

QUESTIONS ASSOCIATED WITH 31,000 CFS TEST FLOW
[W.R.T. PHYSICAL HABITAT AND SEDIMENT]

- **What is the Residence Time of Fines In Marble Canyon and Impact of PPQ in Glen Canyon?**
- **Are Sand Bars Significantly Aggraded in as Little as 48-Hours?**
- **Can Fines Be Conserved Along Shorelines By PPQ Immediately Following Tributary Inputs?**
- **Can High-Resolution Hydro Bathymetry Quickly Determine Gross Channel-Storage Changes?**
- **Are Sand Bars Preferentially Altered by PPQ in Terms of RBARS, SBARS, CMDs or Backwaters?**

TWG
1-21-98

Overheads from
T. Melis Presentation

Attachments 4b

ANTECEDENT CONDITIONS - 1990 TO TIME OF TEST FLOW IMPLEMENTATION [W.R.T. PARRA AND MARBLE CANYON]

- **1997 Inputs Largest Since 1980, and Likely Since Dam Closure [Twice Annual Mean in 6 Weeks]**
- **1997 Inputs Much Finer [higher silt/clay %] Than Those of Spring 1992**
- **1997 Inputs Hit High-Constant Stage/Discharge in Mainstem vs. Interim Flows of Spring 1992**
- **1997 Inputs Triggered By Dissipating Tropical Cyclones in E. Pacific [Decade-Scale Events]**
- **Shields' Relationship Predicts Silt/Clay Sized Particles Transport More Difficult Than Sand**

Table 12. Tropical Cyclone of September 20-25, 1926
daily precipitation

Station	September							Total
	23	24	25	26	27	28	28	
Douglas, Az.	.68	0	.05	1.68	3.58	.91	6.90	
Hereford, Az.	0	.05	.07	3.10	5.05	0	8.27	
Naco, Az.	0	.30	0	4.70	1.50	0	6.50	
Animas, NM.	0	0	.35	.30	2.70	.78	4.13	
Rodeo, NM.	0	0	0	1.44	2.58	.79	4.81	

amounts in inches.

m³ s⁻¹ was estimated downstream at Redington (drainage km²)².

Tropical Cyclone of September 27-30, 1926

In contrast with the previous tropical cyclone, this could not be linked with any known floods and was associated relatively minor amounts of precipitation. On September 27 the cyclone tracked into the Gulf of California and, subsequently, moved ashore and dissipated (Figure 23). Scattered showers in New Mexico and Arizona on October 1 and became more intense the following day as a cold front pushed into Arizona from the south. The showers were located in eastern New Mexico and Texas and headed east. Balmorhea, Texas and Hobbs, N.M.

HURRICANE OF
9/4-6 1939

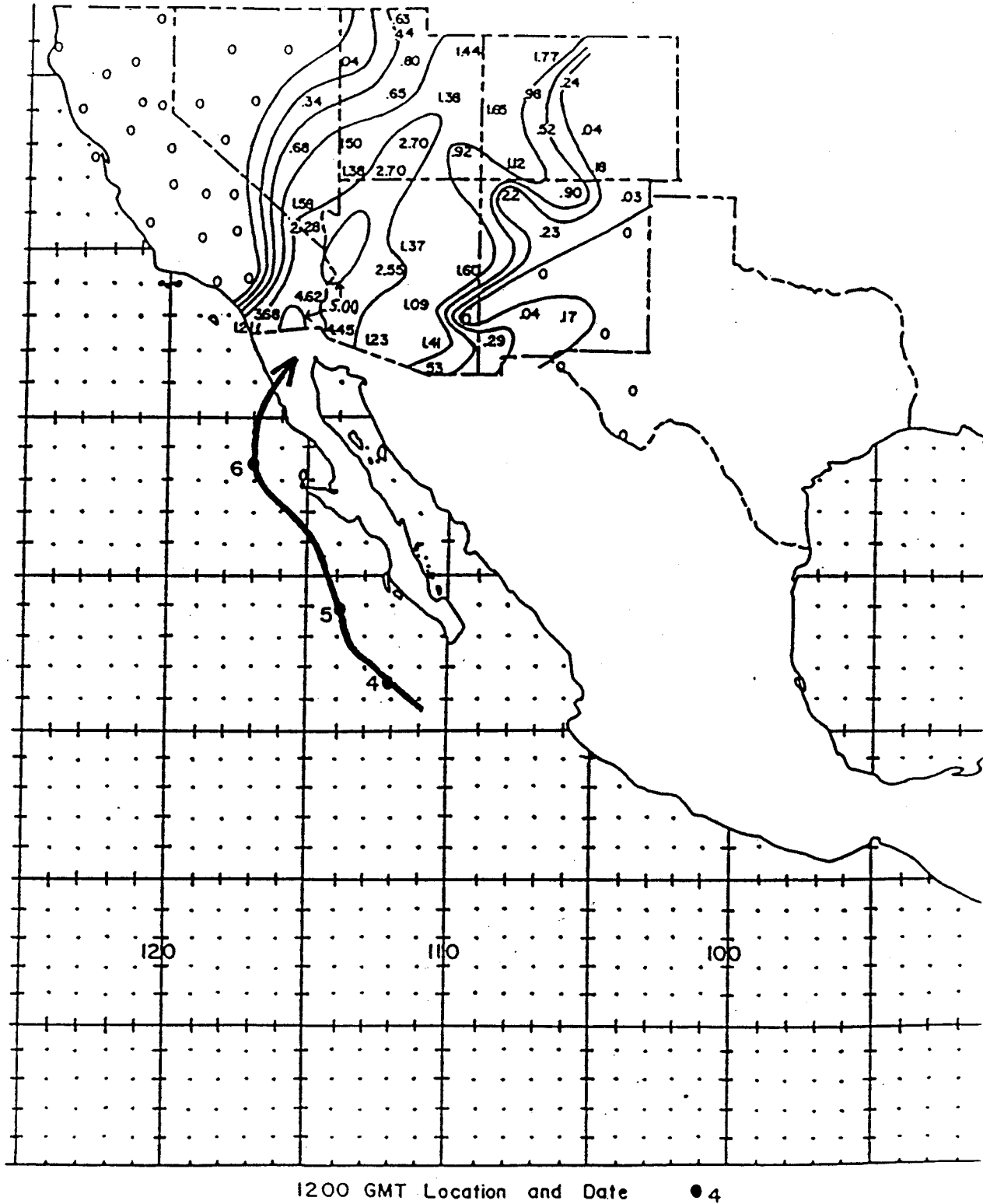


Figure 37. Track of the Tropical Cyclone of September 4-6, 1939 and associated rainfall in the Southwest. Precipitation totals are in inches and the isohyets are drawn at .01, .25, .50, 1.00, 2.00, and 5.00 inches.

Table 18. Tropical Cyclone of August 4-9, 1939
daily precipitation

Station	August					Total
	7	8	9	10	Total	
Nogales, Az.	.80	.08	.86	.03		1.57
Patagonia, Az.	1.05	.30	1.51	.21		3.07
Wickenburg, Az.	0	0	1.60	.06		1.66

amounts in inches.

Table 19. Hurricane of September 4-6, 1939 daily precipitation

Station	September							Total
	3	4	5	6	7	7	Total	
Bright Angel Ranger Station, Az.	0	1.62	2.72	1.54	.67			6.55
Kingman, Az.	0	.46	2.10	2.70	.19			5.45
Parker, Az.	.10	.13	3.43	1.66	.13			6.85
Truxton (near), Az.	0	3.62	1.16	2.02	.05			6.50
Yarnell, Az.	0	1.69	1.87	2.92	.02			6.33
Brawley, Ca.	0	0	2.53	3.80	0			5.95
Hayfield Reservoir, Ca.	0	0	2.50	3.05	.40			5.02
Imperial, Ca.	.03	.04	2.41	2.98	.13			5.59
Iron Mountain, Ca.	0	1.51	.10	1.70	.24			3.55
Alto Utah	0	1.18	.37	1.85	.05			3.45

Springdale, Utah
inches

Table 20. Tropical Cyclone of September 6-12,
1939 daily precipitation

Station	September			Total
	10	11	12	
Fredonia, Az.	.10	.82	2.15	.66
Mohawk, Az.	0	.53	1.50	1.00
Mt. Trumbell, Az.	.36	1.65	1.86	0
Yarnell, Az.	0	.52	1.55	1.19
Alton, Utah	.39	.27	1.57	1.12
Bryce Canyon, Utah	.51	.94	3.15	0
Tropic, Utah	.50	.85	1.10	1.73
Searchlight, Nev.	00	.11	3.84	.11

00 = trace; amounts in inches.

from there travelled to the northwest at least in
The storm most likely dissipated after hitting Be
sometime on September 18 or 19. Moisture associat
ex-tropical cyclone appears to have entered south
and western Arizona on September 19 and led to its

