UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality maps for 12 water samples from springs and domestic wells near the El Dorado, Lime Canyon, and Million Hills Wilderness Study Areas, Clark County, Nevada

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Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of analyses of water samples collected as part of a geochemical survey of El Dorado, Lime Canyon, and Million Hills Wilderness Study Areas, Clark County, Nevada.

INTRODUCTION

In April 1987, the U.S. Geological Survey conducted reconnaissance geochemical surveys of El Dorado (NV-050-423), Lime Canyon (NV-050-231), and Million Hills (NV-050-233) Wilderness Study Areas, Clark County, Nevada. Routine sample media for the reconnaissance surveys were minus-80-mesh (0.17-mm) stream-sediment samples, and panned concentrate samples derived from stream sediment. Results of analyses of the stream-sediment and concentrate samples are tabulated by McHugh and others (1989a,b). A few springs and wells are located in or near the wilderness study areas. Results from the analysis of water samples are presented in this report. Streams in the study area are ephemeral and most were dry when the reconnaissance geochemical survey was in progress.

The El Dorado Wilderness study area is about 10 mi south of Boulder City, Nevada, on the west side of the Colorado River between Lake Mead and Lake Mohave (fig. 1). The Lime Canyon and Million Hills Wilderness Study Areas are, respectively, about 45 and 60 mi east of Las Vegas, Nevada (fig. 1); these two wilderness study areas are north of Lake Mead and between the Overton Arm of Lake Mead on the west and the Arizona state line on the east.

The U.S. Bureau of Land Managment requested studies of 11,069 acres (17 mi^2) for the El Dorado Wilderness Study Area. Access is from U.S. Highway 95 and Nevada Route 164 (fig. 1). Elevations range from about 2,300 to over 3,800 ft in the El Dorado Wilderness Study Area. Vegetation is predominantly desert shrubs, creosote, cacti, and yucca.

The geology of the El Dorado Wilderness Study Area is included in a detailed study by Anderson (1971). Longwell and others (1965) described the geology and mineral deposits of Clark County. Except for relatively small areas underlain by Precambrian metamorphic rocks, the wilderness study area is underlain by Tertiary volcanic and intrusive rocks. A compilation of the geology of Nevada (Stewart and Carlson, 1978) and a report by Volborth (1973) assigned a Tertiary age to most of the intrusive rocks near the wilderness study area that were mapped as Precambrian by Longwell and others (1965). Andesite and basalt flows, intermediate to andesitic flows and breccias, and silicic ash-flow tuffs predominate in the El Dorado Wilderness Study Area. Anderson (1971) suggested that Tertiary volcanic rocks accumulated to a thickness of about 17,000 ft on a Precambrian surface and underwent a period of intense faulting during the later stages of the major volcanism. A major stike-slip(?) fault, the Nelson fault zone, separates the predominately volcanic terrane of the El Dorado Wilderness Study Area, which is north of the fault, from the largely granitic terrane south of the wilderness study area (Volborth, 1973).

