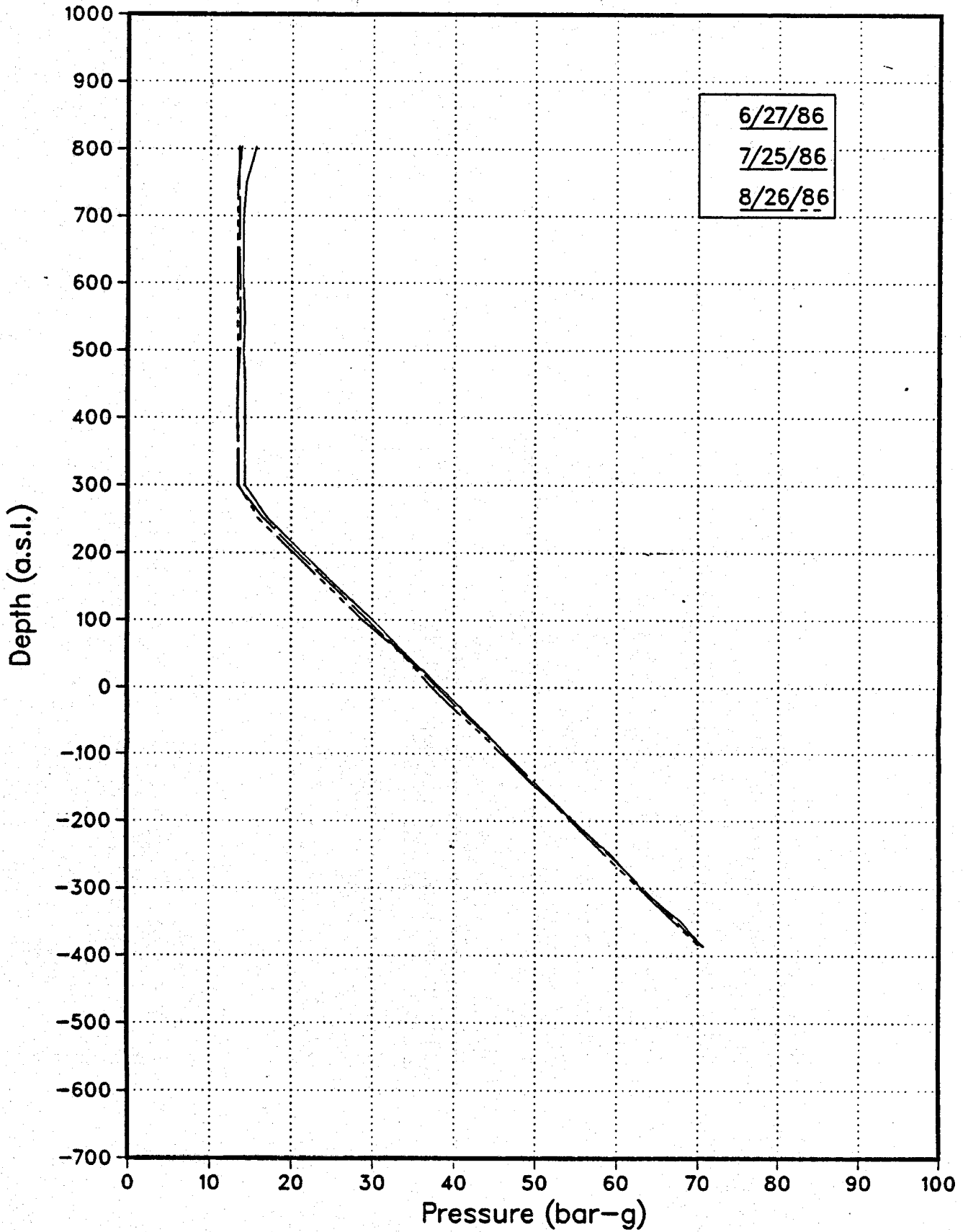
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THE HISTORY OF THE UNITED STATES

The history of the United States is a complex and multifaceted story that spans centuries. It begins with the early Native American civilizations, such as the Mayans, Aztecs, and Incas, who developed advanced societies in the Americas. The arrival of European explorers in the late 15th century marked the beginning of a new era, as they sought to establish trade routes and colonies. The Spanish, French, and British all played significant roles in the early history of the continent.

The American Revolution (1775-1783) was a pivotal moment in the nation's history, as the thirteen colonies declared their independence from Great Britain. This led to the formation of the United States of America, a new nation based on the principles of liberty, democracy, and the rule of law. The Constitution of 1787 established the framework for the federal government, and the Bill of Rights (1791) guaranteed the fundamental rights of the citizens.

The 19th century was a period of rapid expansion and growth for the United States. The westward movement, known as Manifest Destiny, led to the acquisition of vast territories, including the Louisiana Purchase and the Texas Annexation. This period also saw the rise of the Industrial Revolution, which transformed the economy and society. The Civil War (1861-1865) was a defining moment, as it resolved the issue of slavery and preserved the Union.