TROPICAL STORM NORMA 8/30-9/5 1970

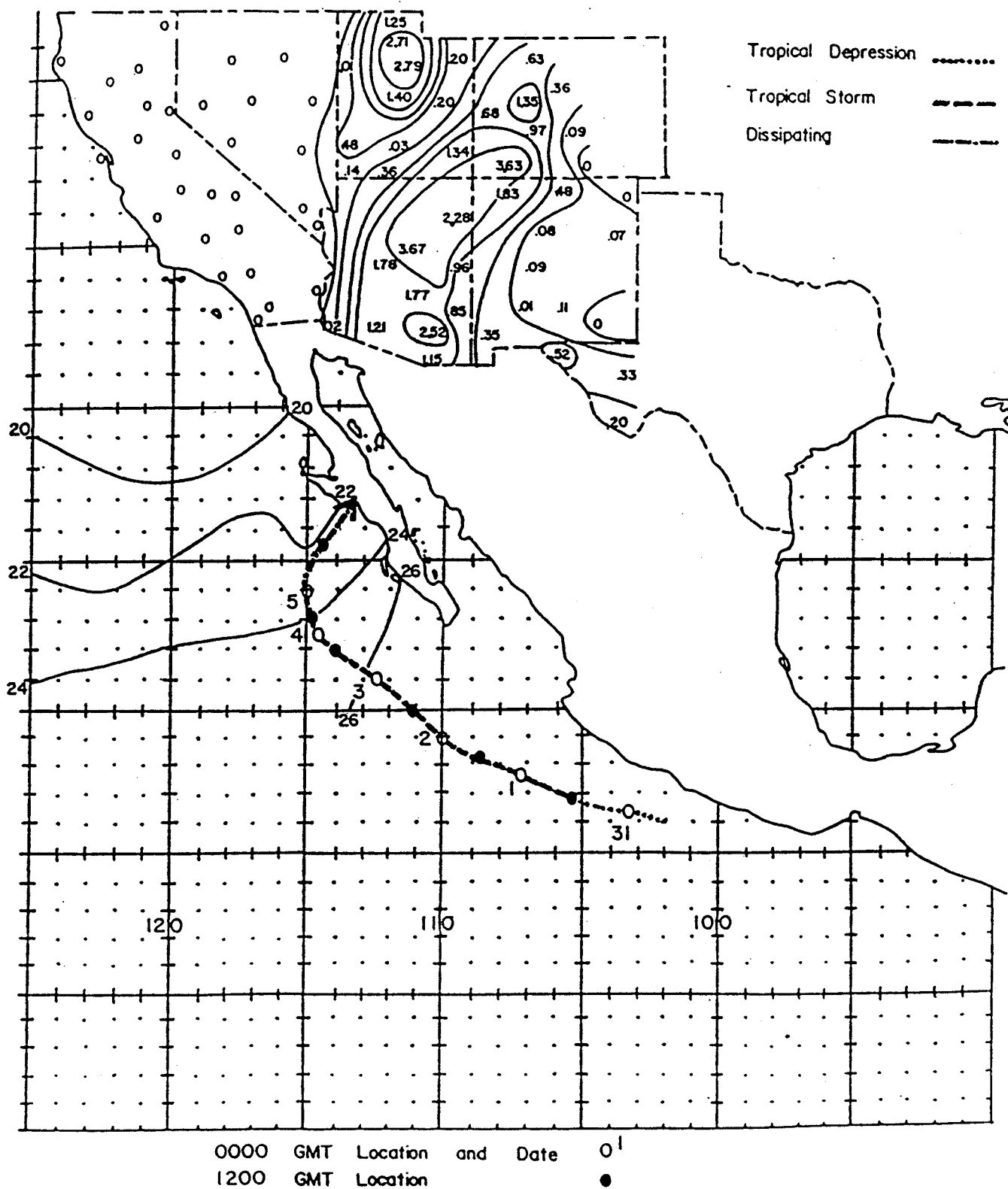


Figure 95. Track of Tropical Storm Norma; August 30 - September 5, 1970; and associated rainfall in the Southwest. Precipitation totals are in inches and the isohyets are drawn at .01, .25, .50, 1.00, and 2.00 inches. Sea surface temperatures are in °C.

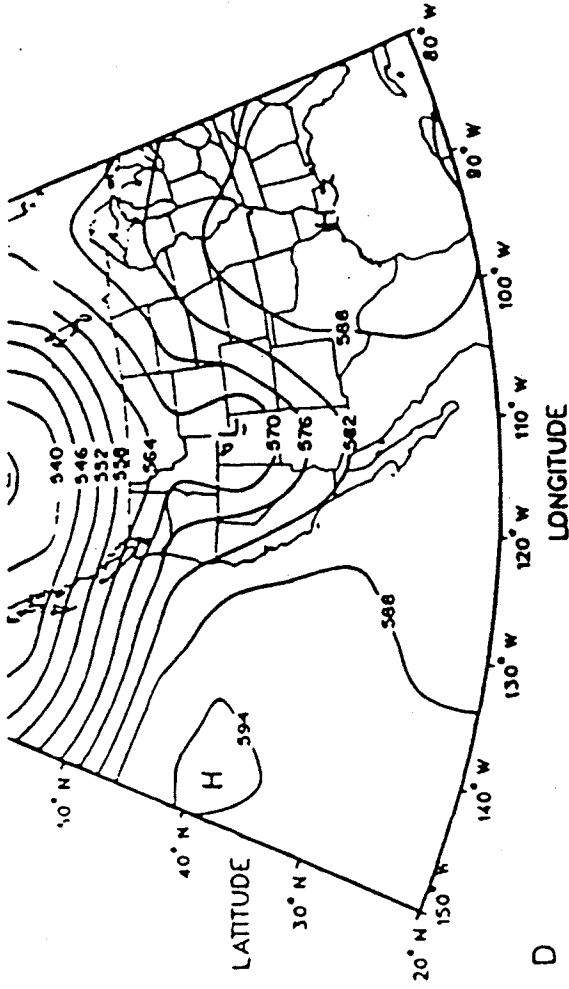


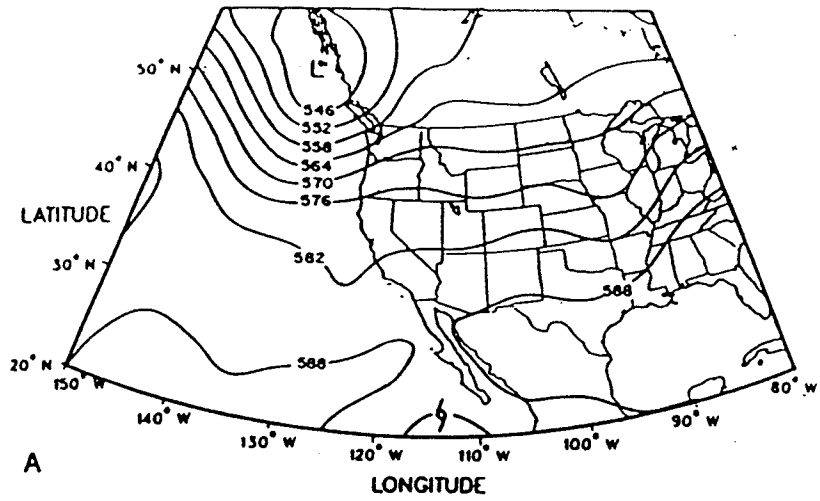
Figure 94. (continued) As in Figure 44.

Table 39. Tropical Storm Norma; August 30 - September 5, 1970; daily precipitation

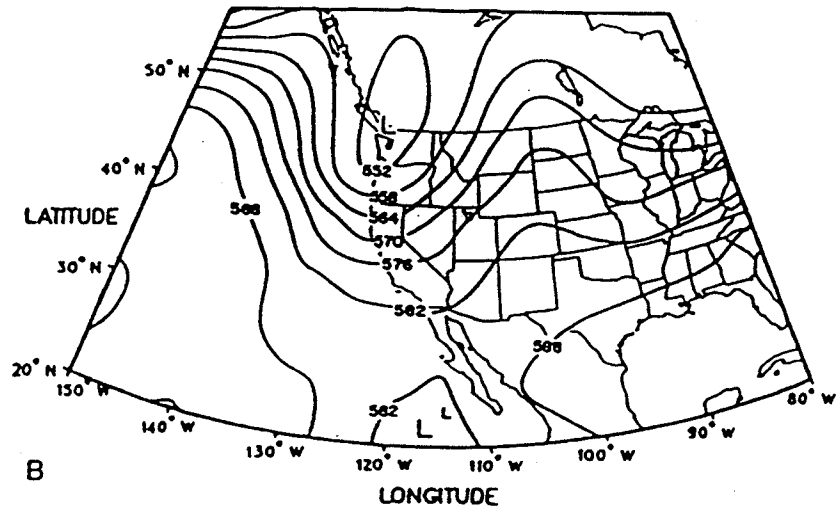
Station	September							Total
	3	4	5	6	7	7		
Crown King, Az.	0	.85	4.50	1.66	0	0	0	7.01
Junipine, Az.	0	.78	5.28	0	0	0	0	6.04
Kitt Peak, Az.	.08	2.85	1.01	3.71	.45	.35	.45	8.08
Palisade Ranger Station, Az.	.62	1.51	2.50	3.78	.35	.35	.35	8.74
Payson Ranger Station, Az.	0	.23	6.20	0	0	0	0	6.43
Sedona Ranger Station, Az.	.05	.80	5.50	0	0	0	0	6.35
Sunflower 3NNW, Az.	0	.30	8.00	.14	0	0	0	8.44
Tonto Creek Fish Hatchery, Az.	0	.25	1.25	5.63	0	0	0	7.13
Workman Creek 1, Az.	---	---	11.40	---	---	---	---	11.40
Bug Point, Utah (unofficial)	0	0	6.50	0	0	0	0	6.50
Cedar Point, Utah	0	.30	3.75	.23	0	0	0	4.28
Durango, Co.	0	.81	2.62	0	0	0	0	3.43
Silt, ton, Co.	0	.71	1.43	2.05	0	0	0	4.19
WOL, Peak Pass 4W, Co.	0	.90	3.20	0	0	0	0	4.10

amounts in inches.