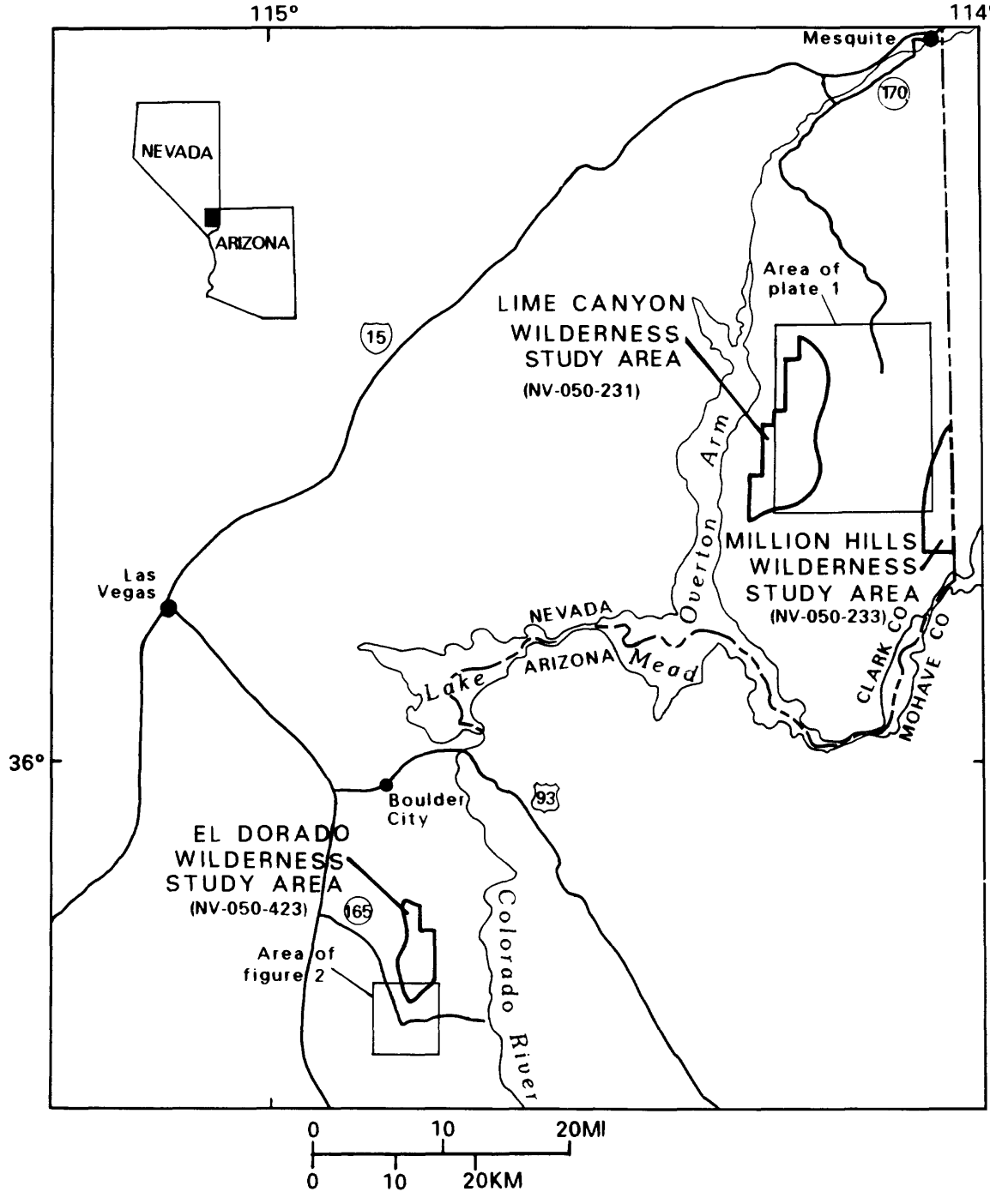

Figure 1. Index map showing location of El Dorado, Lime Canyon and Million Hills Wilderness Study Areas, Clark County, Nevada.

The El Dorado Wilderness Study Area adjoins the Eldorado Canyon mining district, one of the oldest in Nevada. Historic mining began about 1857, but old arrastres and prospect pits found at that time indicated that mining by the Spanish or Mexicans had taken place long before (Longwell and others, 1965). Productive mines in the district are all located within the 1-1.5 mile-wide Nelson fault zone (Volborth, 1969). The ore bodies are in fissure zones. According to Longwell and others (1965), from 1907 to 1961 the district produced over 100,000 oz of gold, over 2,300,000 oz of silver, about 34,000 lbs of copper, 169,000 lbs of lead, and 7,000 lbs of zinc. Ore produced before 1907 was worth several million pre-1907 dollars.

The Lime Canyon Wilderness Study Area comprises 34,680 acres (54 mi) and the Million Hills Wilderness Study Area comprises 9,599 acres (15 mi^2). Access to these wilderness study areas is from Interstate 15 near Mesquite, Nevada, by way of Nevada Route 170 and then over paved, gravel, and dirt roads. The north, east, and south boundaries of the Lime Canyon Wilderness Study Area can generally be reached by dirt roads; the west boundary is generally inaccessible by vehicle. The boundary of Million Hills Wilderness Study Area can be reached by vehicle only on the road that follows Garden Wash; elsewhere around Million Hills Wilderness Study Area, roads are from one-half to several miles away.

