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Pleistocene Fresh-water Ostracodes from a Sediment Core in Butte Valley, Siskiyou County, California

by

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Claire Carter

ABSTRACT

Fourteen species of ostracodes were recovered from a 102-m core drilled in the Pleistocene lake sediments of Butte Valley, California. Eight of the species were not found above a depth of about 83 m. Most of the species are left in open nomenclature, pending further study, but they are all illustrated and their population fluctuations are documented herein. Included are three well-known modern species: *Limnocythere ceriotuberosa* Delorme, *L. sappaensis* Staplin, and *Cytherissa lacustris* (Sars).

INTRODUCTION

Recent research into the relationships between ostracodes, lacustrine water properties (temperature, salinity, etc.), and climate (Forester, 1987; 1991; DeDeckker and Forester, 1988) has revealed the usefulness of ostracodes as paleolimnological and paleoclimatic indicators. Using the modern occurrences of certain ostracode genera and species, it is possible to extrapolate environmental conditions back into the fossil record, giving us a general picture of the climatic history of the area under study. Ostracode faunas collected from a core drilled in lacustrine sediments and plotted by depth of occurrence reveal changing environmental conditions in the lake and thus climatic history through time.

SETTING

Butte Valley is a complexly downfaulted basin south of the town of Dorris, California, very near the Oregon-California border (Fig. 1). The valley floor is a nearly flat plain more than 130 square miles in area (Wood, 1960) and has been the site of a lake for at least 1 million years, although the present lake, Meiss Lake, is relatively much smaller than the prehistoric lake. The area is part of the U.S. Forest Service's Butte Valley National Grassland.

Butte Valley is a closed drainage basin bounded on the west by a part of the Cascade Range and on the east by the northwest-trending fault block of the Mahogany Mountain ridge, which separates it from the marshland of Lower Klamath Lake. The basin is filled mostly with semiconsolidated lake deposits ranging in age from ?Pliocene to Holocene and exceeding 900 feet in thickness (Wood, 1960). It is near the western edge of the Modoc Plateau and is presently subject to active, extensional tectonism.

The climate of the Butte Valley area is semiarid, with warm, dry summers and cool, wet winters. Cyclonic storms move periodically across the region from west to east (Wood, 1960).

At an altitude of about 4200 feet, the valley, as well as the surrounding mountains, receives most of its winter precipitation in the form of snow.

SITE AND METHODS

In the fall of 1992, a 3-inch diameter core was drilled east of Meiss Lake down to a depth of 102 meters (Adam and others, 1994). The site selection and drilling were under the direction of David P. Adam (USGS) as part of his project to study Quaternary climatic conditions in western North America. The recovered core was shipped to the USGS refrigerated core storage facility in Menlo Park, California, where it was sampled for ostracodes.

Each of the 111 samples was placed in a steel beeker, frozen, thawed, and treated with approximately 300ml of hot water and a rounded teaspoon of baking soda. After cooling, about 2 tablespoons of Calgon were added and each sample was allowed to sit for 24 hours. Following wet sieving over a 100 mesh sieve, the residue was air dried, then dry-sieved to obtain size fractions, which were then examined and picked for adult carapaces and valves.

RESULTS

Table 1 lists each sample by depth and records the component species of the ostracode faunas in the upper 83.5m of the Butte Valley core. Also listed are the drive and slug and the weight of each sample, and the occurrences of other organic remains such as plant fragments, diatoms, and molluscan shell fragments. Table 2 lists the samples from the lower 18.5m of the core. Because the ostracode carapace consists of two valves that commonly become separated after the animal's death, the species numbers represent whole carapaces or the equivalent in single valves (one right valve + one left valve = one whole carapace). Most of the species are left in open nomenclature pending further study. However, three species are commonly-found modern forms with well-known ecological requirements: *Cytherissa lacustris* (Sars), *Limnocythere ceriotuberosa* Delorme, and *Limnocythere sappaensis* Staplin (Figs. 2, 3). The ecological and climatic implications of the data are discussed elsewhere (Carter and Adam, in prep.).