TROPICAL STORM NORMA
SEPTEMBER 3, 1970



SEPTEMBER 4, 1970



SEPTEMBER 5, 1970

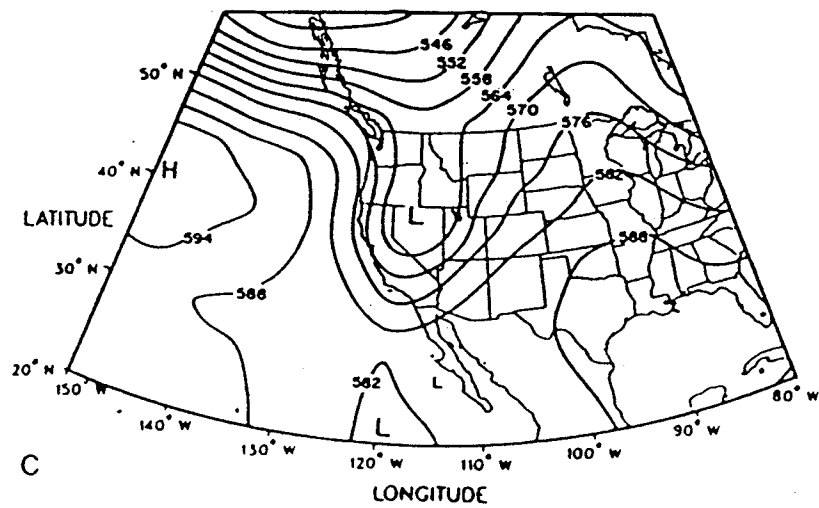
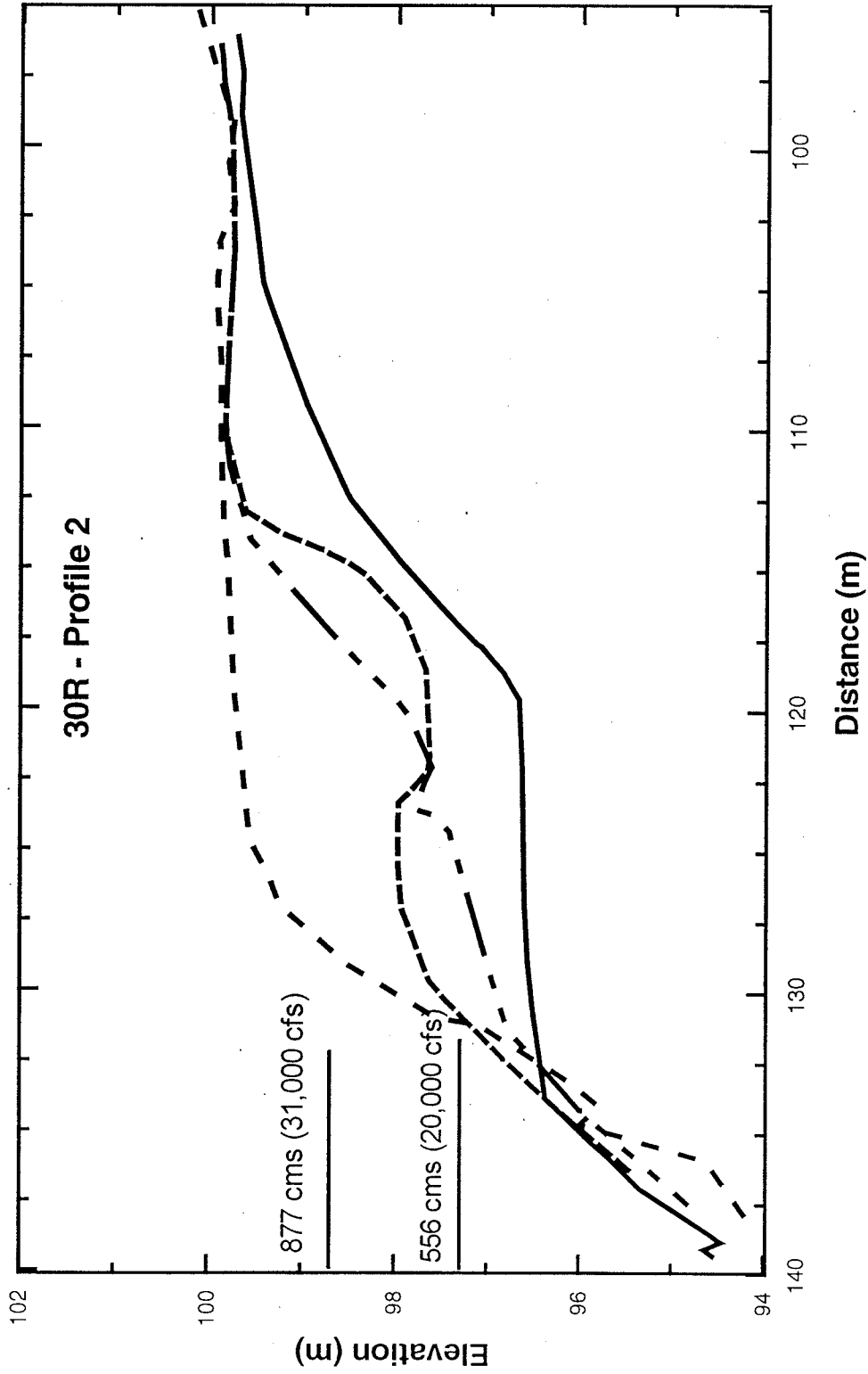
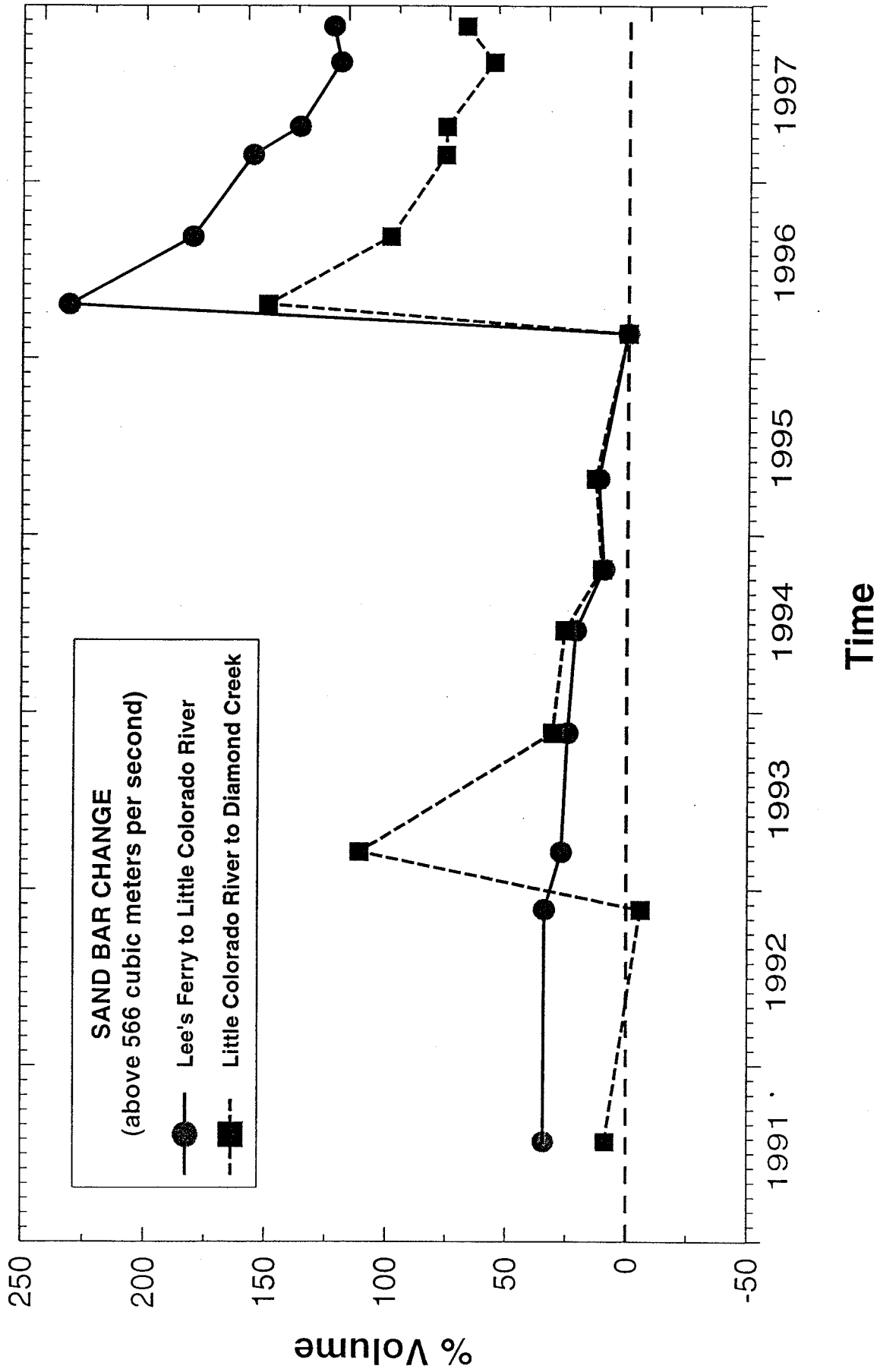