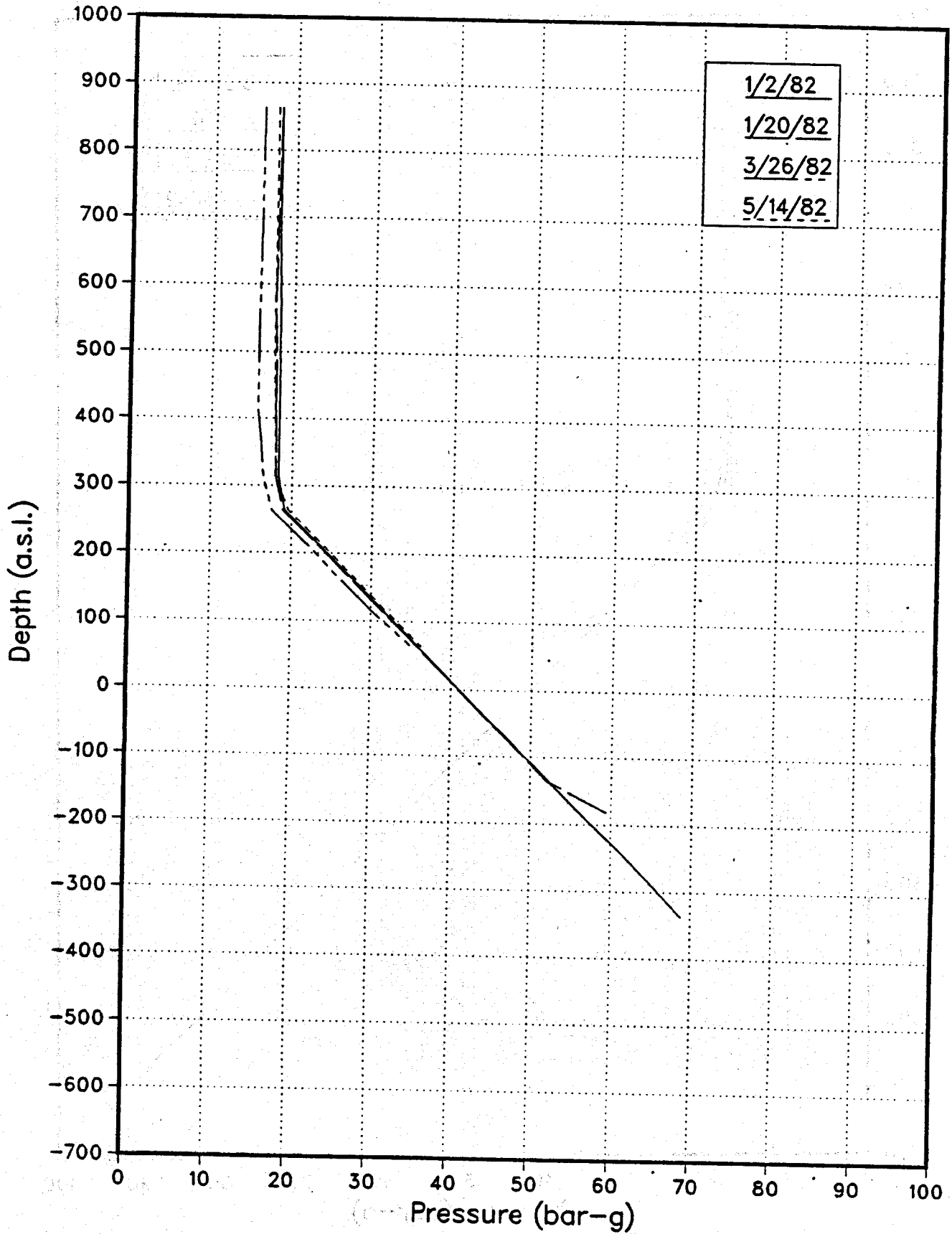
The 20th century was a time of global conflict and social change. The United States emerged as a superpower after World War II, playing a leading role in the Cold War. The civil rights movement of the 1950s and 1960s challenged the legacy of slavery and segregation, leading