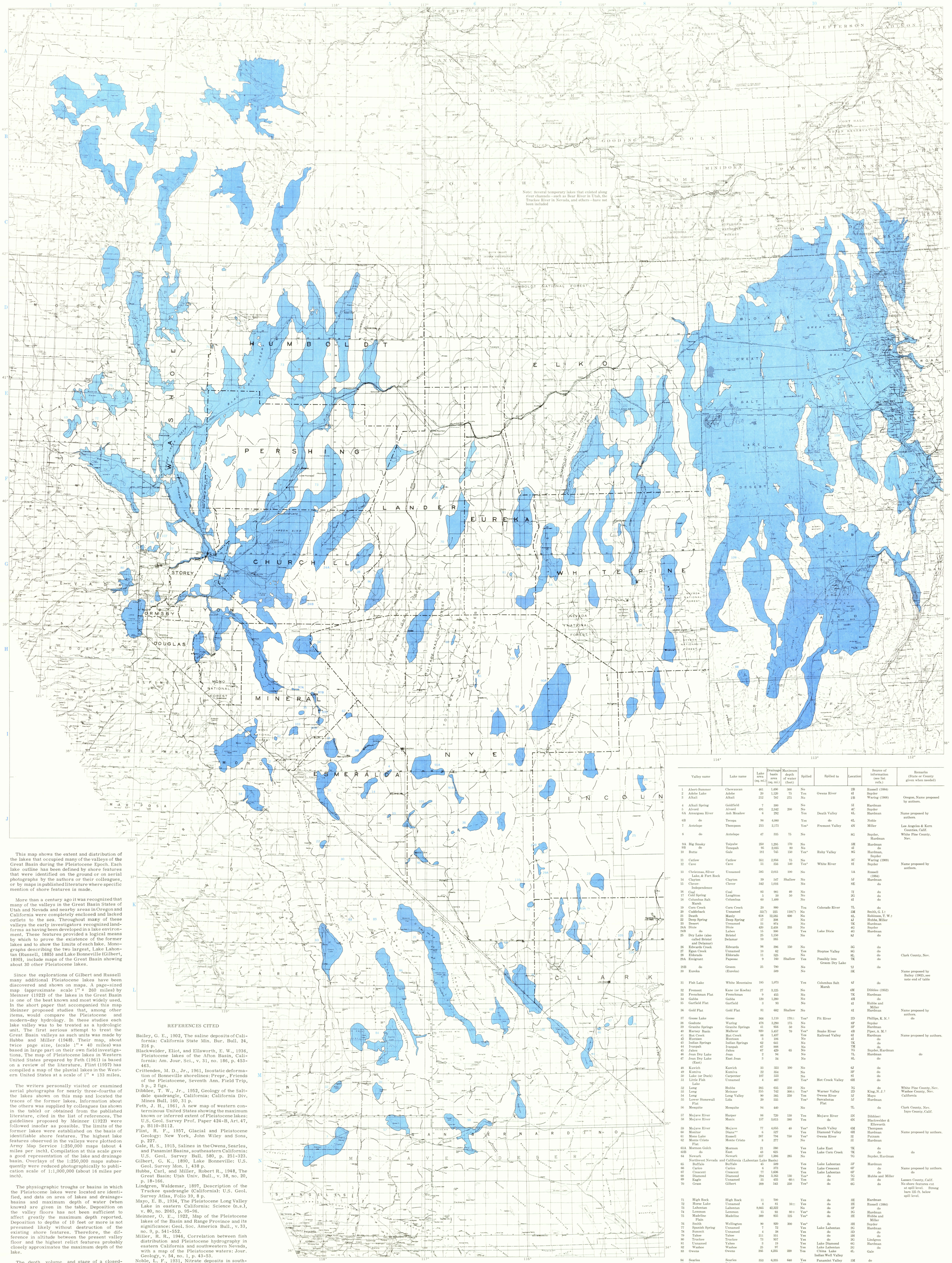

This map shows the extent and distribution of the lakes that occupied many of the valleys of the Great Basin during the Pleistocene Epoch. Each lake outline has been defined by shore features that were identified on the ground or on aerial photographs by the authors or their colleagues, or by maps in published literature where specific mention of shore features is made.