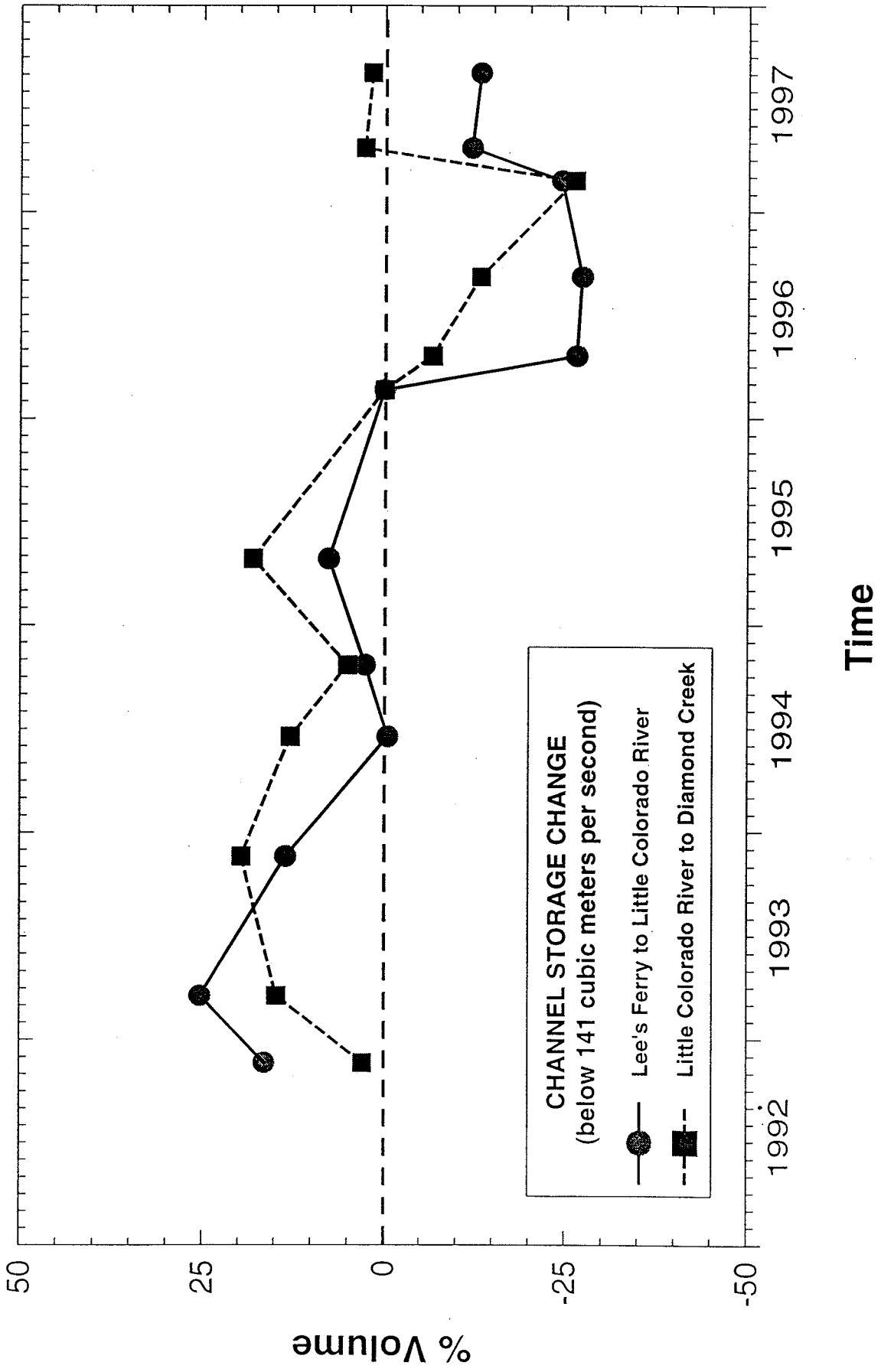
Figure 94. As in Figure 44.

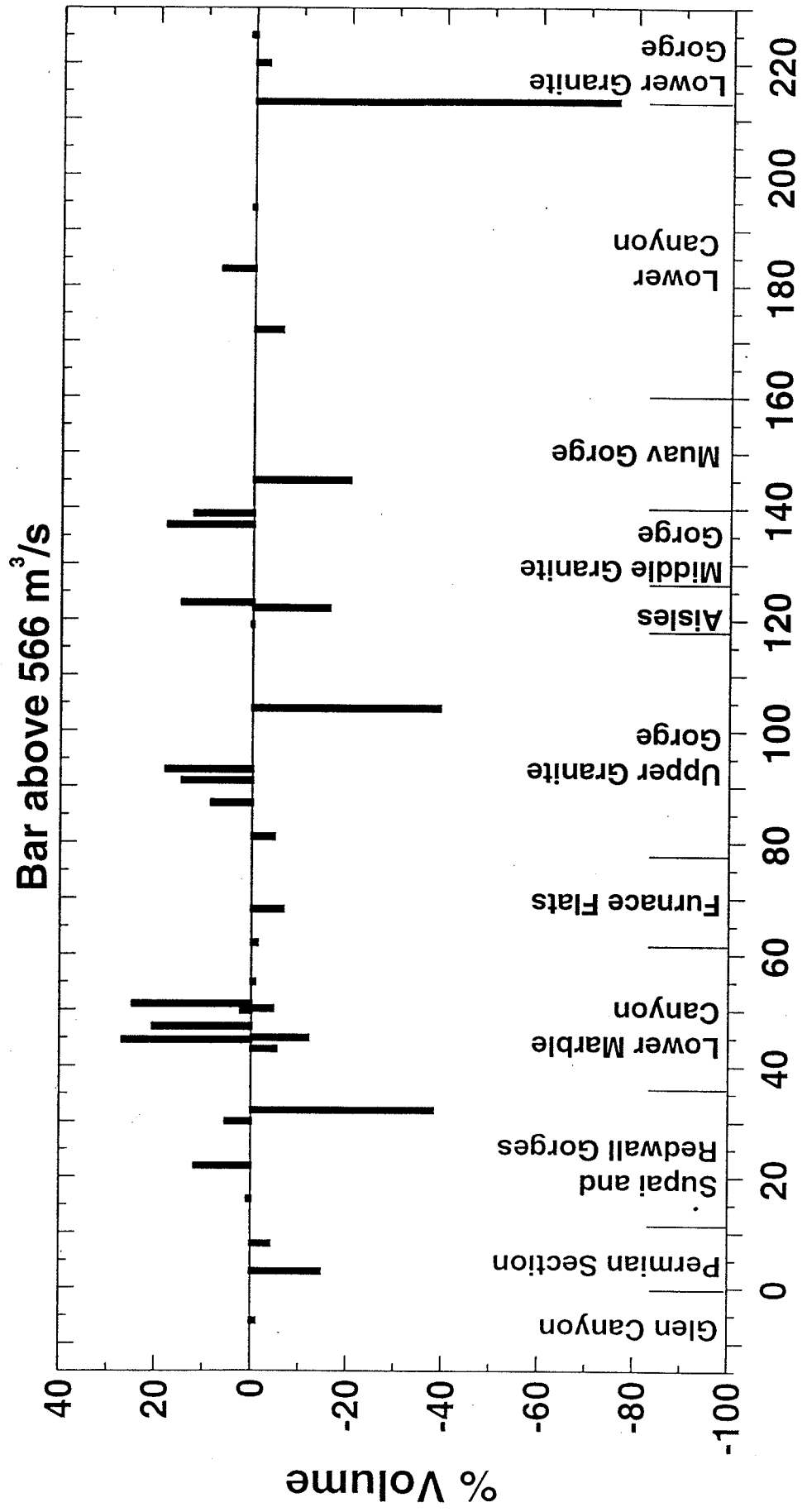


877 cms (31,000 cfs)

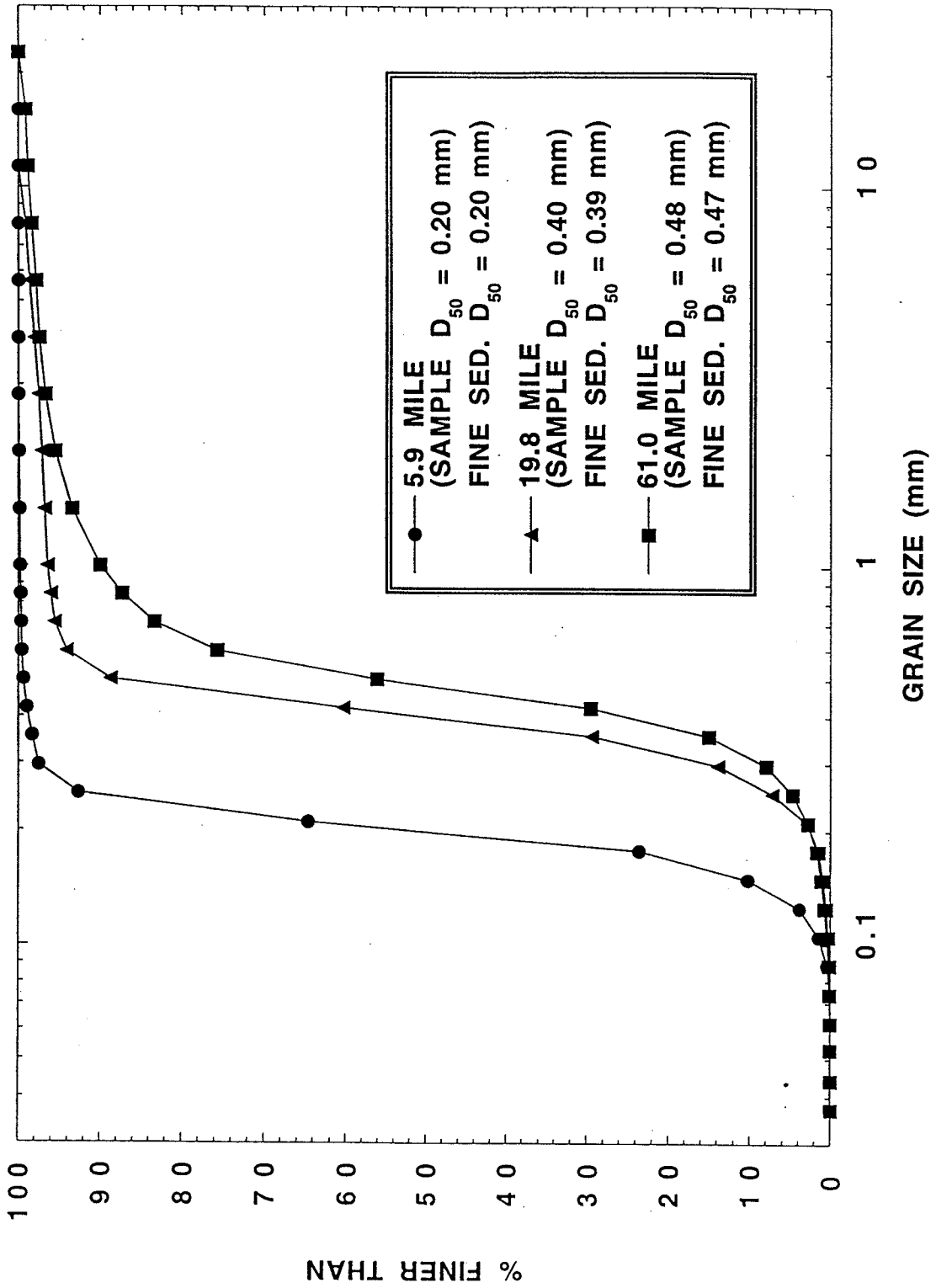
556 cms (20,000 cfs)