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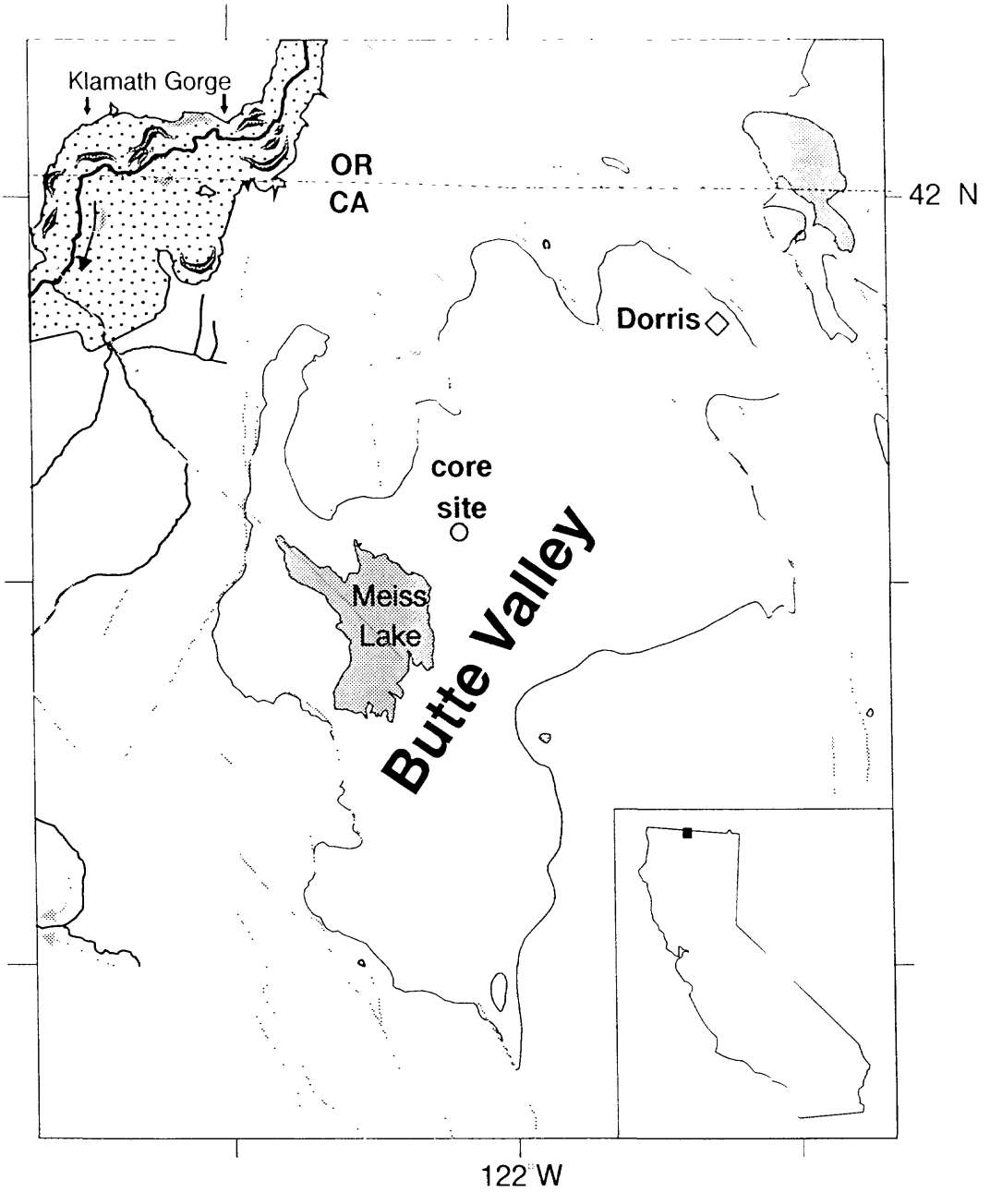