More than a century ago it was recognized that many of the valleys in the Great Basin States of Utah and Nevada and nearby areas in Oregon and California were completely enclosed and lacked outlets to the sea. Throughout many of these valleys the early investigators recognized landforms as having been developed in a lake environment. These features provided a logical means by which to prove the existence of the former lakes and to show the limits of each lake. Monographs describing the two largest, Lake Lahontan (Russell, 1885) and Lake Bonneville (Gilbert, 1890), include maps of the Great Basin showing about 30 other Pleistocene lakes.

Since the explorations of Gilbert and Russell many additional Pleistocene lakes have been discovered and shown on maps. A page-sized map (approximate scale 1" = 260 miles) by Meinzer (1922) of the lakes in the Great Basin is one of the best known and most widely used. In the short paper that accompanied this map Meinzer proposed studies that, among other items, would compare the Pleistocene and modern-day hydrology. In these studies each lake valley was to be treated as a hydrologic unit. The first serious attempt to treat the Great Basin valleys as such units was made by Hubbs and Miller (1948). Their map, about twice page size, (scale 1" = 40 miles) was based in large part on their own field investigations. The map of Pleistocene lakes in Western United States prepared by Feth (1961) is based on a review of the literature. Flint (1957) has compiled a map of the pluvial lakes in the Western United States at a scale of 1" = 133 miles.

The writers personally visited or examined aerial photographs for nearly three-fourths of the lakes shown on this map and located the traces of the former lakes. Information about the others was supplied by colleagues (as shown in the table) or obtained from the published literature, cited in the list of references. The guidelines proposed by Meinzer (1922) were followed insofar as possible. The limits of the former lakes were established on the basis of identifiable shore features. The highest lake features observed in the valleys were plotted on Army Map Service 1:250,000 maps (about 4 miles per inch). Compilation at this scale gave a good representation of the lake and drainage basin. Overlays of the 1:250,000 maps subsequently were reduced photographically to publication scale of 1:1,000,000 (about 16 miles per inch).

The physiographic troughs or basins in which the Pleistocene lakes were located are identified, and data on area of lakes and drainage-basins and maximum depth of water (when known) are given in the table. Deposition on the valley floors has not been sufficient to affect greatly the maximum depth reported. Deposition to depths of 10 feet or more is not presumed likely without destruction of the existing shore features. Therefore, the difference in altitude between the present valley floor and the highest relict features probably closely approximates the maximum depth of the lake.

The depth, volume, and stage of a closed-basin lake are related closely to the configuration of the basin and the amount of water available. The depth and surface area of a lake that overflows are controlled by the level of the spillway or outlet. If a basin fully contains the lake, the size and surface area of the lake are regulated by the balance between inflow to the lake and evaporative losses from the lake surface. When inflow exceeds losses the lake expands, with a consequent increase of surface area from which added evaporation can take place. Conversely, when losses exceed inflow the lake level drops until a new balance is reached or the lake goes dry. The high lake stage occurs when the combination of climatic factors such as temperature, precipitation, and evaporation produces a maximum inflow and a minimum rate of evaporation loss. Such conditions existed during the Pleistocene. The Snyder and Langbein (1962) study of the Pleistocene lake in Spring Valley, Nevada, showed that a relatively modest increase in precipitation and decrease in evaporation rate would provide the conditions needed for restoration of a high-level lake in this closed, undrained basin.

This map and table present the best current information about the Pleistocene lakes on a modern base map at a usable scale. Data are given only on the lakes at their maximum stage. This map should be helpful in further studies of closed-basin hydrology.

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Base map prepared from U.S. Geological Survey 1:1,000,000 series state index maps; Arizona, California, Idaho; Nevada, Oregon, and Utah, 1961

Lakes and drainage divides by C. T. Snyder, George Hardman, and F. F. Zdenek, 1960–61. Prepared in collaboration with the Nevada Department of Conservation and Natural Resources.