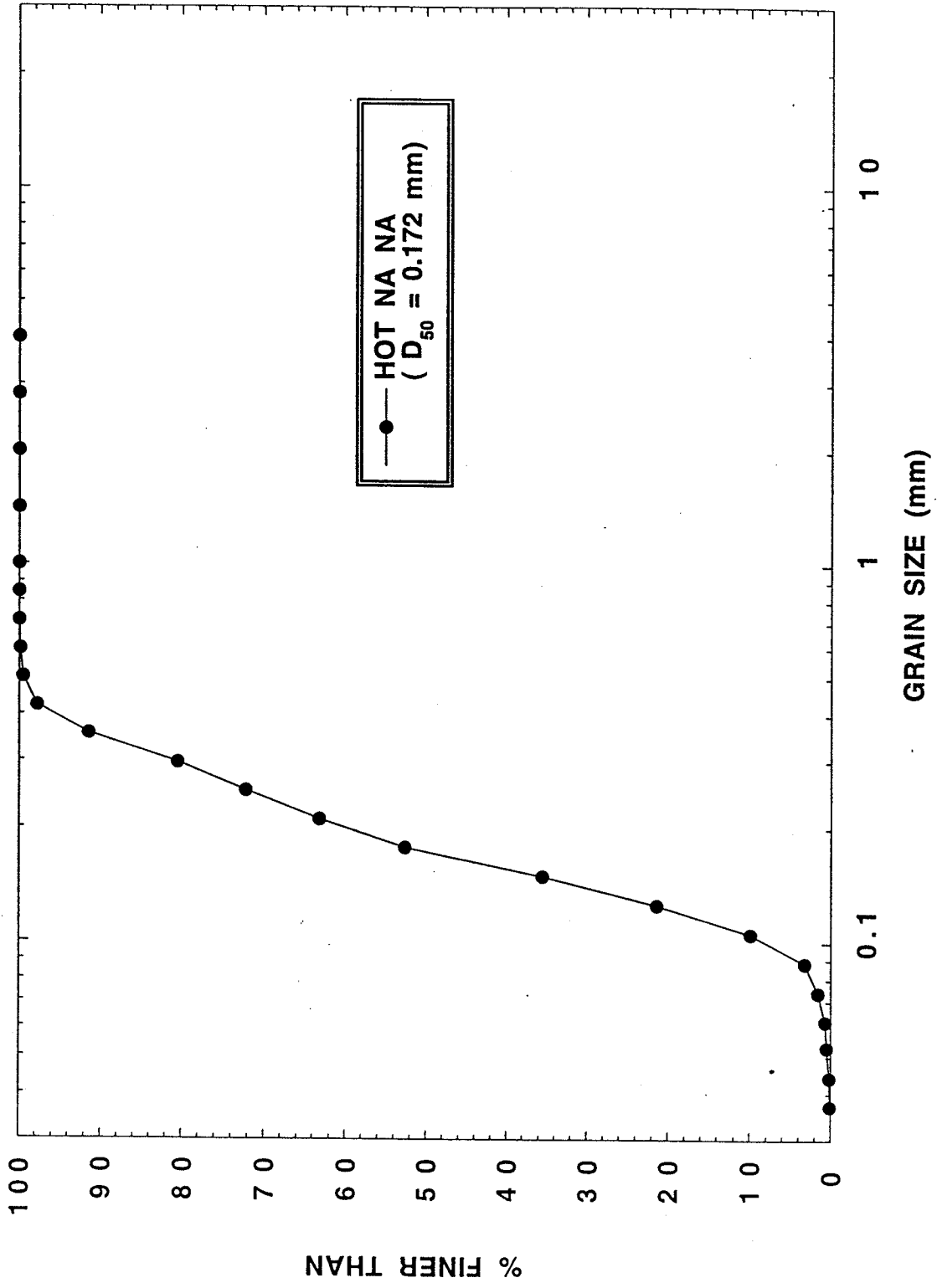




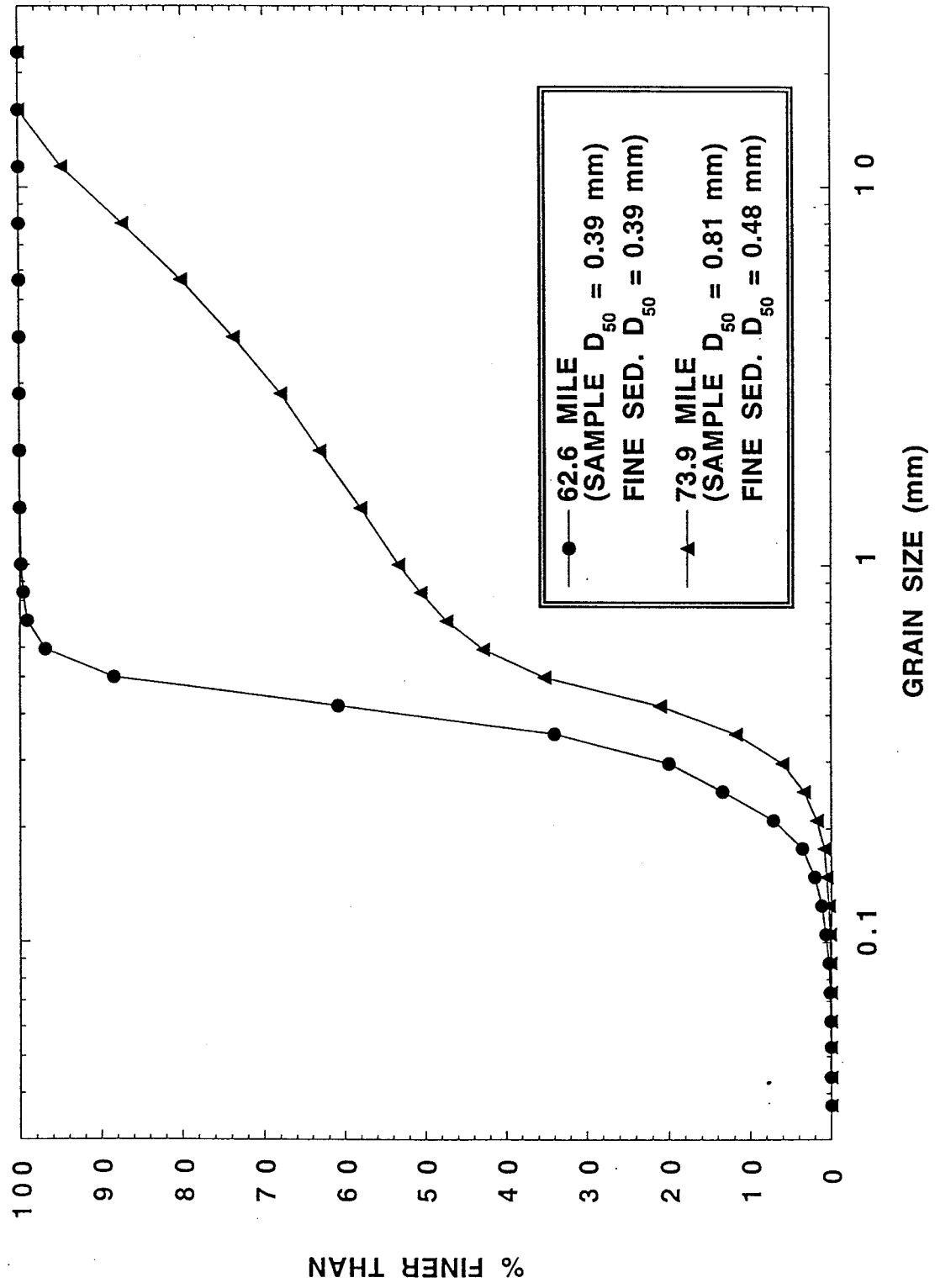
MARBLE CANYON MAIN-CHANNEL SAMPLES



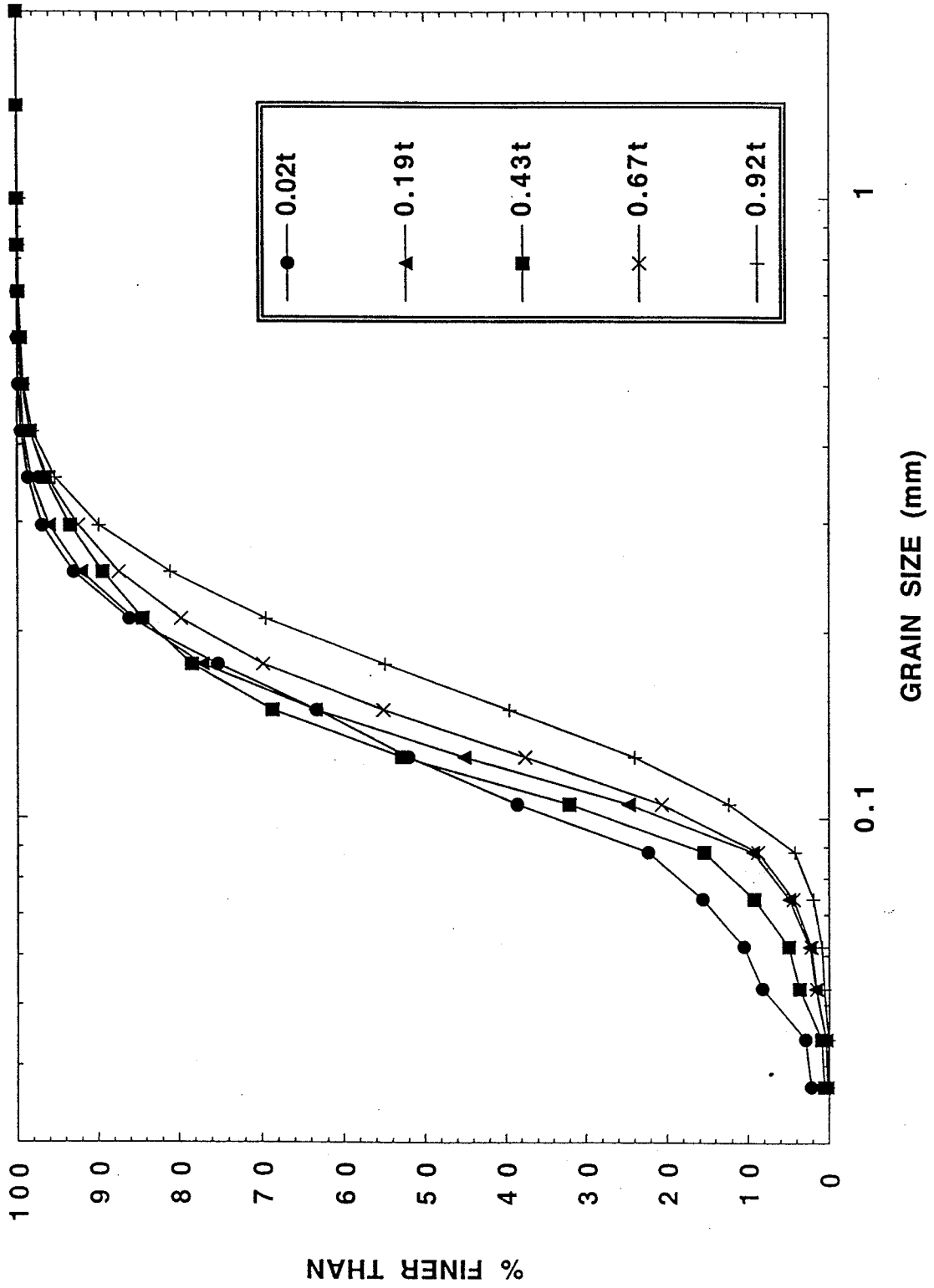
MARBLE CANYON EDDY SAMPLES