Figure 1. Map showing Butte Valley and vicinity. Light gray pattern shows distribution of valley-bottom lake sediments; dark gray shows lakes. Coarse pattern shows Klamath River gorge, with landslide scarps shown by arcs. Streams are shown in black; lighter lines are lineaments interpreted from topographic maps. (From Adam and others, 1994)

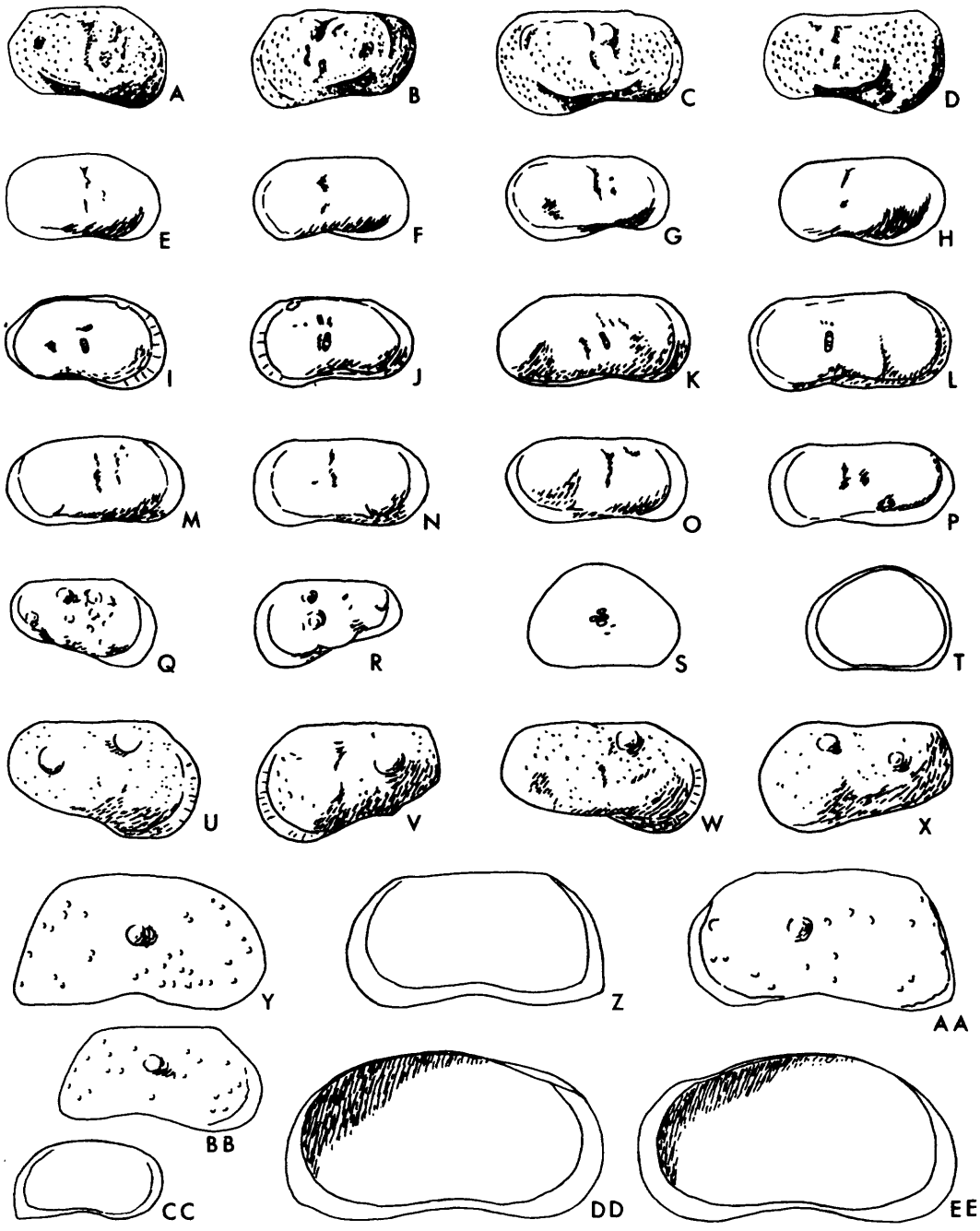

Figure 2. Camera lucida sketches of ostracodes found in Butte Valley core. All approximately x33; all exterior views except as noted. A-D, *Limnocythere ceriotuberosa* Delorme, sample no. 8347: A, right valve, female; B, left valve, female; C, right valve, male; D, left valve, male. E-H, *L. sappaensis* Staplin, sample no. 3460: E, right valve, female; F, left valve, female; G, right valve, male; H, left valve, male. I-L, *L.* aff. *L. bradburyi*, sample no. 10645: I, right valve, female; J, left valve, female; K, right valve, male; L, left valve, male. M-P, limnocytherid sp. A, sample no. 3460 (note posterio-ventral spine): M, right valve, female; N, left valve, female; O, right valve, male; P, left valve, male. Q,R, limnocytherid sp. B, sample no. 3460, female right and left valves, respectively. S,T, *Cypria* sp., sample no. 3460, exterior and interior views, respectively, of right valve. U-X, *Cytherissa lacustris* (Sars), sample no. 3464: U, right valve, female; V, left valve, female; W, right valve, male; X, left valve, male. Y,Z,AA,BB, *Tuberocypris* sp., sample no. 3460, all females: Y, exterior view, right valve; Z, interior view, right valve; AA, exterior view, left valve; BB, exterior view, right valve, juvenile. CC-EE, *Candona* sp. F: CC, interior view, left valve, juvenile, sample no. 10684; DD, interior view, left valve, female (?), sample no. 10684; EE, interior view, right valve, female (?), sample no. 3460.