EXPLANATION

Drainage divide

Inferred drainage divide

Pleistocene lake
Arrow indicates direction of spill at high stage

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	Valley name	Lake name	Lake area (sq. mi.)	Drainage basin area (sq. mi.)	Maximum depth of water (feet)	Spilled	Spilled to	Location	Source of information (see list refs.)	Remarks (State or County given when needed)
1	Abert-Summer	Chewaucan	461	1,490	300	No		2B	Russell (1884)	
2	Adobe Lake	Adobe	20	1,120	75	Yes	Owens River	4I	Snyder	
3	Alkali	Alkali	212	787	275	No		2B	Waring (1908)	Oregon, Name proposed by authors.
4	Alkali Spring	Goldfield	7	300		No		5I	Hardman	
5	Alvord	Alvord	491	2,342	200	No		4C	Snyder	
6A	Amargosa River	Ash Meadow	6	292		Yes	Death Valley	6L	Hardman	Name proposed by authors.
6B	do	Tecopa	98	4,080		Yes	do	6L	Noble	
7	Antelope	Thompson	215	2,175		Yes*	Fremont Valley	4N	Miller	Los Angeles & Kern Counties, Calif.
8	do	Antelope	47	335	75	No		8G	Snyder, Hardman	White Pine County, Nev.
9A	Big Smoky	Toiyabe	250	1,295	170	No		5H	Hardman	
9B	do	Tonopah	95	2,035	80	No		4I	do	
10	Butte	Gale	181	745	150	Yes*	Ruby Valley	8G	Hardman, Snyder	
11	Catlow	Catlow	351	2,956	75	No		3C	Waring (1909)	
12	Cave	Cave	51	556	140	Yes*	White River	8I	Snyder	Name proposed by authors.
13	Christmas, Silver Lake, & Fort Rock	Unnamed	585	2,015	100	No		1A	Russell (1884)	
14	Clayton	Clayton	39	547	Shallow	No		5J	Hardman	
15	Clover-Independence	Clover	342	1,016		No		8E	do	
16	Coal	Coal	83	981	40	No		7I	do	
17	Cold Spring	Laughton	5	50	50	No		2G	do	
18	Columbus Salt Marsh	Columbus	60	1,400		No		4I	do	
19	Corn Creek	Corn Creek	20	880		Yes	Colorado River	7L	do	
20	Cuddeback	Unnamed	35(?)	225	110(?)	No		5M	Smith, G. I.†	
21	Death	Manly	618	12,585	600	No		6L	Robinson, T. W.†	
22	Deep Spring	Deep Spring	17	208		No		4J	Hubbs, Miller	
23	Desert	Unnamed	51	974		No		7K	Hardman	
24A	Dixie	Dixie	420	2,438	235	No		4G	Snyder	
24B	do	Labon	15	300		Yes	Lake Dixie	4G	Hardman	
25	Dry Lake (also called Bristol and Delamar)	Bristol	25	1,150		No		8J	do	
		Delamar	10	385						
26	Edwards Creek	Edwards	98	396	150	No		5G	do	
27	Egan Creek	Unnamed	10	62		Yes	Steptoe Valley	8G	do	
28	Eldorado	Eldorado	11	525		No		8L	do	Clark County, Nev.
29A	Emigrant	Papoose	9	160	Shallow	Yes	Possibly into Groom Dry Lake	7K	do	
29B	do	Groom	25	790		No		7J	do	
30	Eureka	(Eureka)		509		No		5K		Name proposed by Bailey (1902), see note end of table
31	Fish Lake	White Mountains	185	1,073		Yes	Columbus Salt Marsh	4J	do	
32	Fremont	Kane (or Koehn)	27	3,125		No		4M	Dibblee (1952)	
33	Frenchman Flat	Frenchman	9	455		No		7K	Hardman	
34	Gabbs	Gabbs	120	1,280		No		4H	do	
35	Garfield Flat	Garfield	3	93		No		4I	Hubbs and Miller	
36	Gold Flat	Gold Flat	81	682	Shallow	No		6I	Hardman	Name proposed by authors.
