Origin of the Arrowhead Landmark near San Bernardino, California

Norman Meek
California State University, San Bernardino

Abstract

A seven-acre vegetational feature in the shape of a large arrowhead is visible from much of the San Bernardino Valley. There is a large number of legends that explain why the arrowhead exists, and a common theme of these legends is that the arrowhead is a natural landmark.

The concentrations of 32 soil elements from within and outside of the arrowhead landmark were examined. The chemical and field measurements indicate that there do not appear to be any substrate controls that can account for the arrowhead landmark, and suggest that it might be a human-made or human-modified feature.

A tentative conclusion of this work is that the arrowhead may be a human-made advertisement created sometime in the late 1850s or early 1860s, perhaps by the founder of the nearby hot springs resort.

Introduction

On the San Bernardino Mountain front, visible from much of the nearby valley, is a landmark in the shape of an arrowhead (Figure 1). The landmark is reported to be 1,375 feet (419 m) long, 449 feet (137 m) wide, and covering 7.5 acres (*Legends of the Arrowhead* 1913; Duke 1988, p. 3). The landmark is at an elevation of approximately 2,800 feet (853 m) a.s.l., and consists of "soft chaparral" (e.g., California buckwheat, white sage, black sage, laurel sumac), surrounded by "hard chaparral" (e.g., greasewood, chamise, manzanita). There is a widespread popular belief that the landmark is a natural feature. In the earliest known description, a newspaper reporter wrote:

> "In glancing from our valley toward the lofty coast range, the eye involuntarily rests on that very striking mark on the southern face of the mountain, which has the shape of an Indian arrowhead, or, as some prefer to call it, 'the ace of spades.' It appears to the distant

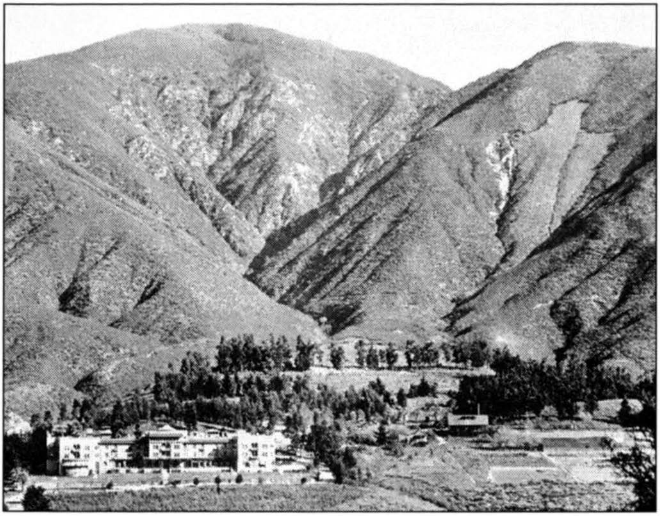

Figure 1.—Photograph of Arrowhead Springs in 1907. Courtesy of the Library of Congress.

> observer as if it were a 'wash' on the declivity, but on a nearer view it proves to be a section of the mountain composed of a soil differing from the adjoining slopes. It is a portion of the mountain formed of decomposed granite rock, the surface loosened by the action of the atmosphere, plentifully interspersed with boulders, and bearing a sparse growth of the low grayish shrub known as the sageplant, together with wild oats. The adjoining part of the mountain has a somewhat different soil, and bears a heavy growth of the dark green shrub commonly known as the greasewood. The arrowhead is a freak of nature, but it is as well defined as if laid out by rule and line" (*The Arrowhead* 1867, p. 3).

The arrowhead landmark has persisted despite numerous fires that have burnt across the area. Hotels at the nearby hot springs burnt down on March 20, 1885; July 4, 1895; and November 24, 1938; and eight outbuildings were lost on November 24, 1980. Fires that burnt the mountainside can be documented in 1916, 1922, 1938, 1943, 1953, 1958, 1970, 1975, 1980, 2001, 2003, and at least three fires occurred between 1863 and 1888. The area is slated to soon become the site of an expensive new development hosting 1,350 new homes, retail shops, a golf course, and corporate offices (City of San Bernardino 2005).