Elevations range from about 1,500 ft to about 4,400 ft in the Lime Canyon Wilderness Study Area and from about 1,800 ft to about 4,700 ft in the Million Hills Wilderness Study Area. Vegetation in both wilderness study areas is predominately desert shrubs, creosote, cacti, and yucca. Joshua trees are present in parts of the Lime Canyon Wilderness Study Area. Topography of the two wilderness study areas is similar. Both areas have major north-south-trending ridges with outwash plains sloping toward Lake Mead or toward the stream valleys that are tributary to Lake Mead. In the Lime Canyon Wilderness Study Area, the dominant north-south ridge is Lime Ridge and the outwash plain slopes to the west. In the Million Hills Wilderness Study Area, the dominant ridge is Azure Ridge and the outwash plain slopes east. Terrain between the two wilderness study areas is made up of additional north-south ridges, parallel valleys, and basins; this intervening terrain is drained by washes that pass through or around the wilderness study areas.

Longwell and others (1965) described the geology of Clark County. Recent compilations of the geology of the Las Vegas 1° x 2° quadrangle (Bohannon, 1978) and the state of Nevada (Stewart and Carlson, 1978) include the wilderness study areas. The two wilderness study areas lie on either side of the northeast-trending Gold Butte fault, a major structural feature. The Lime Canyon Wilderness Study Area is north of the Gold Butte fault and is 10 mi west of the Million Hills Wilderness Study Area, which is mostly south of the fault. Bohannon (1979) presents evidence that the Gold Butte fault is a left-lateral strike-slip fault with an offset of about 6 mi. Geology of the Lime Canyon and Million Hills Wilderness Study Areas is quite similar. Outcrops of Precambrian metamorphic rocks, which are regionally extensive, underlie relatively small parts of both wilderness study areas. The major north-south-trending ridges are composed mostly of Paleozoic carbonate rocks. Paleozoic or Mesozoic sandstones and shales also underlie extensive parts of both areas. Tertiary volcanic rocks are present in both areas and Quaternary gravels blanket the outwash plains.

The Lime Canyon Wilderness Study Area is within the Gold Butte mining district (Longwell and others, 1965). Mineral deposits and mining activity within and near the Lime Canyon Wilderness Study Area are described by Winters (1988); occurrences within 2 mi of the wilderness study area include minor

concentrations of gold, silver, copper, lead, and zinc in bedrock and dumps, minor placer gold, patented gypsum claims, and numerous uranium exploration trenches.

The Million Hills Wilderness Study Area is on the east edge of the Gold Butte mining district. Causey (1988) describes mines, prospects, and mineralized areas in and within 0.5 mi of the wilderness study area. The Azure Ridge mine (plate 1) is hosted in Cambrian(?) dolomite and produced several carloads of zinc or copper ore and probably a few thousand pounds of lead. Causey (1988) found higher-than-expected cobalt concentrations (as high as 471 ppm) in brecciated dolomite at the mine. Manganese-rich layers in Quaternary alluvium north of Garden Wash and immediately east of the area shown on plate 1 contain as much as 6,100 ppm cobalt, 1,700 ppm nickel, 1,900 ppm lead, 3,700 ppm zinc, 500 ppm copper, 100 ppm molybdenum, and 80 ppm thallium (Causey, 1988); the bedrock source of these concentrations is unknown.

SAMPLING TECHNIQUES

Samples were collected from 9 springs and 3 wells (fig. 2 and plate 1). Locations and other information about the sampled springs and wells are listed in table 1. Fifty ml of water from each source were filtered through a 0.45-micron membrane filter into an acid-rinsed polyethylene bottle and were then acidified to approximately pH 2 with ultrapure, concentrated nitric acid. In addition, a new 250-ml bottle was filled with untreated water.

ANALYTICAL TECHNIQUES

Water temperature and pH were measured at the sample site. All other analyses were done in the U.S. Geological Survey laboratory in Denver, Colorado. Alkalinity, sulfate, chloride, fluoride, nitrate, uranium, and specific conductance were determined using the untreated sample.