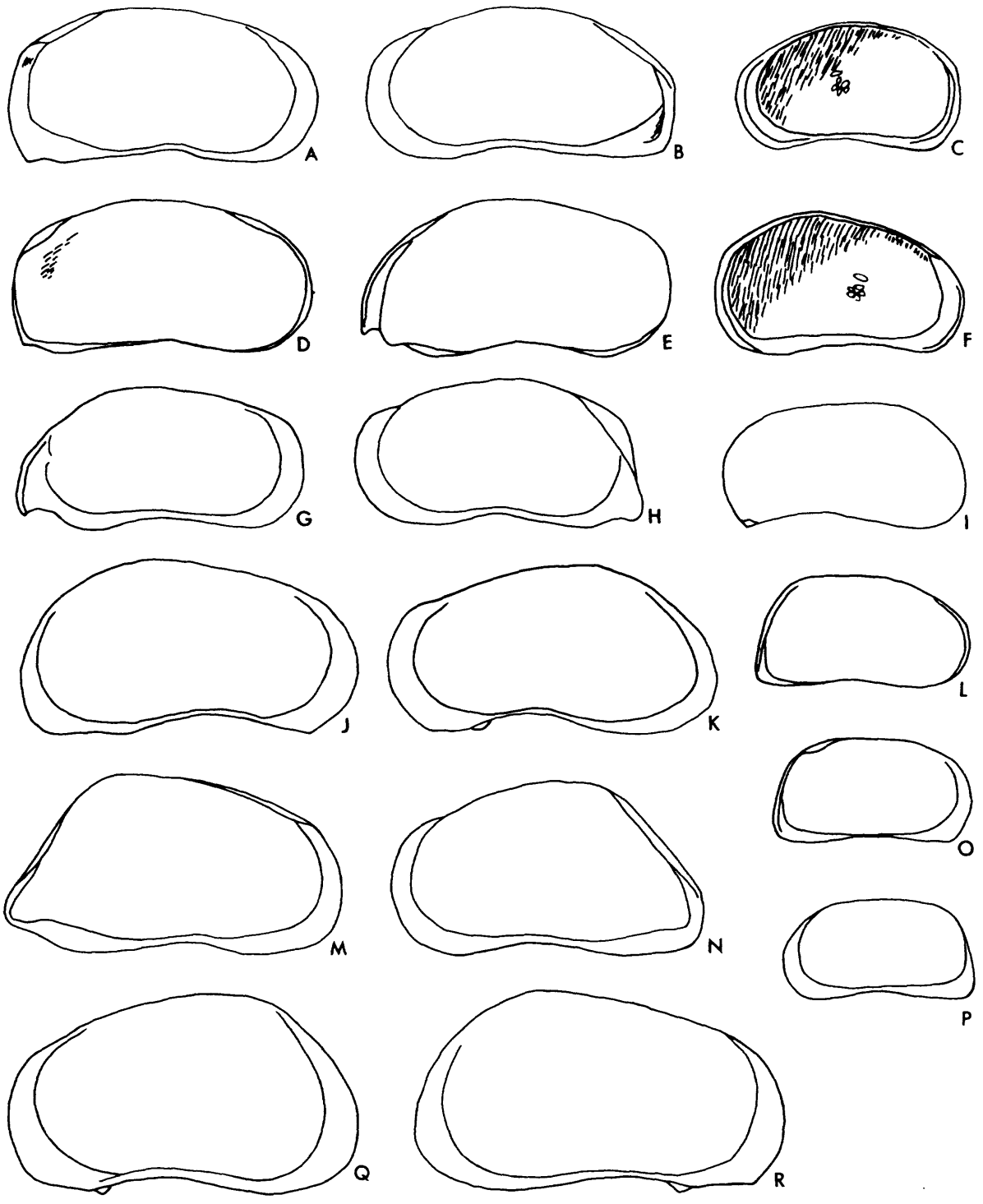

Figure 3. Camera lucida sketches of candonid ostracodes found in Butte Valley core. All approximately x 33; all from sample no. 3460 except as noted; all are interior views except as noted. A,B,D, *Candona* sp. A: A, left valve; B, right valve; D, whole carapace, right view. C,F, *Candona* sp. E (of the rawsonoid group): C, right valve, juvenile female, sample no. 10645; F, left valve, female, sample no. 10151. E,G,H,J,K, *Candona* sp. C: E, whole carapace, right view, female; G, left valve, female; H, right valve, female; J, left valve, male; K, right valve, male. I,L,O,P, *Candona* sp. D, sample no. 3464: I, exterior view, left valve, male; L, whole carapace, right view, female; O, left valve, female; P, right valve, female. M,N,Q,R, *Candona* sp. B: M, left valve, female; N, right valve, female; Q, right valve, male; R, left valve, male.