The purposes of this paper are threefold. The primary objective is to determine the first reliable evidence for the arrowhead's existence. A second objective is to examine the soils within and outside of the arrowhead to see if they differ in any significant and measurable ways that can account for the vegetation differences. Finally, the ultimate purpose of the paper is to figure out whether the arrowhead landmark is indeed a natural or human-made landmark, and if the latter, when it was constructed.

Historical Background

Regarding the origin of the arrowhead, Thompson (1976, p. 1) writes, "The story of Arrowhead Springs begins in 1857 with the arrival of David Noble Smith, builder of the first permanent building. Naturally the Arrowhead was well known prior to that time. Expeditions by Spanish soldiers passed through the valley below as early as 1772, and priests frequently visited the region following the establishment of a capilla, or temporary chapel, by Padre Dumetz in 1810."

Notably, the arrowhead was not mentioned by any 18th-century diarists that traveled in expeditions through the region. Moreover, Harley (1988) has thoroughly examined the evidence for the 1810 Dumetz expedition and has concluded that there is no reliable evidence for such an expedition, nor that a church structure was built in the region before 1819 (see also Belden, 1951). Critical to this paper is that there is no mention of the arrowhead landmark in any written records of the early Spanish inhabitants or the travelers in the region during the era of the Old Spanish Trail and the founding of Agua Mansa in the early 1840s.

Mormon colonization of the San Bernardino area followed in 1851. A stockade was constructed, and a thriving community of about 440 colonists grew in the valley about 10 km south-southwest of the landmark (Lyman 1996). Interestingly, no mention of the arrowhead landmark has yet been discovered in the diaries of the Mormon residents by the leading scholar of this era (Leo Lyman, personal communication 2000). This is noteworthy, especially because the Mormon diarists wrote wonderful descriptions of the surrounding environment.

The first scientific expedition to the area was the Williamson Survey in 1853, one of the expeditions conducted in preparation for a transcontinental railroad (Williamson 1853). The surrounding environment and hot springs immediately beneath the arrowhead landmark were described, and the temperatures of the various spring waters were measured (Williamson 1853, pp. 80–85), yet no mention of the arrowhead landmark was reported. It seems unlikely that a scientific expedition meant to describe the physical environment would miss such an important landmark on the mountainside directly above the hot springs they sampled.

Following a large, destructive earthquake on the nearby San Andreas fault in 1857 (McAfee 1992), the first evidence of an arrowhead landmark is a photograph reportedly made in 1864 (see Figure 2). The photograph shows the original infirmary building at the hot springs constructed by David Noble Smith and opened on April 14, 1864 (Thompson 1976, p. 5).

Figure 2.—Photograph of Arrowhead Springs reportedly made in 1864.

Thompson (1976, p. 3) accompanies a description of these events with:

> "While at his father's death bed, an apparition appeared before Smith—a saint he believed—and took him away to a far-off land. The spirit showed him a spot where a unique combination of climate and curative waters fused in such a manner as to perform miraculous cures for all lung diseases. The spot was marked by a gigantic arrowhead. Until he found this landmark, he said, he felt 'like a wanderer in search of a lost home.' Smith did wander around for a while, first to Texas and then to Illinois, where he met Thomas B. Elder, his future brother-in-law. In 1857, Smith and some of his friends from Illinois came to California, where later that same year he spotted the arrowhead."

If this is indeed accurate, then the arrowhead may have existed as early as 1857, but there is obvious reason to doubt the historical reliability of such a story.

Similarly, the earliest known newspaper description of the landmark in 1867 suggests that the landmark was an old feature by that time:

> "Several years ago, when prospecting was more common than now-a-days, some men were attracted by that mark, concluding that it had not been placed there for nothing, and that if a diligent prospect were made, something would be found in the locality which would well reward the search.... Years passed away, and the thought of these springs often presented itself to the mind of one of the discoverers, and after working to obtain means to enable him to make improvements, he returned to the springs and began, four of five years ago, the establishment now known as the 'Arrowhead hygienic infirmary'" (*The Arrowhead* 1867).