37	Goose Lake	Goose	368	1,110	170±	Yes*	Pit River	2D	Phillips, K. N.†	do
38	Goshute	Waring	478	3,290	175	No		8F	Snyder	
39	Granite Springs	Granite Springs	41	956	50	No		3F	Hardman	
40	Harney Basin	Malheur	920	5,457	70	Yes*	Snake River	4B	Piper, A. M.†	
41	Hot Creek	Hot Creek	88	1,437		Yes	Railroad Valley	6I	Hardman	Name proposed by authors.
42	Huntoon	Huntoon	3	106		No		4I	do	
43	Indian Springs	Indian Springs	62	641		No		7K	do	
44	Ivanpah	Ivanpah	67	888		No		7M	do	
45	Jakes	Jakes	67	429	65	No		7G	Snyder, Hardman	
46	Jean Dry Lake	Jean	2	94		No		7L	Hardman	do
47	Jean Dry Lake (East)	East Jean	3	34		No		8L	do	
48	Kawich	Kawich	33	353	100	No		6J	do	
49	Kumiva	Kumiva	22	354		No		3F	do	
50	Lake (or Duck)	Carpenter	107	553		No		8I	do	
51	Little Fish Lake	Unnamed	4	467		Yes*	Hot Creek Valley	6H	do	
52	Long	Hubbs	205	635	250	No		7G	do	White Pine County, Nev.
53	Long	Meinzer	355	742	300±	Yes*	Warner Valley	2D	King, N. J.†	Washoe County, Nev.
54	Long	Long Valley	90	385	250	Yes	Owens River	3J	Mayo	California
55	Lower Stonewall Flat	Lida	20	535		Yes*	Sarcobatus Flat	5J	Hardman	
56	Mesquite	Mesquite	94	440		No		7L	do	Clark County, Nev. Inyo County, Calif.
57	Mojave River	Harper	86	720	130	Yes	Mojave River	5N	Dibblee†	
58	Mojave River	Manix	157	3,615	380	Yes	do	6N	Blackwelder & Ellsworth	
59	Mojave River	Mojave	77	4,055	40	Yes*	Death Valley	6M	Thompson	
60	Monitor	Diana**	6	527		Yes	Diamond Valley	6H	Hardman	Name proposed by authors.
61	Mono Lake	Russell	267	794	750	Yes*	Owens River	3I	Putnam	
62	Monte Cristo Flat	Monte Cristo	8	277		No		5I	Hardman	
63A	Mormon Gulch	Mormon	21	380		Yes	Lake East	7K	do	
63B	do	East	43	625		Yes	Lake Corn Creek	7K	do	do
64	Newark	Newark	357	1,386	285	No		7G	Snyder, Hardman	
	Northwest Nevada and California (Lahontan Lake Basin)									
65	Buffalo	Buffalo	45	509		Yes	Lake Lahontan	5F	Hardman	
66	Carico	Carico	6	373		Yes	Lake Crescent	6F	do	Name proposed by authors.
67	Crescent	Crescent	77	1,636		Yes	Lake Lahontan	6F	do	do
68	Diamond	Diamond	294	3,163	130	Yes*	do	7G	Hubbs and Miller	
69	Eagle	Unnamed	55	435	60±	Yes	do	1E	do	Lassen County, Calif.
70	Grass	Gilbert	209	543	250	Yes*	do	6G	do	No shore features cut at spill level. Strong bars 125 ft. below spill level.
71	High Rock	High Rock	11	700		Yes	do	3E	Hardman	
72	Horse Lake	Unnamed	8	81	10±	Yes	do	2E	Russell (1884)	
73	Lahontan	Lahontan	8,665	42,222		No	do	3F	do	
74	Lemmon	Lemmon	15	93	80+	Yes*	do	2G	Hardman	
75	Madeline Plain	Madeline	300	835	125	Yes*	do	2E	Hubbs and Miller	
76	Smith	Wellington	90	920	300	Yes*	do	3H	Snyder	
77	Spanish Spring	Unnamed	7	72		Yes	Lake Lahontan	2G	Hardman	
78	Summit	Unnamed	4	38		Yes	do	3D	do	
79	Tahoe	Tahoe	211	551		Yes	do	2H	do	