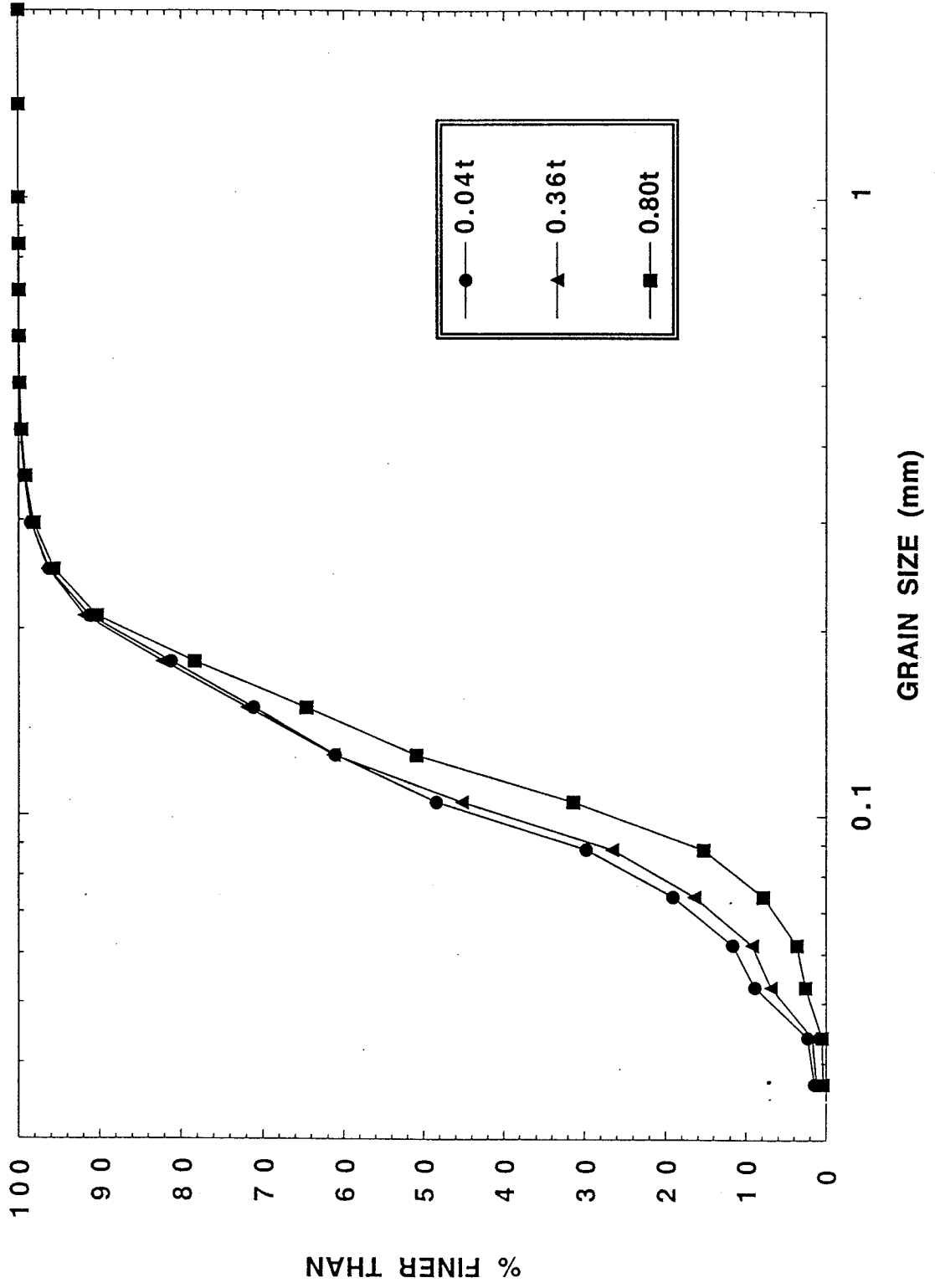
GRAND CANYON MAIN-CHANNEL SAMPLES



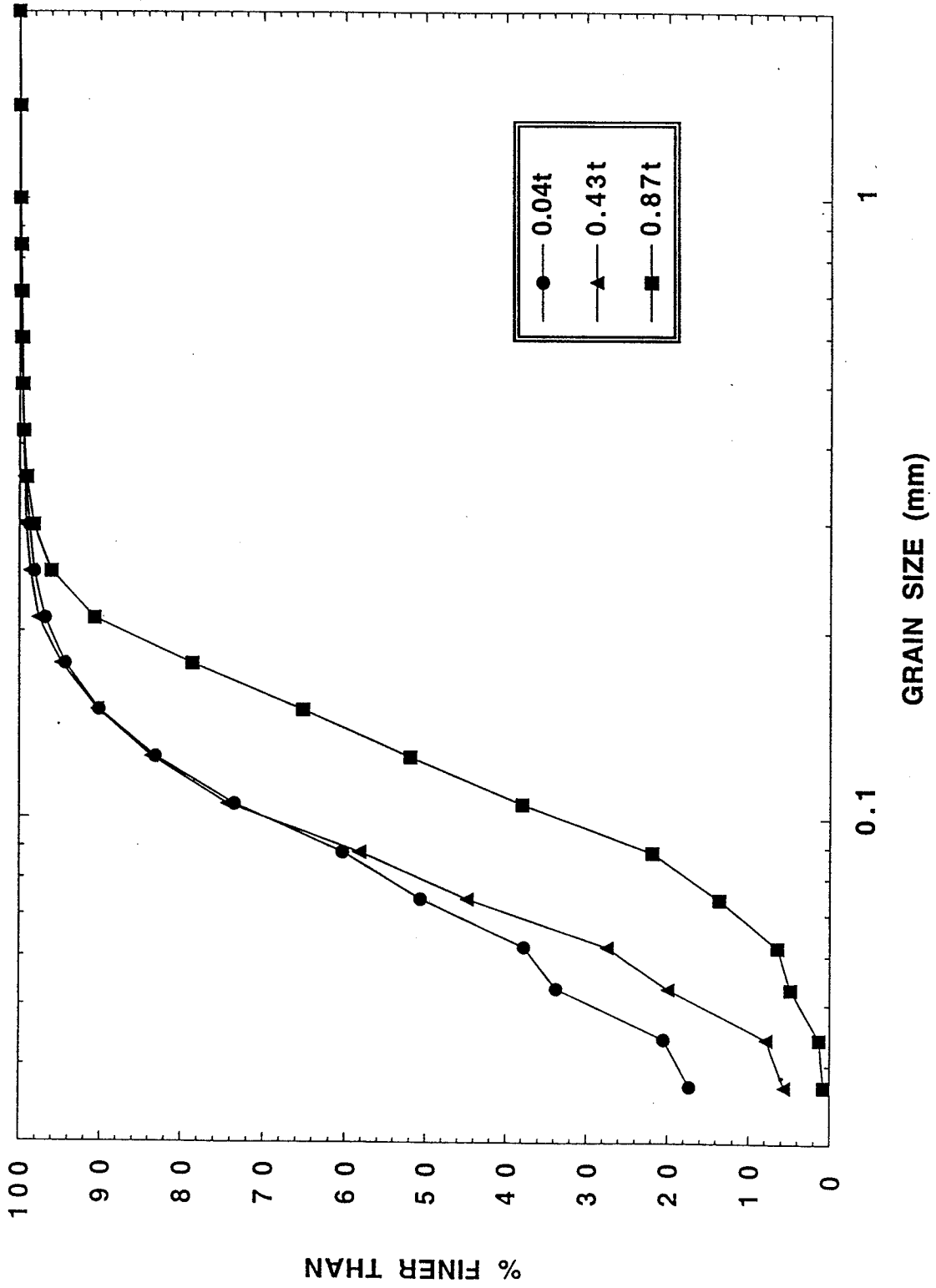
22-MILE BAR (14.3 m from h.w.m.; deposit thickness = 1.23 m)