The arrowhead landmark appears in numerous photographs and reports after the late 1860s. It became a symbol of community pride and has been periodically maintained by the community since at least 1911. Thompson (1976, p. 25) reports that the Civilian Conservation Corps built about 200 check dams in the gullies within the arrowhead about 1940, and that the Boy Scouts helped renovate the site following the 1953 fire. He further notes that "state prison crews spent thousands of hours in manual labor" working to maintain the Arrowhead. To help define the arrowhead landmark, in 1953 four rows of *Cistus* (rock rose) plants were planted around the arrowhead (Duke 1988, p. 5; another source reports that this occurred in 1957). *Cistus* is native to the Levant and was believed to be fire resistant. Reseeding efforts were scheduled after the 1975 fire (Thompson 1976, p. 26).

Examination of the Local Substrate

Yetzer (1975, p. A6) reports, "As early as the 1920's, historian Lyman Rich took soil samples both inside and outside the landmark down to a depth of 12 inches. He sent the samples to the University of California at Berkeley and after several months of analysis the scientist concluded that there was no chemical content in the soil that could account for the difference in vegetation." Because this study was apparently not published, this paper presents the results of a new sampling of the soils both from within and outside of the arrowhead landmark using modern techniques.

On June 16, 1998, soils were sampled from 21 sites, 10 within the arrowhead and 11 outside of the arrowhead on all sides (see Figure 3). Following a texture analysis, the samples were sent to Chemex Labs, Inc. in Sparks, NV, for ICP-AES (Inductively Coupled Plasma with Atomic Emission Spectroscopy) multi-element analysis, the standard procedure employed by prospectors using exploration geochemistry (see www.alschemex.com for more details). The concentrations of 32 elements were examined for 15 of the 21 soil samples (see Table 1). The other six samples were examined using an ICP technique that can detect the concentrations of 39 elements in even greater detail (see Table 2).

The samples were then divided into two classes: one group from inside the arrowhead and one group from outside of it. Both a T-Test and a Wilcoxon statistical analysis were performed on the 15 samples shown in Table 1 to see if there are statistically significant differences in the means between each class for each of the 32 elements.

Using a 5 percent level to determine statistical significance, three elements (lanthanum, potassium, and scandium) occur in higher concentrations outside of the arrowhead, and two elements (lead and phosphorus) are significantly elevated within the arrowhead (see Table 3). Magnesium reaches the 5 percent significance level only in the Wilcoxon test, and is found at higher concentrations outside of the arrowhead.

Theoretically, potassium and phosphorus (and perhaps magnesium) are elements critical for plant growth, and the results suggest that substrate differences might play some role in the vegetation dif-