to significant social and political reforms. The Vietnam War (1955-1975) and the Watergate scandal (1972) were major events that shaped the nation's identity.

The 21st century has been marked by technological advancements, globalization, and new challenges. The September 11 attacks (2001) led to a period of heightened security and military intervention. The 2008 financial crisis and the subsequent Great Recession (2007-2009) tested the resilience of the American economy. The rise of the Affordable Care Act (2010) and the election of Barack Obama (2008) were significant milestones in the nation's history.

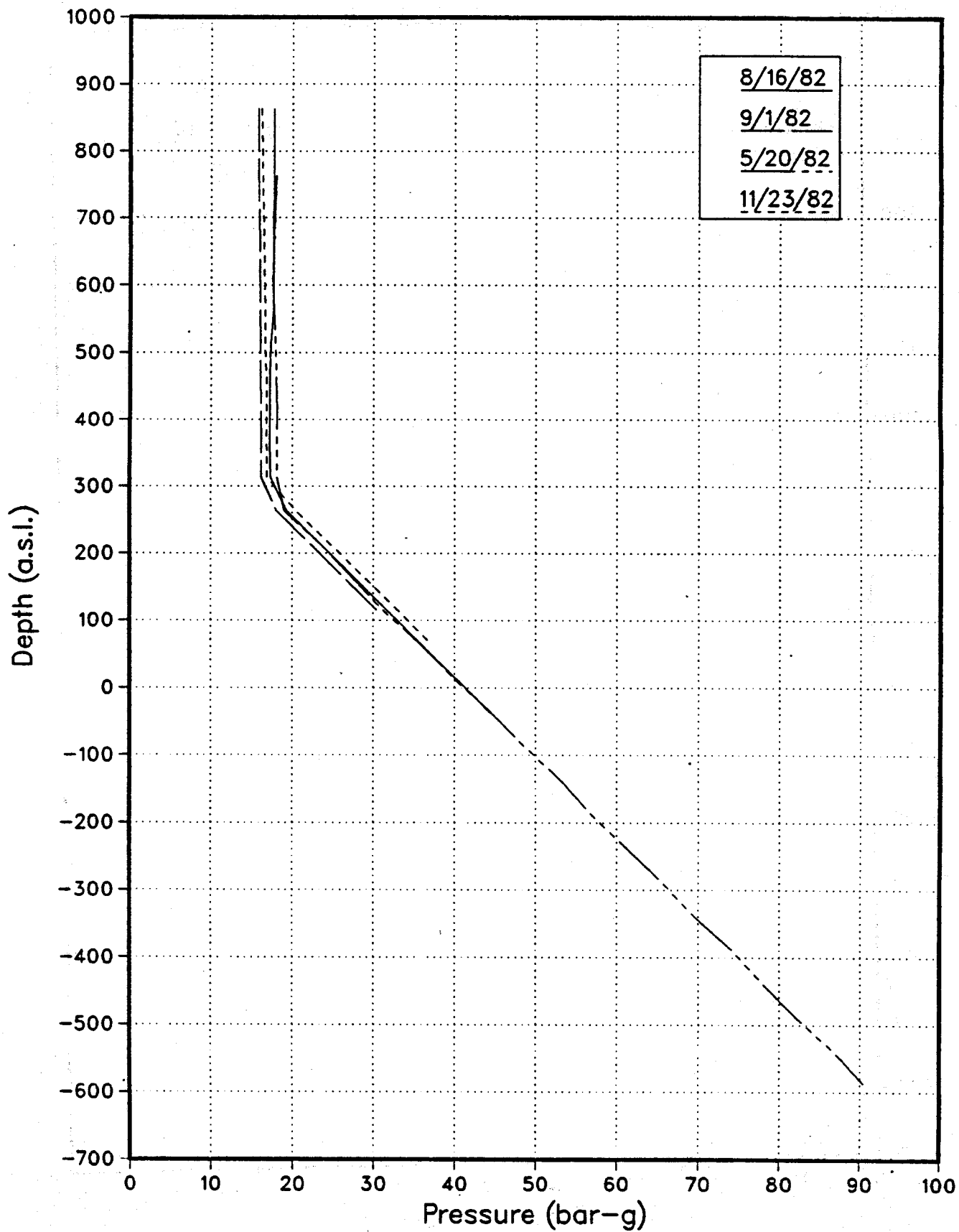
As the United States continues to evolve, it faces new challenges and opportunities. The ongoing debate over immigration, climate change, and social inequality are among the key issues of the day. The history of the United States serves as a guide and inspiration for the