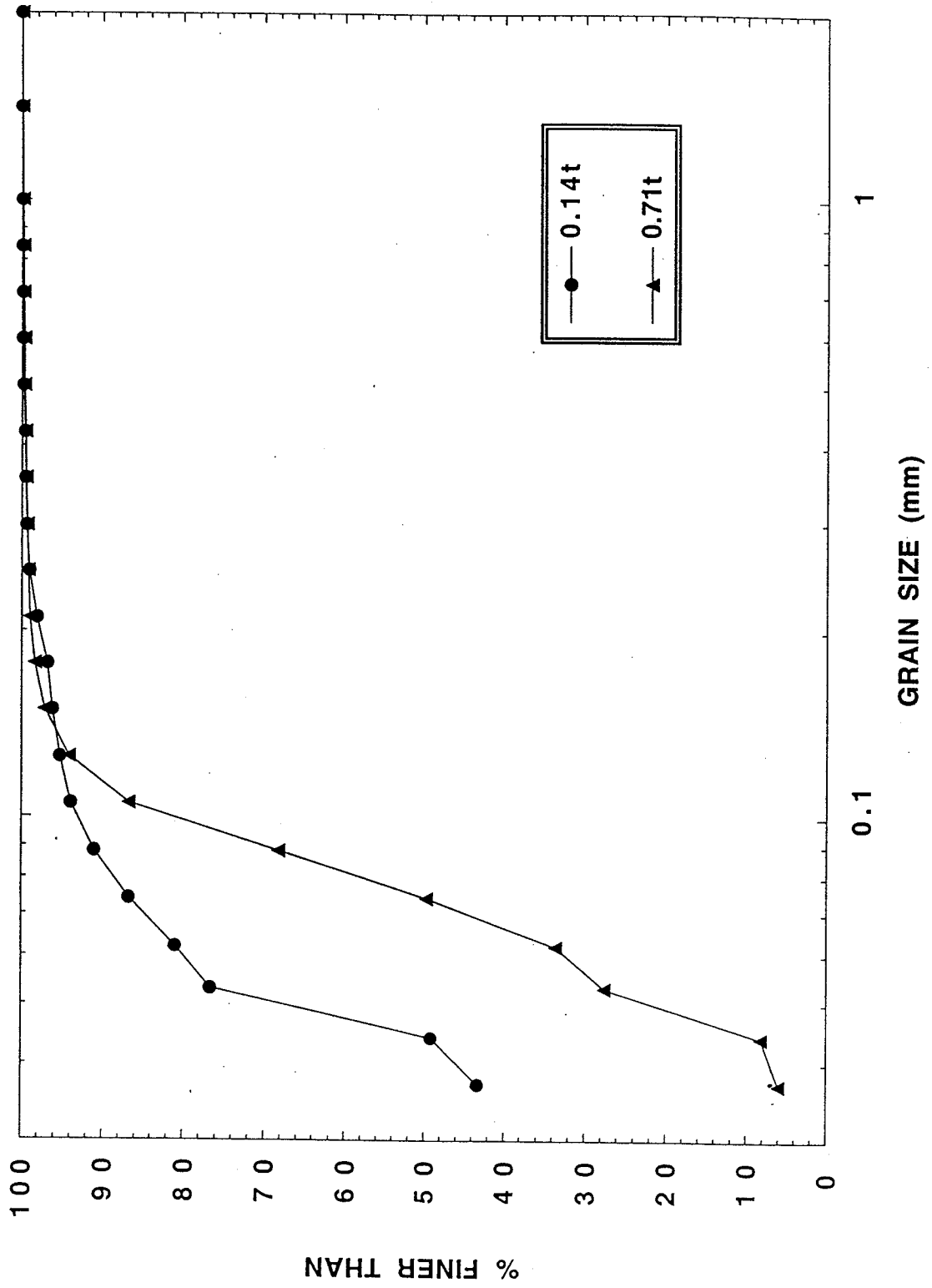
EMINENCE SITE 3 (11.5 m from h.w.m.; deposit thickness = 0.55 m)

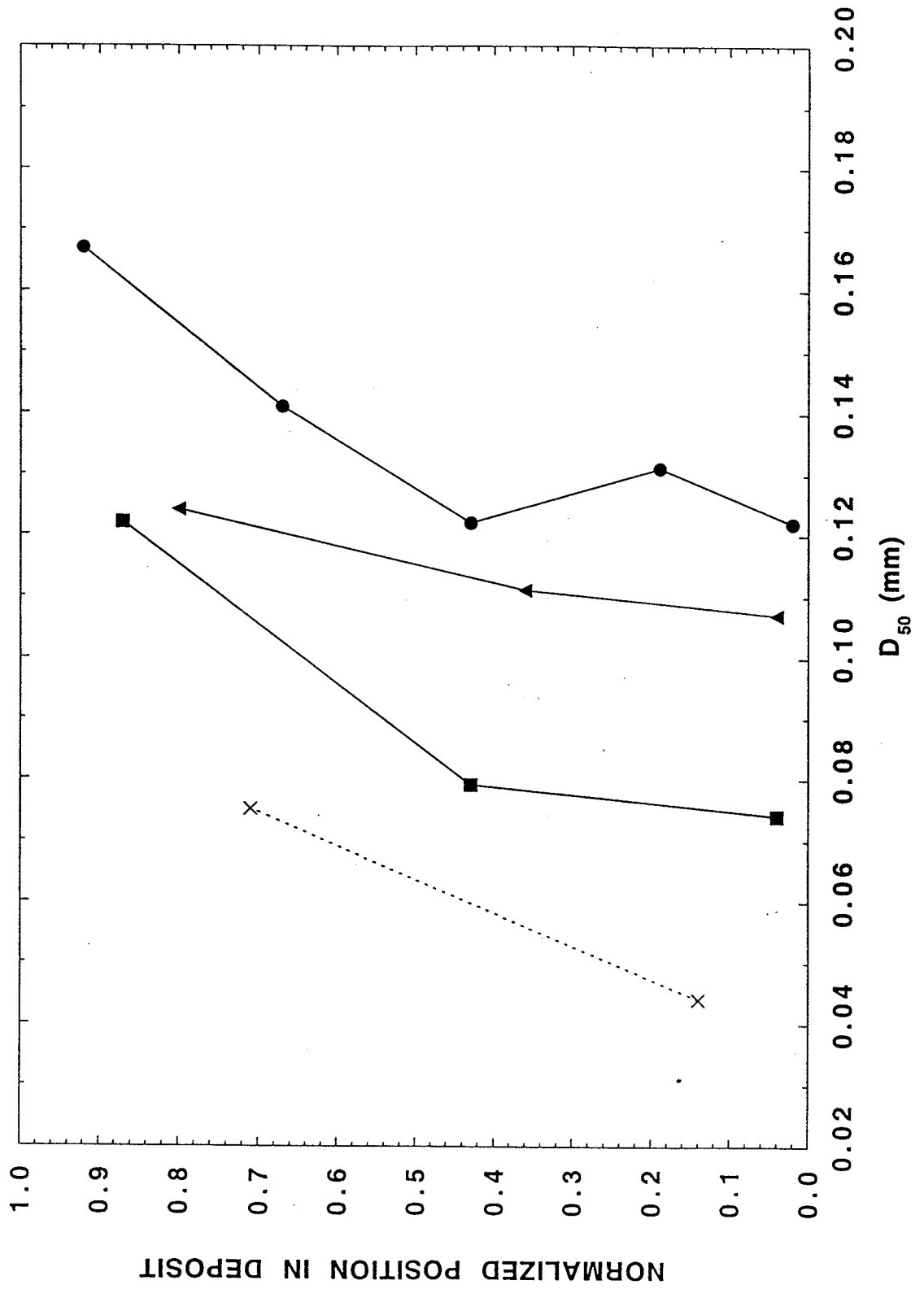
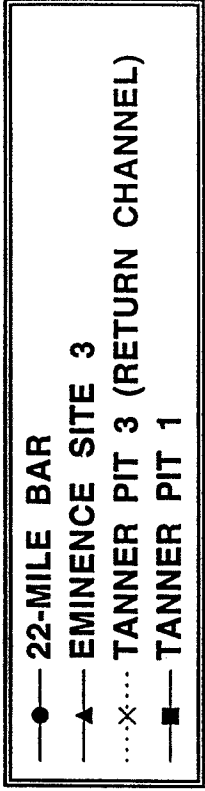