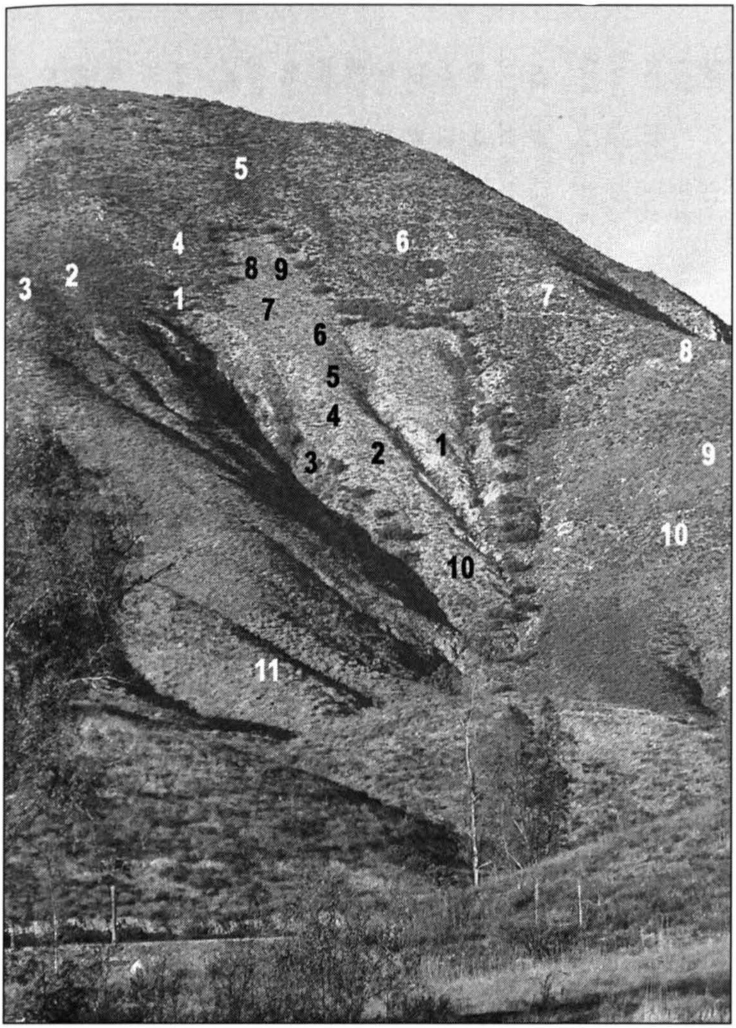

Figure 3.—The arrowhead landmark, March 2007. The sampling sites labeled in white were chosen so that runoff from the arrowhead could not contaminate them.

ferences between the arrowhead and its surroundings, despite the fact that the concentrations of the two elements trend in opposite directions.

The fact that both lead and phosphorus are elevated inside the arrowhead is unusual. I hypothesized that both might have been components of 1970s-era Phos-Chek, a commercial phosphate substance commonly dropped by planes to control fires. This belief

ID#	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	La	Mg	Mn	Ni	P	Pb	Sc	Sr	Ti	V	Zn
A1	3.46	4	50	0.46	9	17	18	3.95	0.45	30	0.82	465	10	1080	36	3	56	0.17	90	112
A3	2.89	2	50	0.42	10	16	22	3.97	0.59	30	0.89	530	9	1020	40	3	46	0.18	89	354
A4	3.57	6	50	0.61	10	15	16	3.45	0.50	40	0.93	535	11	1320	38	3	71	0.17	80	122
A5	3.55	6	50	0.47	9	17	16	3.59	0.48	40	0.88	520	10	1330	52	3	52	0.17	84	112
A7	3.14	6	60	0.61	9	17	16	3.47	0.50	40	0.88	570	10	1590	36	3	65	0.16	80	102
A8	3.07	6	60	0.70	9	14	15	2.92	0.54	30	0.94	545	10	1340	50	3	78	0.16	71	112
A9	2.98	8	50	0.63	9	18	17	3.60	0.50	30	0.88	515	12	1280	76	3	60	0.17	90	134
Avg	3.24	5.4	52.9	0.56	9.29	16.3	17.1	3.56	0.51	34.3	0.89	525.7	10.3	1280	46.9	3	61.1	0.17	83.4	149.7
StDev	0.26	1.8	4.5	0.10	0.45	1.3	2.2	0.33	0.04	5.0	0.04	29.9	0.9	173.8	13.4	0	10.3	0.01	6.5	83.9