future, reminding us of the values and principles that have shaped the nation.



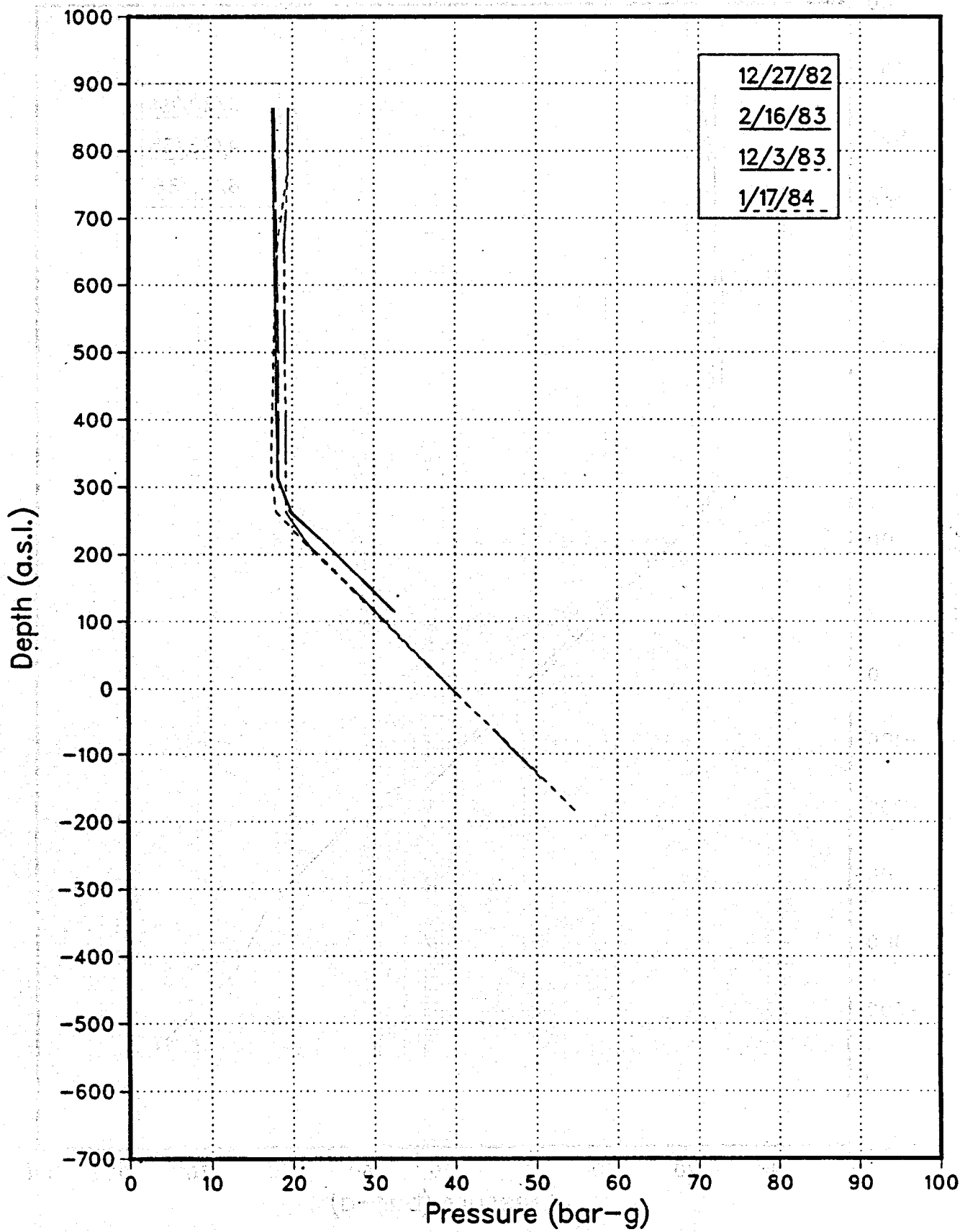
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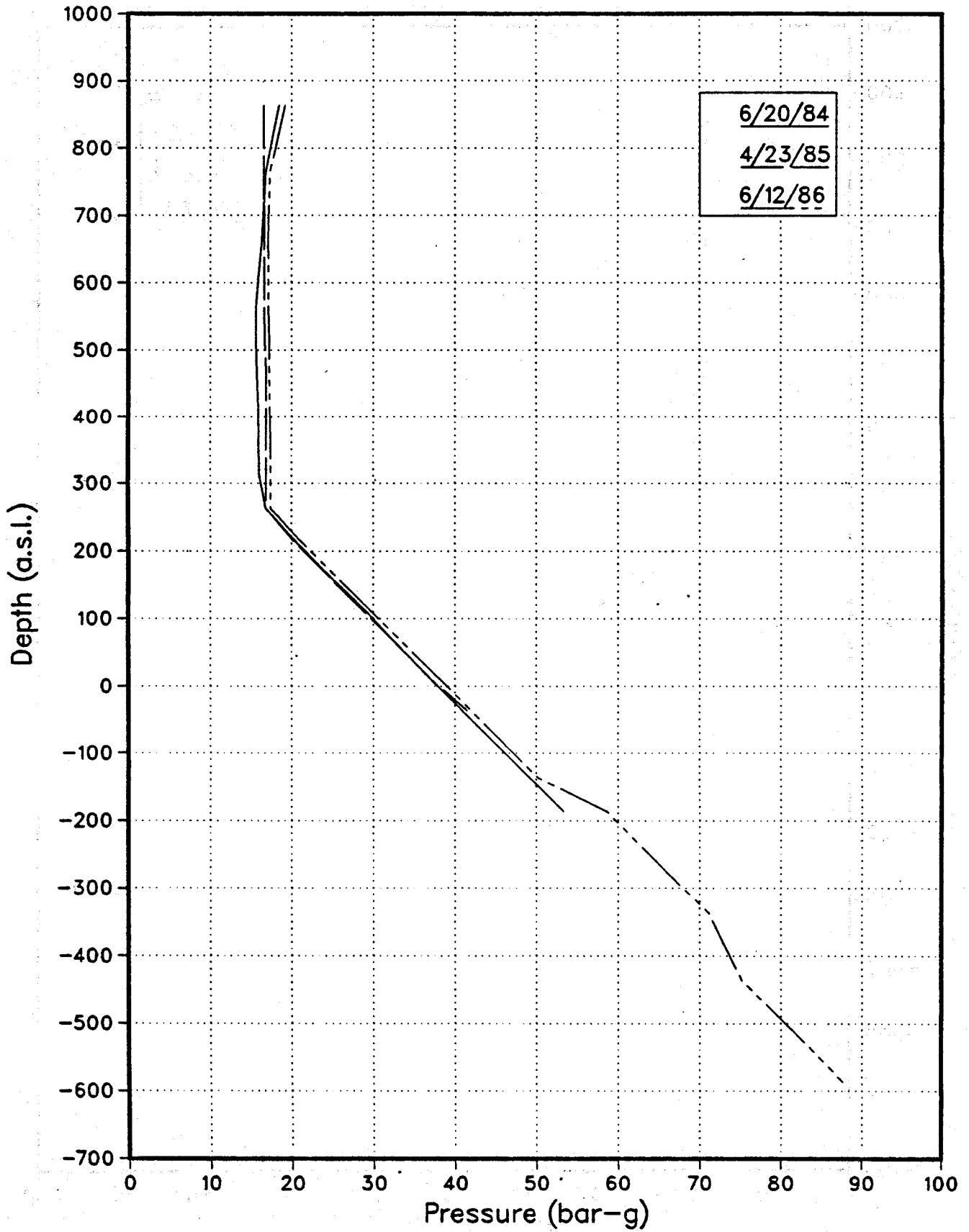
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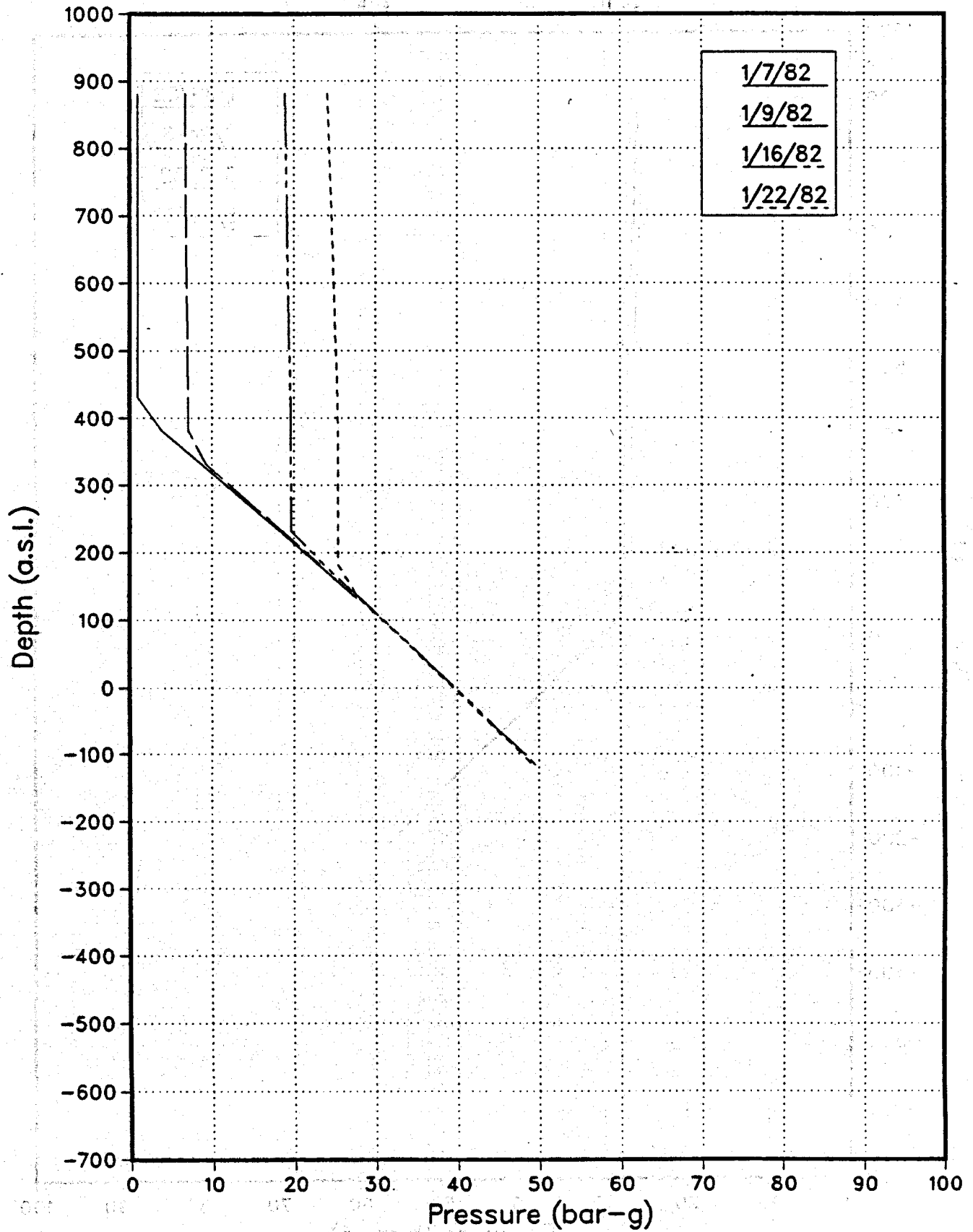