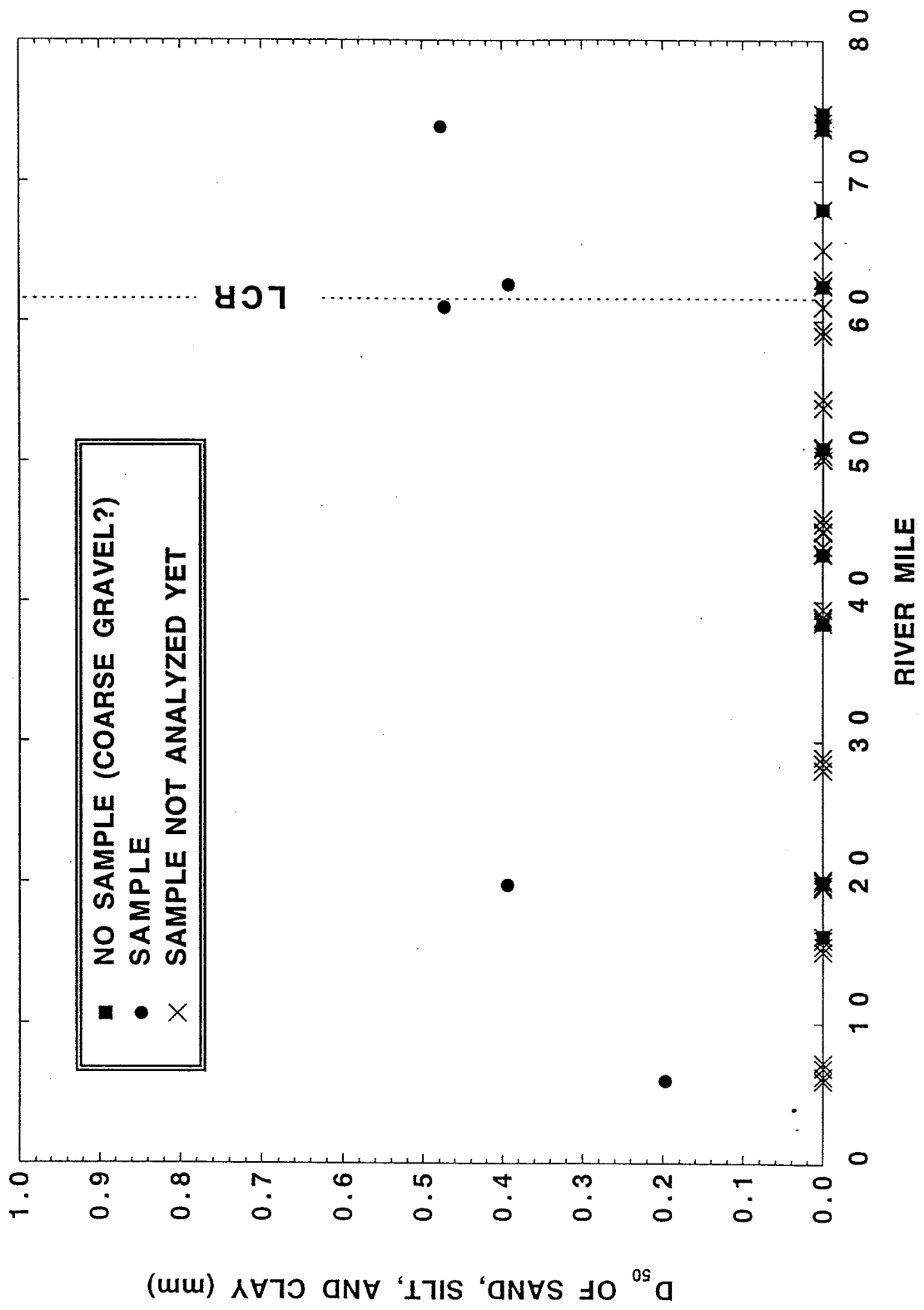
TANNER PIT 1 (11.2 m from h.w.m.; deposit thickness = 0.23 m)



TANNER PIT 3 (5.1 m from h.w.m.; deposit thickness = 0.14 m)

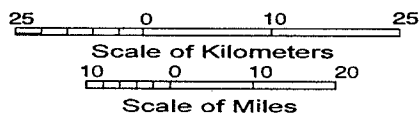
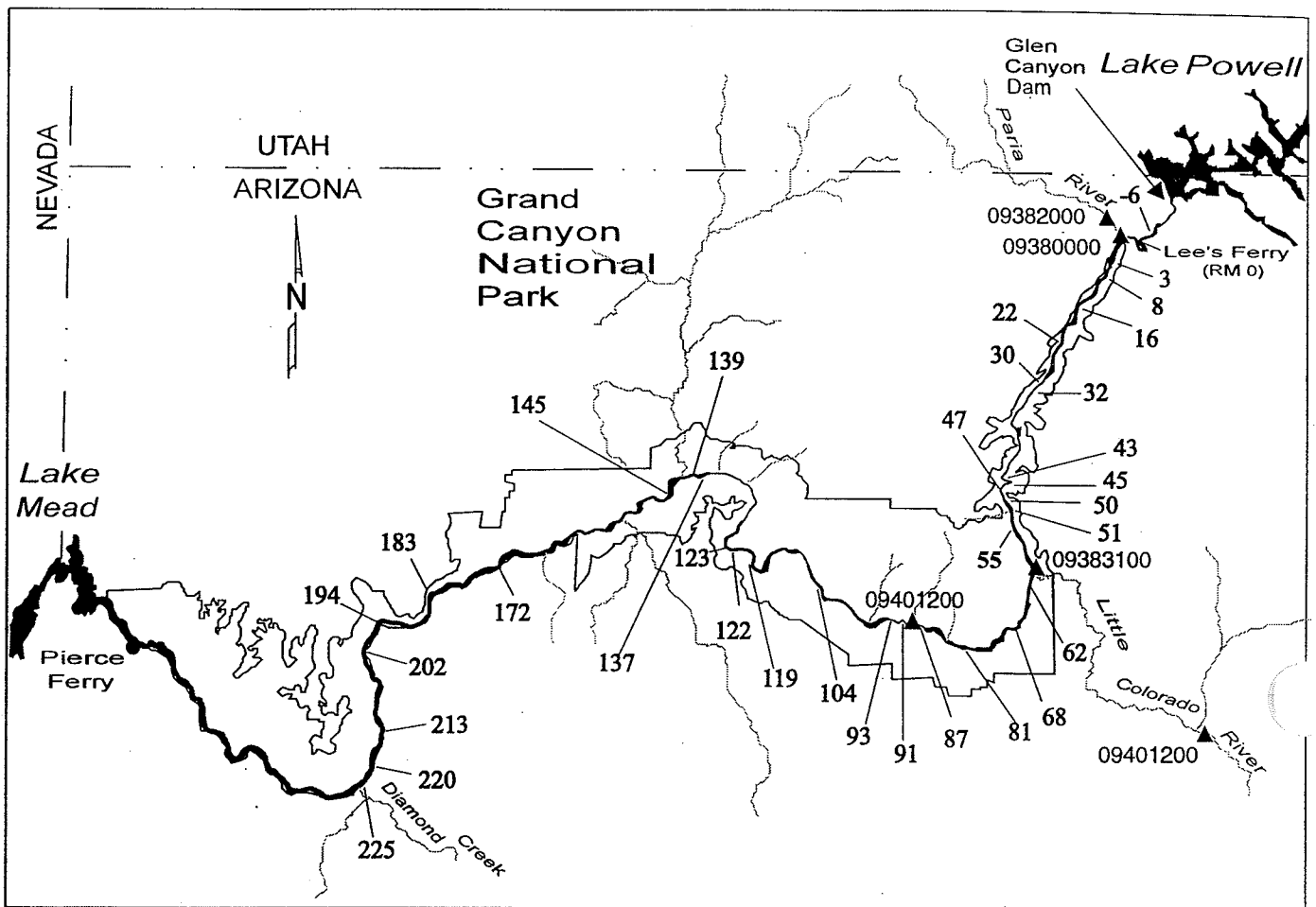






PRELIMINARY FINDINGS FROM THE
NOVEMBER 1997 - 31,000 CFS TEST FLOW

- **No Net Change in Glen Canyon Reach w.r.t. Sand Bars or Channel Storage**
- **Net Aggradation of Most Sand Bars Below Badger Rapids, and Coarsening Up [to 1.3 meters thick]**
- **Fine Sediments From Paria Still in Upper Marble Canyon Reach [system remains loaded]**
- **1-Meter Bedforms Evolved and Persisted Between Paria Confluence and Badger Rapids**
- **Channel Coarsening DS Suggests a Longer Residence Time for Fines Than Previously Thought**



EXPLANATION

- ▲ 09383100 USGS STREAMFLOW-GAGING STATION-Number is station identifier
- 145 STUDY SITE-Number is in Stevens (1983) River Miles