Alkalinity is a term used to indicate the total acid-neutralizable constituents in water. Generally the alkalinity is due to carbonate and bicarbonate ions. Calcium, magnesium, sodium, potassium, silica, iron, manganese, arsenic, cobalt, copper, molybdenum, and zinc were determined using the acidified-filtered sample. A complete list of analytical techniques used and a reference for each are listed in table 2.

RESULTS

Sampling localities for the 3 samples from near the El Dorado Wilderness Study Area are shown on figure 2 and the sample localities for the 9 samples from the Lime Canyon and Million Hills Wilderness Study Areas are shown on plate 1. The analytical results of the 21 constituents that were determined for these samples are shown in table 3. The latitude and longitude for each sample locality are also shown in table 3.

The results of the charge balance shown in table 3 for the 12 samples show good accuracy for the analyses. Because ionic solutions are electrically neutral, comparing the sums of the charges for cations against anions checks the accuracy of the analyses. All of the samples are shown to be within 10 percent of electrical neutrality.

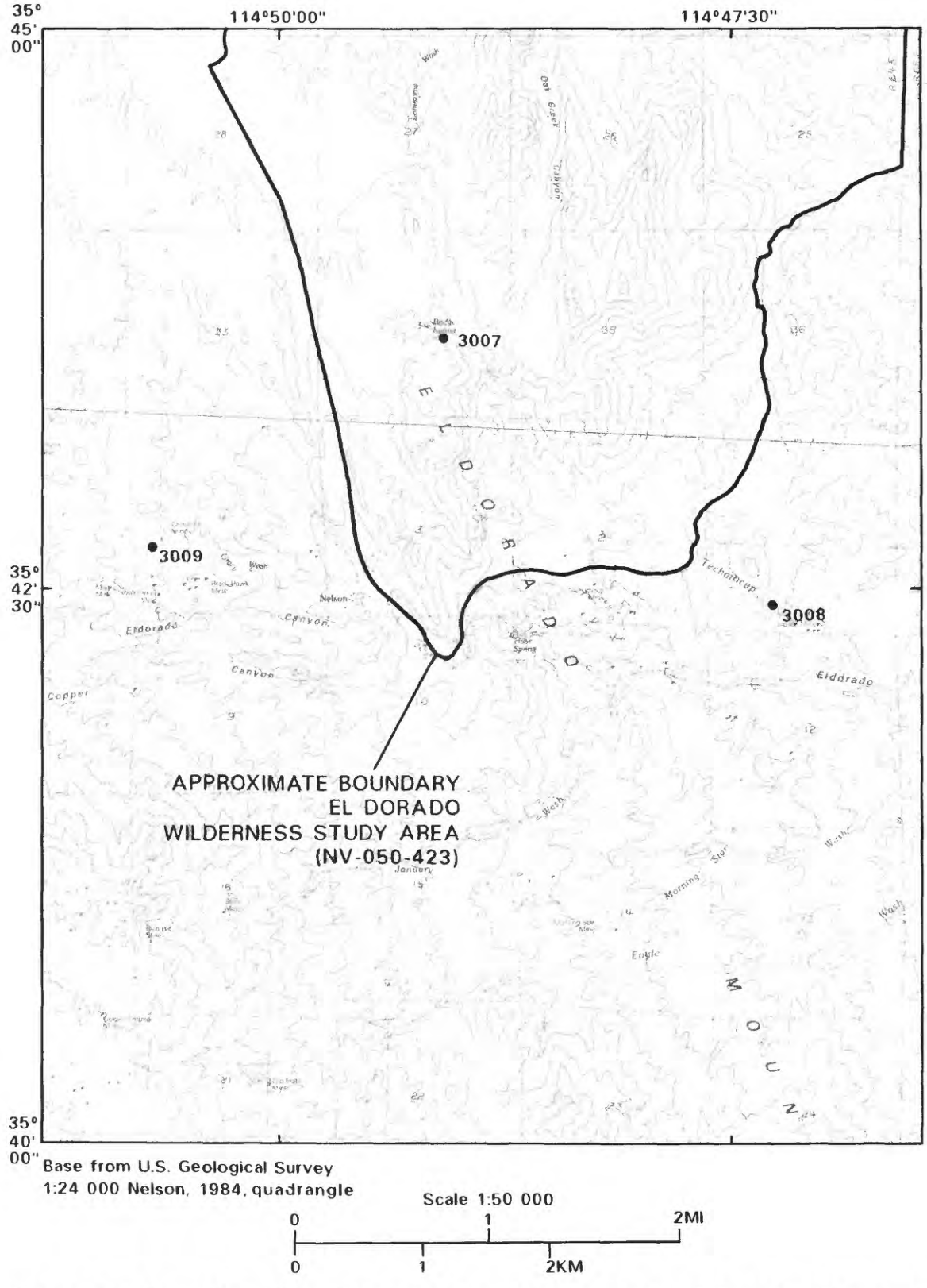

Figure 2. Sampling sites for water samples from near El Dorado Wilderness Study Area, Clark County, Nevada.

DATA STORAGE SYSTEM

Upon completion of the analytical work, the results were entered into a U.S. Geological Survey computer data base called PLUTO. This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC, VanTrump and Miesch, 1977) for computerized statistical analysis or publication.

REFERENCES CITED

Anderson, R.E., 1971, Thin skin distension in Tertiary rocks of southeastern Nevada: Geological Society of America Bulletin, v. 82, p. 43-58.

Bohannon, R.G., compiler, 1978, Preliminary geologic map of Las Vegas 1° x 2° quadrangle, Nevada, Arizona, and California: U.S. Geological Survey Open-File Report 78-670, 6 p., scale 1:250,000.