Table 1. Ostracodes from the upper 83.5 meters of the Butte Valley core

Sample	Drive/slug	Depth in meters	Weight	L.cerio	L.sappa	CandonaC	CandonaE	L.aff.br	Limno A	Limno B	Fish	Other
8210	2/A	1.02-1.03	2									
8221	5/A	2.01-2.02	2.01									plants
8234	7/A	3.38-3.39	2.02									
8251	13/A	6.66-6.67										
8274	14/A	8.93-8.94	2.09									
8451	14/A	9.33-9.34	2.05	7		3						
8295	16/A	11.23-11.29	2.07									
8310	17/A	14.68-14.69		57	8		j					
8335	21/A	17.34-17.35	2.07	46			4				x	pl, mo
8336	23/A	19.41-19.42	2.07	j								
8337	24/B	21.60-21.61	2.09	10			j				x	
8344	27/A	24.05-24.06	2.03									
8345	29/A	26.17-26.18	2.06	j			j					
10149	30/A	27.77-27.78	2.28	j			j				x	
10150	30/A	28.06-28.07	2.18	2	j		2				x	
8347	30/A	28.24-28.25	2	12	2		5				x	pl, mo
10151	30/A	28.48-28.49	2.32	7			4				x	pl, mo
10152	31/A	28.75-28.76	2.32	j	j		2				x	plants
10153	31/A	29.24-29.25	2.26	j			j				x	
10154	31/A	29.75-29.76	2.15									
10155	32/A	30.40-30.41	2.09									
8350	32/A	30.61-30.62	2.09	7	7	3	3					diatoms
10156	32/A	30.92-30.93	2.28	j		j						
10157	32/B	31.05-31.06	2.07			j					x	
10158	32/B	31.43-31.44	2.04	14	j	1	j				x	cladoceran
10159	32/B	31.76-31.77	2.32	j	j						x	plants
10160	33/A	31.90-31.91	2.36	2							x	
10645	33/A	32.62-32.63	2.08	4	j	1	9	11				
10646	33/A	33.12-33.13	2.12	5	3		1				x	pl, dia
10647	34/A	33.31-33.32	2.23	18	j		7				x	
8369	34/A	33.61-33.62	2.07	3	1						x	pl, dia
10648	34/A	34.11-34.12	2.31	12			j				x	plants
10649	35/A	34.32-34.33	2.21	5							x	
10650	36/A	34.90-34.91	2.15	2		1						
10651	37/A	35.56-35.57	2.26	2		1						
8460	37/A	35.92-35.93	2.1			j			j	j		molluscs
10652	37/A	36.54-36.55	2.27	3			j					
8388	38/A	36.94-36.95	2.07	6		j		5			x	plants
8389	40/A	38.97-38.98	2	1								
8390	43/A	42.20-42.21	2.05	j								plants
8391	43/C	44.20-44.21	2.08									
8392	44/B	46.22-46.23	2.02									
8393	45/A	48.22-48.23	2.01								x	diatoms
8394	45/B	50.22-50.23	2.09									
8409	46/A	51.26-51.27	2.09			?j						
8410	46/B	53.17-53.18	2.04									pl, dia
8423	47/B	55.26-55.27	2.09									
8438	48/A	57.28-57.29	2.06									
8439	49/A	59.03-59.04	2.09									diatoms
8440	49/C	61.28-61.29	2.06									
8491	51/A	63.37-63.38	2.05								x	
8492	52/A	65.31-65.32	2.09									
8493	53/B	67.31-67.32	2.05									plants
8494	54/A	69.32-69.33	2.07	?		?j						pl, mo
8495	54/B	71.33-71.34	2.05	9	18	4					x	diatoms
8496	55/A	73.20-73.21	2		4	2					x	pl,mo,dia
8497	56/A	75.35-75.36	2.08	5	1		j	10				
8498	57/A	77.34-77.35	2.15				j					
8499	58/A	79.54-79.55	2.05									
8500	59/A	81.54-81.55	2		27	3						diatoms
10653	59/C	82.71-82.72	2.27		7	1						diatoms
10654	59/C	83.29-83.30	2.25		j	j						

EXPLANATION

Depth in meters, weight in grams
L.cerio=Limnocythere ceriotuberosa Delorme
L.sappa=L. sappaensis Staplin
CandonaC=Candona sp. C
CandonaE=Candona sp. E
L.aff.br=L. aff. L. bradburyi
Limno A=L. sp. A
Limno B=L. sp. B
Fish=fish bones, teeth, scales
dia=diatoms, mainly Campylodiscus sp.
pl=fragments of plant material
mo=molluscs, including gastropods, pelecypods
j=juveniles
x=present, not counted

Table 2.