ID#	Al	As	Ba	Ca	Co	Cr	Cu	Fe	K	La	Mg	Mn	Ni	P	Pb	Sc	Sr	Ti	V	Zn
B1	2.85	6	50	0.60	10	18	16	3.79	0.57	40	0.93	550	12	880	46	3	50	0.17	91	116
B2	3.63	8	40	0.25	9	9	11	2.47	0.59	70	1.03	415	6	80	10	3	60	0.17	54	88
B4	3.20	10	50	0.62	10	16	15	3.37	0.60	50	1.01	595	10	710	38	4	54	0.18	83	106
B6	3.28	6	40	0.37	10	13	17	3.29	0.76	60	1.08	540	7	340	10	4	37	0.19	79	92
B7	2.48	2	30	0.17	8	12	11	3.26	0.49	40	0.71	320	6	130	10	3	21	0.13	81	66
B9	3.69	6	70	0.76	17	21	12	3.81	0.83	70	1.66	675	11	800	14	6	66	0.22	112	116
B10	3.28	10	80	0.63	14	21	15	3.51	0.92	50	1.35	635	13	740	44	5	56	0.20	94	118
B11	3.02	12	90	1.05	17	51	23	3.61	0.87	40	1.78	495	25	1390	14	8	62	0.26	111	66
Avg	3.18	7.5	56.3	0.56	11.9	20.1	15	3.39	0.70	52.5	1.19	528.1	11.3	633.8	23.3	4.5	50.8	0.19	88.1	96.0
StDev	0.37	3.0	20.0	0.27	3.4	12.3	3.7	0.40	0.15	12.0	0.35	109.1	5.8	406.8	15.3	1.7	14.0	0.04	17.5	20.2

Table 1. Chemical analyses of the soil samples by ICP-AES. Samples beginning with an ID# A come from within the arrowhead, and samples beginning with a B are from outside of it. The Al, Ca, Fe, K, Mg, and Ti values are in percent. The others are in ppm. The values for Ag, Be, Bi, Cd, Ga, Hg, Mo, Na, Sb, Tl, U, and W are not shown because they were all below the detection limit, or the values for all samples were exactly the same.

ID#	Al	Ba	Ca	Co	Cr	Cu	Fe	K	La	Mg	Mn	Nb	Ni	P	Pb	Sr	Ti	V	Y	Zn
A2	9.59	440	2.44	10.8	19	15	4.61	1.81	50.5	1.07	705	36.6	9.8	900	36	428	0.64	123	41.4	282
A6	8.88	410	2.39	10.2	18	19	3.92	1.66	49.5	0.98	780	28.2	10.8	1360	41.5	425	0.54	99	32.7	108
A10	8.79	430	2.58	10.4	19	17	4.98	1.72	43.5	0.95	705	34.8	9.6	920	30.5	431	0.62	124	36.9	96
Avg	9.09	426.7	2.47	10.5	18.7	17	4.50	1.73	47.8	1.00	730	33.2	10.1	1060	36.0	428	0.60	115.3	37.0	162
StDev	0.36	12.5	0.08	0.3	0.5	1.6	0.44	0.06	3.1	0.05	35.4	3.6	0.5	212.3	4.5	2.5	0.04	11.6	3.6	85.0

ID#	Al	Ba	Ca	Co	Cr	Cu	Fe	K	La	Mg	Mn	Nb	Ni	P	Pb	Sr	Ti	V	Y	Zn
B3	10.2	480	1.79	10.4	13	23	3.66	2.10	83.0	0.94	670	22.2	8.2	430	24.5	358	0.47	81	26.6	106
B5	8.64	420	2.30	10.4	18	19	4.26	1.76	41.5	0.97	755	29.6	11	710	55	403	0.58	108	28.4	110
B8	8.86	470	1.92	10	16	43	3.77	2.01	78.0	0.9	760	29.4	10	900	46	352	0.54	85	28.5	126
Avg	9.23	456.7	2.0	10.3	15.7	28.3	3.90	1.96	67.5	0.94	728	27.1	9.7	680	41.8	371	0.53	91.3	27.8	114
St Dev	0.69	26.3	0.2	0.2	2.1	10.5	0.26	0.14	18.5	0.03	41.3	3.4	1.2	193	12.8	22.8	0.05	11.9	0.9	8.6

Table 2. Chemical analyses of the soil samples by ICP-MS, a technique that can analyze many additional elements, and sometimes in more detail. The three samples beginning with an ID# "A" come from within the arrowhead, and the three samples beginning with a "B" are from outside of it. The Al, Ca, Fe, K, Mg, and Ti values are in percent. The others are in ppm. The values for Ag, Be, Bi, Cd, Ce, Cs, Ga, Ge, In, Li, Mo, Na, Rb, Ta, Te, Th, Tl, W, and U are not shown because they were all below the detection limit, or there was little variability among the samples.