_____1979, Strike-slip faults of the Lake Mead region of southern Nevada, in Armentrout, J.M., Cole, M.R., and TerBest, Harry, Jr., eds., Cenozoic paleogeography of the western United States: Pacific Coast Paleogeography Symposium 3, Pacific Section, Society of Economic Paleontologists and Mineralogists, Los Angeles, California, p. 129-139.

Causey, J.D., 1988, Mineral resources of the Million Hills Wilderness Study Area, Clark County, Nevada: U.S. Bureau of Mines Mineral Land Assessment Open File Report MLA 34-88, 29 p.

Fishman, J.J., and Pyen, G., 1979, Determination of selected anions in water by ion chromatography: U.S. Geological Survey Water Resources Investigations 79-101, 30 p.

Longwell, C.R., Pampeyan, E.H., Bowyer, Ben, and Roberts, R.J., 1965, Geology and mineral deposits of Clark County, Nevada: Nevada Bureau of Mines and Geology Bulletin 62, 218 p., 16 plates.

McHugh, J.B., Bullock, J.H., Jr., Roemer, T.A., and Nowlan, G.A., 1989a, Analytical results and sample locality map for stream-sediment and panned-concentrate samples from the El Dorado and Ireteba Peaks Wilderness Study Areas, Clark County, Nevada: U.S. Geological Survey Open-File Report 89-022, 19 p.

McHugh, J.B., Bullock, J.H., Jr., Roemer, T.A., Briggs, P.H., and Nowlan, G.A., 1989b, Analytical results and sample locality map for stream-sediment and panned-concentrate samples from the Lime Canyon and Million Hills Wilderness Study Areas, Clark County, Nevada: U.S. Geological Survey Open-File Report 89-025, 22 p.

Orion Research, Inc., 1978, Analytical methods guide, 9th ed.: Cambridge, Massachusetts, 48 p.

Perkin-Elmer Corporation, 1976, Analytical methods for atomic-absorption spectrophotometry: Norwalk, Connecticut, Perkin-Elmer Corporation, 586 p.

Perkin-Elmer Corporation, 1977, Analytical methods for atomic-absorption spectrophotometry, using the HGA graphite furnace: Norwalk, Connecticut, Perkin-Elmer Corporation, 208 p.

Scintrex Corporation, 1979, UA-3 Uranium Analyzer: Toronto, Canada, 45 p.