Ostracodes from the lower 18.5 meters of the Butte Valley core

Sample	Drive/slug	Depth in meters	Weight	L.cerio	L.sappa	C.lacust	CandonaA	CandonaB	CandonaC	CandonaD	CandonaE	CandonaF	Tubero	Cypria	Limno A	Limno B	L.aff.br	Fish	Other
8501	59/C	83.54-83.55	2.05		19	1	j		9					1				x	mo, dia
10655	59/C	83.62-83.63	2.21	j					j					j	j				
8502	59/C	83.78-83.79	2.06	10	j	13			6					3	6			x	
10656	59/C	83.89-83.90	2.05	2		3	j								j				
10657	60/A	85.21-85.22	2.25																
10658	60/A	85.65-85.66	2.24																
10659	60/A	86.08-86.09	2.28	j	j									j					
10660	60/B	86.24-86.25	2.37																
8503	60/B	86.84-86.85	2.09																
10661	60/B	87.04-87.05	2.29	1	j	j	j		j										
10662	60/C	87.18-87.19	2.53	17	10		1		11									j	
10663	60/C	87.66-87.67	2.52	3	6	2	j		2									2	diatoms
10664	60/C	88.11-88.12	2.53		j	2	j		j										diatoms
10665	61/A	88.31-88.32	2.39		j	j	j		j										
8504	61/A	88.86-88.87	2.05		7				5							j		x	
10666	61/A	89.20-89.21	2.38		12		j		7									x	
10667	61/B	89.57-89.58	2.25						j	j			j		j			x	molluscs
10668	61/B	89.96-89.97	2.23		1	5	j		3	2		j	2	1	2				molluscs
10669	61/B	90.34-90.35	2.15			9	j	j	4	1		j	5	2	j			x	
10670	61/C	90.47-90.48	2.48			34	6	j	5	2		j	j	4	j			x	molluscs
8505	61/C	90.86-90.87	2.09			6	j	?			j		j		j				
10671	61/C	91.40-91.41	2.31				j	j	j			j	j						
7562	62/A	91.73-91.75	13.01	j	1	j			j				1					x	molluscs
10672	62/A	91.93-91.94	2.41				j		j			j	2						
7563	62/A	92.12-92.15	15.15	1	6		j		6	j			j	j				x	molluscs
7564	62/A	92.22-92.24	17.5		5		1	1	26										
7565	62/A	92.30-92.32	12.5		22		18	5	88	1			12	2	3	1		x	molluscs
10673	62/A	92.49-92.50	2.39	j			1		3			j	j	j	j		j	x	diatoms
10674	62/A	92.79-92.80	2.11				2		j	4		j	1	j	1	4			
7566	62/A	92.95-92.97	14.93			j	3	2	12	7			14	10	31	25			
10675	62/B	93.14-93.15	2.47									j							
10676	62/B	93.74-93.75	2.45						j	j		j	j		1	7			
8506	62/B	94.24-94.25	2.05			j			2?	1?	j		1	j	1	2			
10677	62/C	94.54-94.55	2.46						j			j	j		1				
8507	62/C	95.04-95.05	2.06			21	j	10	13	j			28	5	16	11			
10678	62/C	95.19-95.20	2.47			1			j	j		j	1						
10679	63/A	95.58-95.59	2.43	j	j	j			j	j		j	j	1	2	5			
8518	63/A	95.88-95.89	2.07			2			2	j	1?		j	1	5	3			
10680	63/A	96.28-96.29	2.27									j			j				
10681	63/B	96.63-96.64	2.43		j														
10682	63/B	97.28-97.29	2.49				j					j	j						
10683	63/C	97.73-97.74	2.4				j		2	j			1					x	
10684	63/C	98.13-98.14	2.36		j	j	5	6	3			2	5	j	1			x	
8529	63/C	98.58-98.59	2.09		4			4	9	9			10	2	2			x	
3462	64/A	99.04-99.06				j	5	1	17	j			64	48	j			x	molluscs
3463	64/A	99.12-99.16			2	5	15	6	20	12			56	44	5	1		x	molluscs
8530	64/A	99.15-99.16	2.09		1	1	16	11	24	10			54	25	9	4		x	molluscs
3464	64/A	99.30-99.40			j	23	26	6	13	3			24	25	1	6		x	molluscs
8531	64/B	101.49-101.50	2.15		5		j		1	j			1	1	3				

EXPLANATION

Weight in grams
L.cerio=Limnocythere ceriotuberosa Delorme
L.sappa=L. sappaensis Staplin
C.lacust=Cytherissa lacustris (Sars)
CandonaA=Candona sp. A
CandonaB=Candona sp. B
CandonaC=Candona sp. C
CandonaD=Candona sp. D
CandonaE=Candona sp. E
CandonaF=Candona sp. F
Tubero=Tuberocypris sp.
Cypria=Cypria sp.
Limno A=limnocytherid sp. A
Limno B=limnocytherid sp. B
L.aff.br=L. aff. L. bradburyi
Fish=fish bones, teeth, scales
j=juveniles
x=present, not counted
mo=molluscs
dia=diatoms, mainly Campylodiscus sp.