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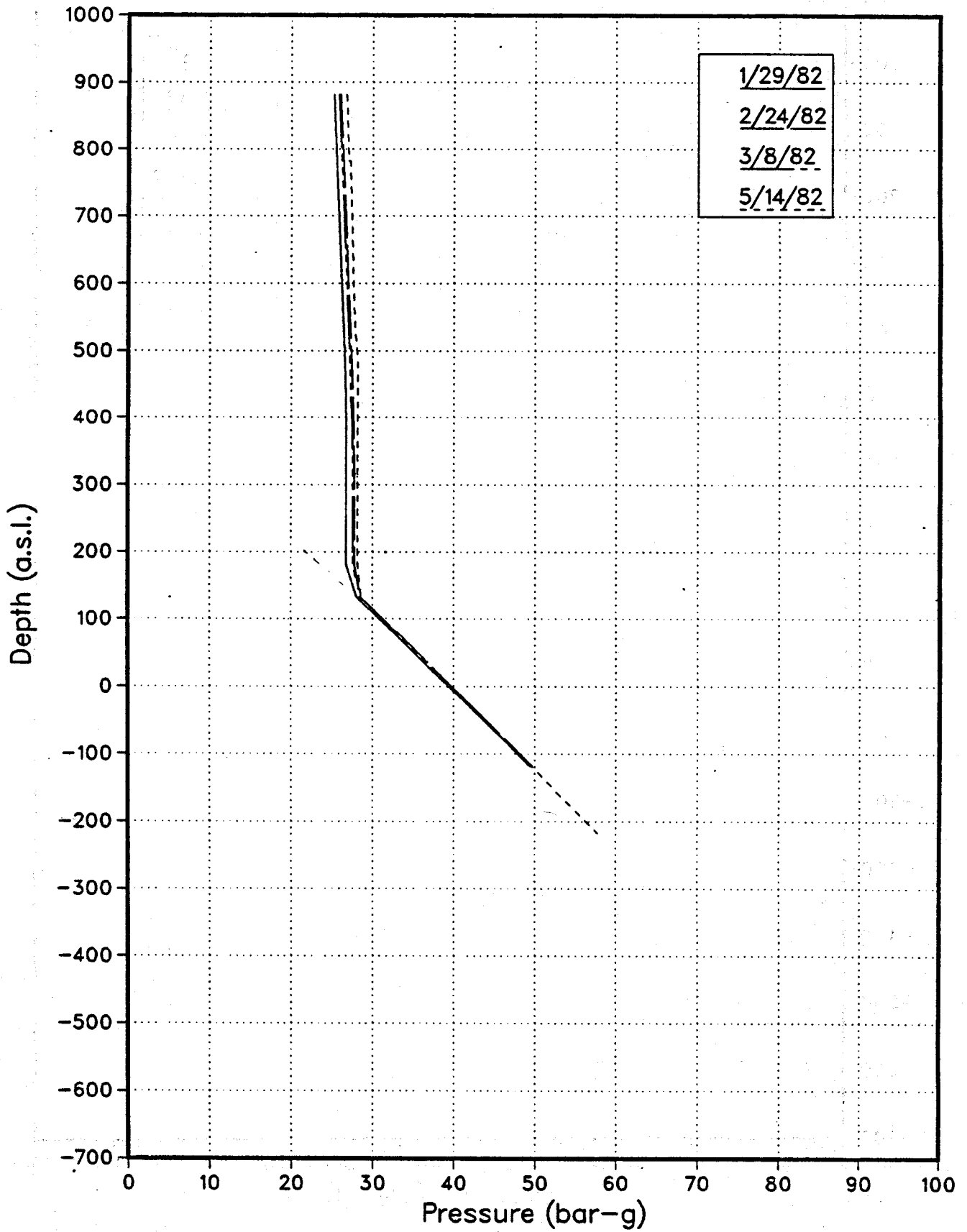
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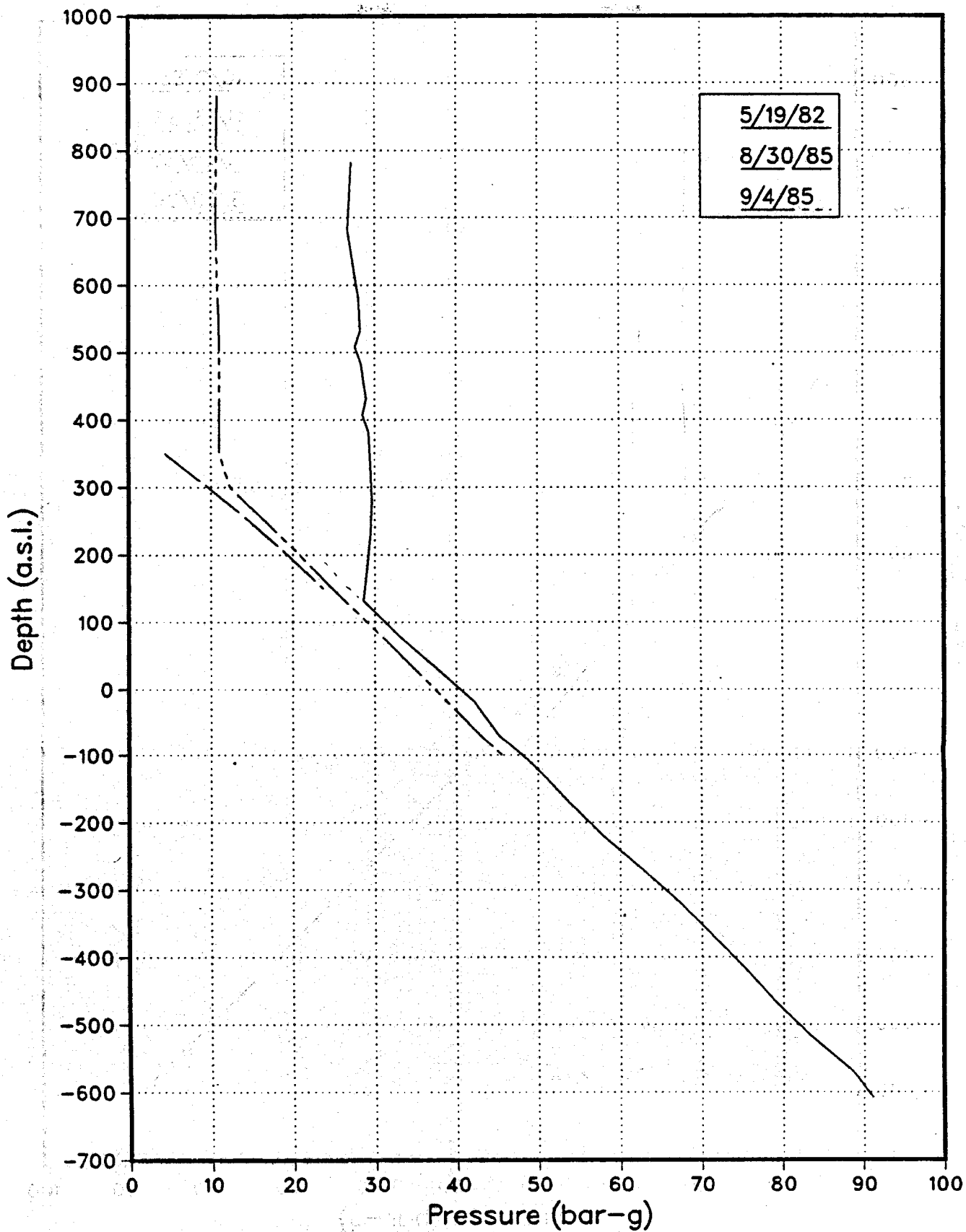
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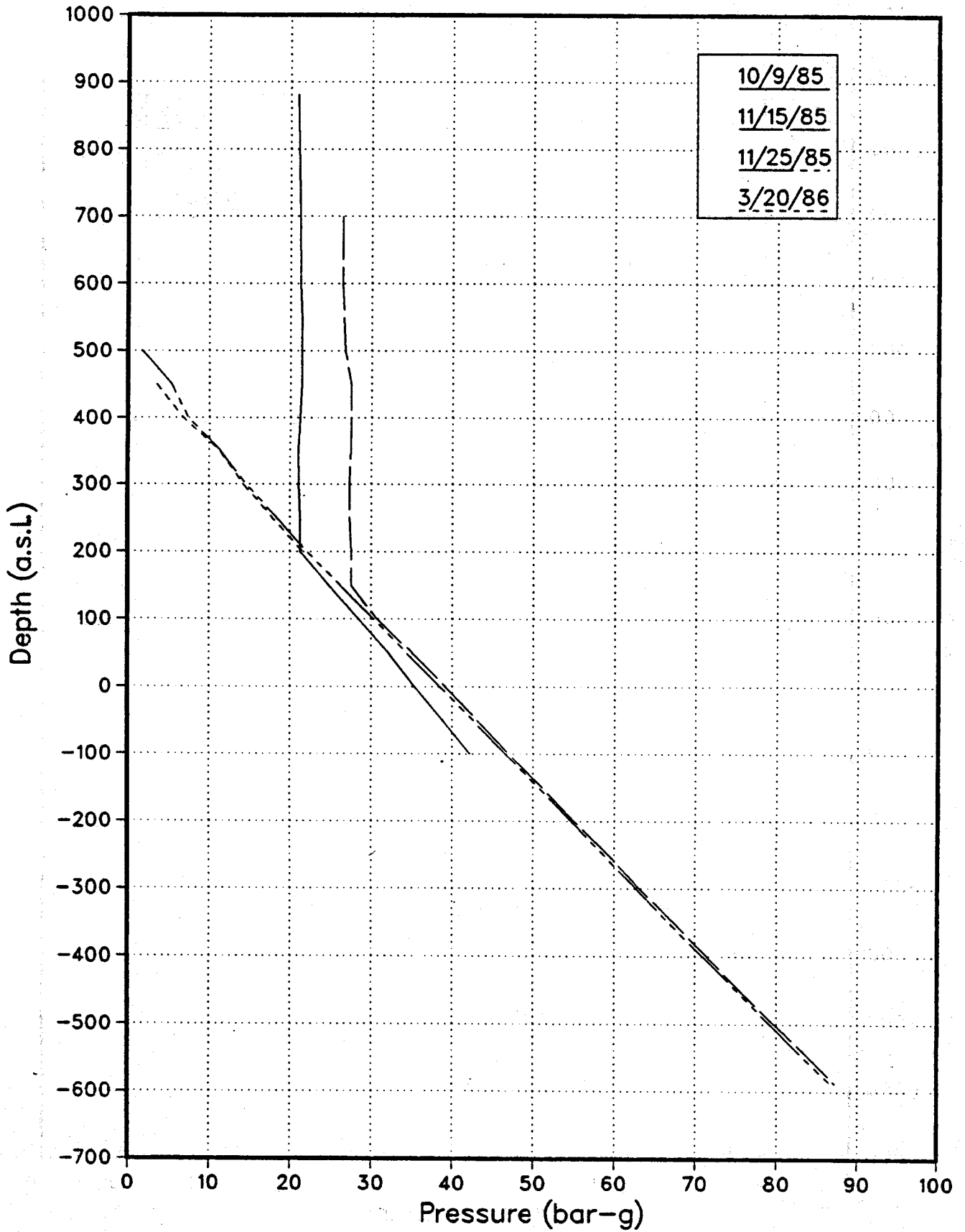