Skougstad, M.W., Fishman, M.J., Friedmann, L.C., Erdmann, D.E., and Duncan, S.S., eds., 1979, Methods for determination of inorganic substances in water and fluvial sediments: Techniques of Water Resources Investigations of the U.S. Geological Survey, chapter A1, 26 p.

Stewart, J.H., and Carlson, J.E., compilers, 1978, Geologic map of Nevada: U.S. Geological Survey, scale 1:500,000.
VanTrump, George, Jr., and Miesch, A.T., 1977, The U.S. Geological Survey RASS-STATPAC system for management and statistical reduction of geochemical data: Computers and Geosciences, v. 3, p. 475-488.
Volborth, Alexis, 1969, Geology of the Eldorado and Newberry ranges: Basin and Range Geology Field Conference, 2nd, Guidebook: Reno, MacKay School of Mines, University of Nevada, p. 2/1-2/9.
_____1973, Geology of the granite complex of the Eldorado, Newberry, and northern Dead Mountains, Clark County, Nevada: Nevada Bureau of Mines and Geology Bulletin 80, 40 p.
Winters, R.A., 1988, Mineral resources of the Lime Canyon Wilderness Study Area, Clark County, Nevada: U.S. Bureau of Mines Mineral Land Assessment Open File Report MLA 40-88, 42 p.

Table 1.--Names, collection dates, and other information for 12 spring- and well-water samples from near El Dorado, Lime Canyon, and Million Hills Wilderness Study Areas, Clark County, Nevada

Site	Name	Illustration	Date of sample collection	Remarks
3001	Red Bluff Spring	Plate 1	4-22-87	Sample from pool in seepy stretch of mostly dry stream channel. Seepy stretch is fed by several springs.
3002	Quail Spring	Plate 1	4-23-87	Sample from spring where it issues from beneath boulder. Flowing 1 l/minute.
3003	Mockingbird Spring	Plate 1	4-23-87	Sample from spout of plastic pipe fed by spring. Flowing 1 l/minute.
3004	Granite Spring	Plate 1	4-23-87	Sample from spout of plastic pipe fed by spring. Flowing 150 ml/minute.
3005	Garden Spring	Plate 1	4-23-87	Sample from spout of galvanized pipe fed by pumping windmill.
3006	Horse Spring	Plate 1	4-23-87	Sample from spout of plastic pipe fed by spring. Flowing 1.5 l/minute.
3007	Bridge Spring	Fig. 2	4-26-87	Sample from pool about 200 ft upstream from natural arch. Water movement visible in pool. Stream channel mostly dry.
3008	---*	Fig. 2	4-26-87	Dug well plotted on topographic base of figure 2. One-quarter mi west of Jubillee mine. Water level 30 ft below ground surface. Well lined with wood timbers. No metal observed in contact with water. Sampled by plastic bottle suspended on cord.
3009	---*	Fig. 2	4-26-87	Dug well plotted on topographic base of figure 2. About 500 ft southwest of Carnation mine. Water level 5 ft below ground surface. Well lined with wood. Iron pipe in well. Cover includes some galvanized sheet metal. Sampled by plastic bottle suspended on cord.
3010	Summit Spring	Plate 1	4-27-87	Sample from running stream at approximate location of spring on plate 1.
3011	---*	1	4-27-87	About 4/10 mi south of Connoly Spring. Sample from spout of plastic pipe. Flowing 250 ml/minute. Two 10-ft-diameter pools upstream from sampled spout. Could not determine if plastic pipe is fed by pool(s), but sample filtered very readily and that is evidence sample was not from pool or reservoir where growth of aerobic organisms could occur.
3012	New Spring	Plate 1	4-27-87	Sample from spout of plastic pipe fed by spring. Flowing 2 l/minute.