Table 3. Statistical results of a two-sample T-test and a Wilcoxon test. These results show the statistical significance of the difference in means between the two sample sets of 15 ICP-AES results from Table 1. Identical statistical tests were performed on the six ICP-MS results from Table 2, but with only three samples in each set, the statistical differences between the means are not a reliable measure of a meaningful difference.

Element	T-Test	Wilcoxon
Aluminum	.7521	1.0
Arsenic	.1558	.1594
Barium	.6888	.8545
Calcium	.9939	1.0
Chromium	.4590	.8613
Cobalt	.0831	.1128
Copper	.2337	.1422
Iron	.4057	.4634
Lanthanum	.0040‡	.0054‡
Lead	.0113†	.0477†
Magnesium	.0503	.0272‡
Manganese	.9588	.6126
Nickel	.6909	.9529
Phosphorus	.0030†	.0093†
Potassium	.0085‡	.0146‡
Scandium	.0442‡	.0190‡
Strontium	.1546	.2707
Titanium	.1724	.0936
Vanadium	.5440	.4511
Zinc	.1266	.0916

†significant at the 5% level, higher concentrations in the arrowhead

‡significant at the 5% level, lower concentrations in the arrowhead

was furthered by Thompson's (1976, p. 25) report that: "On August 12, 1975, fire once again burned the arrowhead. The mark was not completely destroyed this time, perhaps because of the efficient firefighters, who used bombers to drop chemicals on the burning hillside." Consequently, an effort was made to discover the chemical composition of Phos-Chek, a proprietary commercial substance. Eventually a chemist at the manufacturer responded: "There has never been a lead-containing component in any of the Phos-Chek wildland fire retardants.... In 1975, all wildland retardants contained a lead-free pigment grade iron oxide as a colorant" (Vandersall 2006). Thus, at this point the presence of elevated lead levels within the arrowhead landmark cannot be explained. Perhaps it could be due to some sort of adsorption process that occurred during the era of leaded fuel and was catalyzed by phosphorus, but this is pure speculation. Geologically, there are no obvious visible textural or lithologic differences between the substrate in the arrowhead and the surrounding hillside that can explain the elevated concentrations of lead inside the arrowhead.

The fact that potassium and perhaps magnesium levels are elevated outside of the arrowhead could be an important difference, but it could also be an artifact of the reseeding processes that occurred after fires in 1975, 1980, or some other time. In short, because the elements with significant variations are all elements that could be artifacts of human actions during a fire or its recovery, the soil geochemistry differences are inconclusive in determining that the substrate plays the primary role in the persistence of the arrowhead landmark. Undoubtedly, the concentrations of magnesium, phosphorus, and potassium were checked in the 1920s by the Lyman Rich study and not found to be significantly different, but could appear statistically significant today because of modern firefighting and/or reseeding techniques. The fact that only 5 of the 32 elements showed statistically significant differences suggests that there are not major differences between the substrate inside and outside of the arrowhead landmark.

Discussion

L. Burr Belden has written that Arrowhead Springs may have the distinction of "having had more untruths written about it and recorded as fact than any other place [in California] with the possible exception of Death Valley" (cited in Thompson 1976, p. 11). There is no doubt that a large number of myths and legends have arisen about the arrowhead, perhaps because it was the object of an early public relations campaign (e.g., *Legends of the Arrowhead* 1913). Buie (1967) reports:

> "Later the firm of Darby and Lyons, who had built a health resort at the hot springs below the arrowhead, were credited with authorship of many of the legends, including the most widely accepted one that Indians for miles around came to the hot springs and were guided by the arrowhead, pointing to the health-giving waters. As late as 1906, San Bernardino conducted a community celebration, 'The Festival of the Arrowhead,' which was to have commemorated the coming of the Indians to the springs. The story was pure legend." (Buie 1967)

Thompson (1976, p. 11) reports that the advertising campaigns of the 1880s that spread the myths "helped the spa achieve more widespread fame than any other in the state." For example, Dr. H. C. Royer, a promotional businessman, once wrote, "On the face of the mountain is the figure of an arrowhead...which may justly be considered one of the wonders of the world" (Yetzer 1975, p. A6).