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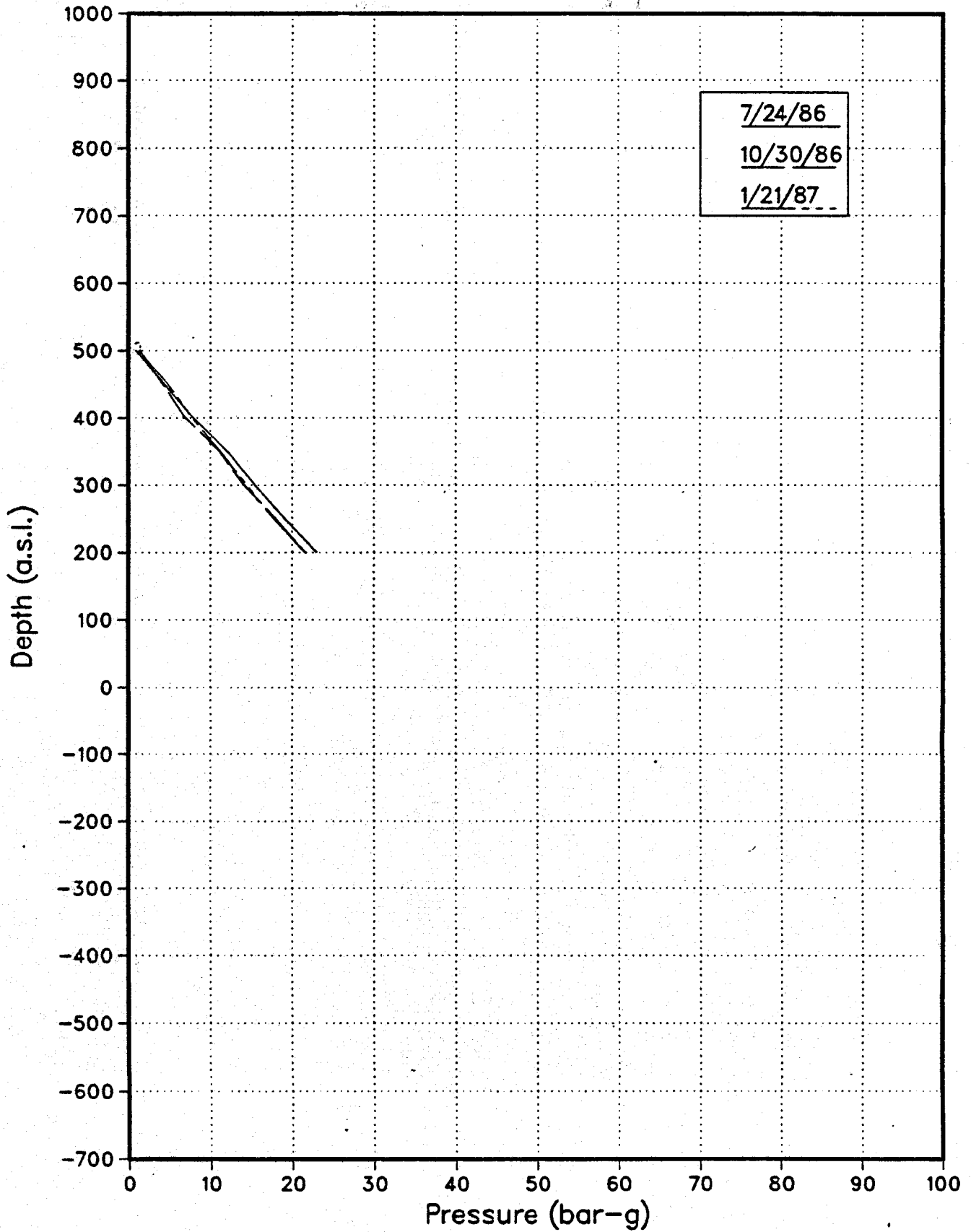
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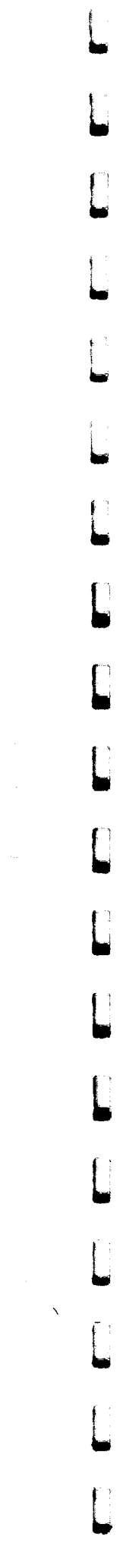


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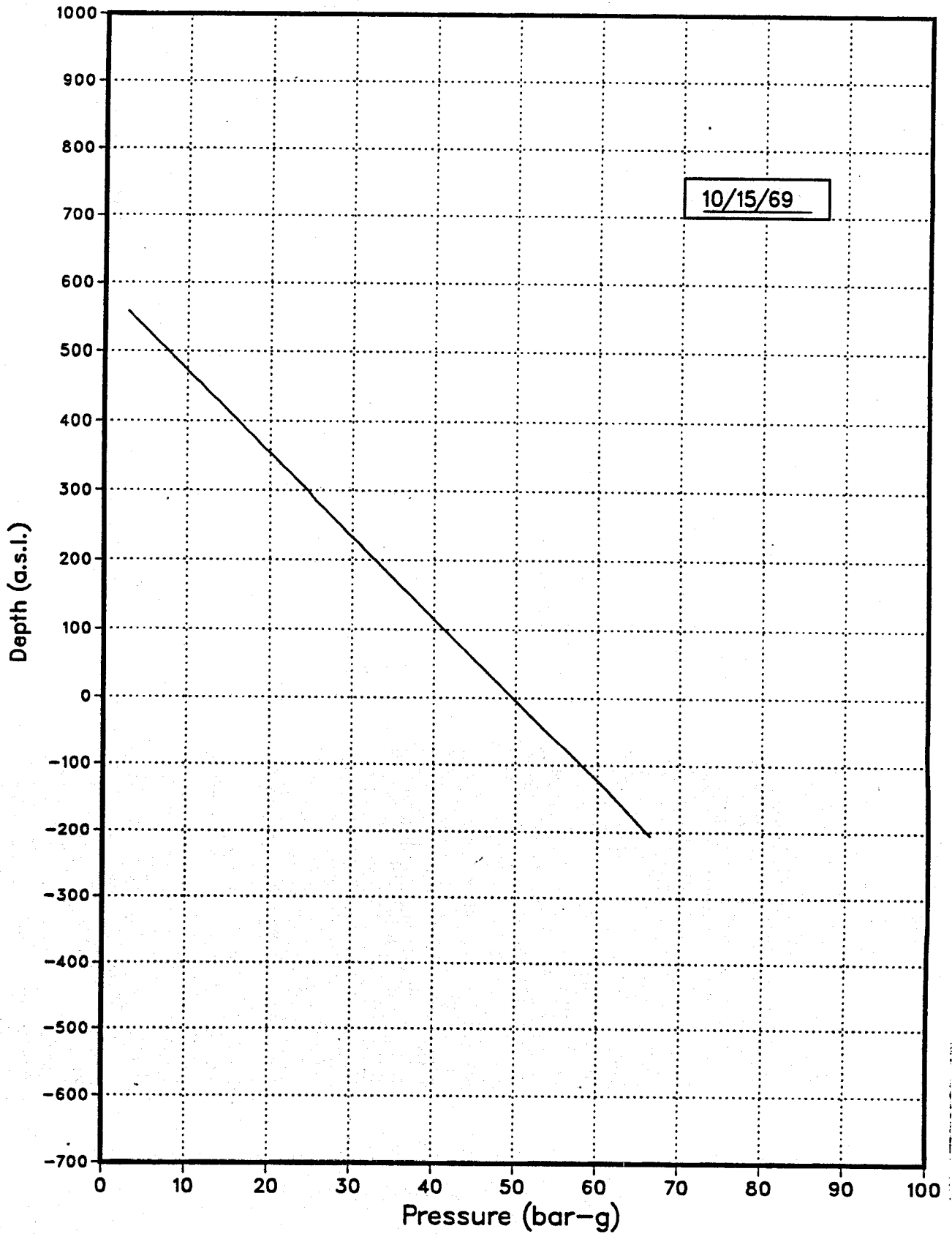
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