80	Truckee	Truckee	73	957		Yes	do	2G	Lindgren	
81	Unnamed	Yahoo	3	19		Yes	Lake Diamond	6G	Hardman	
82	Washoe	Washoe	25	97		Yes	Lake Lahontan	2G	do	
83	Owens	Owens	205	4,235	220	Yes	China Lake Indian Well Valley	4L	Gale	
84	Searles	Searles	353	6,335	640	Yes	Panamint Valley	5M	do	
85	Pahrump	Pahrump	242	992		Yes	Death Valley	7L	Hubbs and Miller	
86	Panamint	Panamint	280	7,965	930	Yes(?)*	do	5L	Gale	
87	Penoyer	Penoyer	60	663		No		7J	Hardman	
88	Pine	Wah Wah	41	720		No		9H	Snyder	Name proposed by authors.
89	Racetrack	(Butte)		184		Yes	Saline Valley	5K	Hubbs and Miller	Named by Bailey (1902), see note end of table.
90A	Railroad	Railroad	525	3,565	315	No		7I	Hardman	
90B	Railroad	Reveille	50	2,138		Yes	Lake Railroad	7I	Hubbs and Miller	
91A	Ralston	Mud	165	2,346		No		6I	Hardman	
91B	do	Cactus Flat						6J	do	
92	Ruby	Franklin	471	1,897	210	Yes(?)*		7F	do	
93	Saline	(Saline)		646		No		5K		Named by Bailey (1902) see note end of table.
94	Sand Spring	Unnamed	4	491	Shallow	No		7I	do	
95	Sarcobatus Flat	Bonnie Claire	57	1,488	do	No		6J	do	Two unnamed tributary lakes.
96	Smith Creek	Desatoya	140	590		No		5G	do	Name proposed by authors.
97A	Soda Spring	Acme	15	170	Shallow	No		4I	do	Subdivided by Hardman.
97B	do	Luning	10	160		No				
97C	do	Mina	2	30		No				
97D	do	Rhodes	15	170		No				
98	Spring	Spring	332	1,641	265	No		8H	Snyder	
99	Steptoe	Steptoe	459	1,785	350	Yes*	Goshute Valley	8G	Hardman	
100	Steptoe (south)	Unnamed	10	358		Yes	Lake Steptoe	8H	do	
101	North Stonewall Flat	Stonewall	9	358	Shallow	No		5J	do	Name proposed by authors.
102	Surprise	Surprise	506	1,481	650	No		2E	Russell (1884)	Named by R. J. Russell (1927).
103	Teels Marsh	Teel	18	278		No		4I	Hardman	
104	Apex Dry Lake	Apex	25	115		No		8L	do	Name proposed by authors.
105	Unnamed	Apex North		110		Yes	Apex Dry Lake	8K	do	do
106	Unnamed basin south of Little Smoky Valley	Unnamed	10	69	Shallow	No		6H	do	Lies between Little Smoky, Sand Spring, and Hot Creek Valleys.
107	Unnamed	Fred	4	22		No		2G	do	
108	Warner (Coleman)	Warner	483	2,648	225	No		2C	Russell (1884)	
109	Western Utah	Bonneville	19,940	53,325		Yes*	Snake River	10E	Crittenden	
110	Yucca Flat	Yucca	7	300		No		7K	Hardman	Name proposed by authors.

*Spilled at maximum stage only. Closed-basin lake during most of its history.
**Named for Diana's Punch Bowl, a unique hot-spring formation in Monitor Valley.
†Personal communication.

( ) Parentheses used to set off lakes that have been named or defined in the literature but could not be identified in the field by the authors.

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975

PLEISTOCENE LAKES IN THE GREAT BASIN

By
C. T. Snyder, George Hardman, and F. F. Zdenek

SCALE 1:1 000 000

25 0 25 50 75 100 MILES

25 0 25 50 75 100 KILOMETERS