*Name unknown to authors

TABLE 2.--Analytical methods used for water analyses, El Dorado, Lime Canyon, and Million Hills Wilderness Study Areas, Clark County, Nevada

Constituents	Method	Reference
Alkalinity	Gran's plot potentiometric titration	Orion Research, Inc., 1978.
Sulfate, chloride, fluoride, and nitrate	Ion chromatography	Fishman and Pyen, 1979.
Uranium	Laser-excited fluorescence	Scintrex Corp., 1979.
Specific conductance	Conductivity bridge	Skougstad and others, 1979, p. 545.
Calcium, magnesium, sodium, potassium, silica, iron, and manganese	Flame atomic-absorption spectrophotometry	Perkin-Elmer Corp., 1976.
Arsenic, cobalt, copper, molybdenum, and zinc	Flameless atomic-absorption spectrophotometry	Perkin-Elmer Corp., 1977.

TABLE 3. RESULTS OF ANALYSES OF WATER SAMPLES FROM EL DORADO, LIME CANYON, AND MILLION HILLS WILDERNESS STUDY AREAS, CLARK COUNTY, NEVADA

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	LATITUDE	LONGITUD	CA(MG/L)	MG(MG/L)	NA(MG/L)	K(MG/L)	SIO2(MG/	ALK(MG/L	SO4(MG/L	CL(MG/L)	F(MG/L)	NO3(MG/L
W3001A	36 27 41	114 15 8	440	78	480	12.0	21	138	2,000	460	1.5	.8
W3002A	36 15 59	114 16 30	80	28	38	4.7	20	177	270	30	1.0	4.6
W3003A	36 15 46	114 17 31	51	14	49	5.6	35	199	75	51	.9	4.9
W3004A	36 16 56	114 11 26	105	14	58	5.2	47	355	72	90	3.5	.5
W3005A	36 18 4	114 8 44	58	18	46	.8	30	339	43	22	<.1	2.1
W3006A	36 20 57	114 7 44	110	40	85	4.6	41	184	490	75	.1	<.1
W3007A	35 43 37	114 49 7	74	13	49	2.6	45	356	50	35	<.1	<.1
W3008A	35 42 24	114 47 17	145	36	119	9.2	26	385	500	68	.7	<.1
W3009A	35 42 40	114 50 43	500	160	130	3.5	23	222	2,300	75	2.3	<.1
W3010A	36 17 9	114 7 3	53	39	67	5.3	56	443	80	34	.1	<.1
W3011A	36 14 28	114 6 18	54	22	42	9.0	50	323	50	32	.1	4.7
W3012A	36 14 49	114 5 49	74	44	95	10.0	55	458	180	95	.1	<.1

Sample	FE(MG/L)	MN(MG/L)	ZN(UG/L)	CU(UG/L)	AS(UG/L)	MO(UG/L)	CO(UG/L)	U(UG/L)	SP. COND	PH	TEMP. C	CHG BAL%
W3001A	.02	.02	50	4.4	85.0	32.0	3.8	14.4	3,200	7.7	23.0	-6.9
W3002A	<.01	<.01	72	1.0	8.3	7.6	<1.0	5.0	790	7.5	22.0	-7.9
W3003A	<.01	<.01	18	1.0	1.5	3.7	1.0	3.2	620	7.8	20.5	-3.3
W3004A	.01	<.01	180	6.8	2.7	6.0	<1.0	16.0	350	7.2	20.0	-5.2
W3005A	.03	<.01	140	12.0	2.0	7.2	<1.0	2.1	620	7.5	19.0	-5.1
W3006A	<.01	<.01	28	3.0	3.0	10.0	1.7	3.6	1,120	7.5	19.5	-9.7
W3007A	<.01	<.01	15	1.0	2.2	2.4	<1.0	15.6	660	7.8	17.0	-6.0
W3008A	.03	.15	21	<1.0	2.3	6.0	30.0	6.2	1,320	7.9	23.0	-8.8
W3009A	.04	.04	41	<1.0	5.0	13.0	3.2	.1	2,900	7.4	18.5	-9.9
W3010A	<.01	<.01	22	<1.0	4.7	7.6	<1.0	15.6	800	8.5	20.0	-5.0
W3011A	<.01	<.01	100	<1.0	5.0	3.3	<1.0	15.4	660	7.4	24.5	-5.3
W3012A	<.01	<.01	24	<1.0	3.6	5.6	<1.0	40.0	1,120	7.3	20.0	-8.6