After discussing the many legends, Thompson (1976, p. 12) goes on to dismiss a manmade origin of the arrowhead. He writes:

> "Some of these myths were reputedly told to the white settlers by the Indians, giving the Indian account of how the mark of an arrowhead came to be on the mountain. But this is unlikely, since neither race noticed the resemblance of the mark to an arrowhead—the settlers called it 'The Ace of Spades.' The honor of first calling it an arrowhead goes to David Noble Smith. One story even suggests the Indians built the arrowhead to point to the healing waters below, and incredible as that story may seem, many people today believe it. In view of the fact that the arrowhead is more than a quarter of a mile long, 450 feet wide, comprising some seven and one-half acres in area, and tilted at an angle of 45 degrees on the mountainside, the improbability of the Indian labor theory is apparent.
>
> One writer called the myths 'grotesque fiction' and tried to debunk them, apparently to no avail. Why people hesitate to see the landmark as an accident of nature is hard to understand. Throughout the area are patches of light vegetation surrounded by darker patches. The land movements which created the mountains left the area dotted with soils of different types. Wild sage and other plants of a silvery hue seem to do better in loose soils, thus forming a contrast to the darker vegetation found in heavier soils. It is not unusual to expect that among the countless thousands of these patches one could be found resembling a formation known to man. Perhaps what makes the arrowhead so remarkable is that it points directly toward the hot springs at its base." (Thompson (1976, p. 12)

Despite these arguments, several lines of evidence point to the manmade origin of the arrowhead landmark. First, there is no written or photographic record of the arrowhead until 1864, coincident with the opening of the infirmary at the hot springs below it, and to which it points. It could have existed a few years before 1864, but it is difficult to believe that the Williamson survey did not report its existence in 1853 when they thoroughly described the area, including the nearby road in Waterman Canyon used to haul lumber from the mountains.

The arrowhead landmark was likely constructed with the assistance of local natives, thus providing some basis for the later legends that it had an Indian origin. It is possible that they may have modified a rare triangular landslide scar, such as one that recently developed northwest of Devore, California, into an arrowhead feature (see

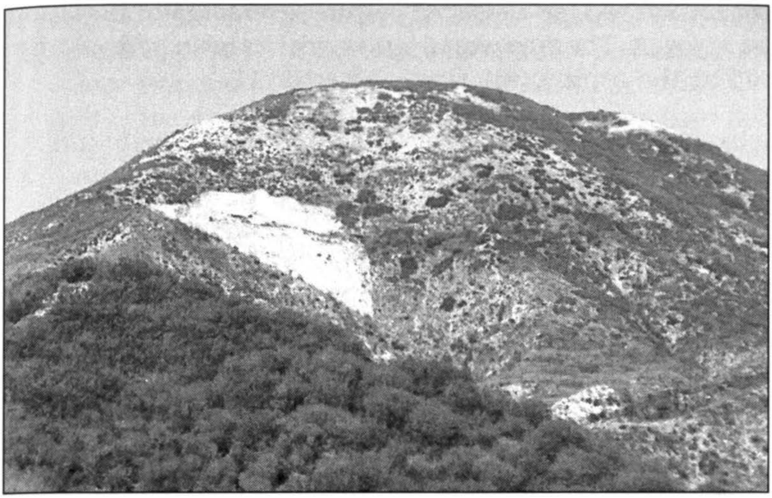

Figure 4.—Oblique view of a recent landslide scar northwest of Devore, CA. This feature has formed since the major fires of 2003, and probably could be modified into an arrowhead landmark if someone wanted to do it. November 2007 photo.

Figure 4). An obvious explanation for the landmark's origin is that it advertised the hot springs and infirmary at its base.

Because there are no significant differences in soil chemistry, slope, or texture between the arrowhead and surrounding areas, there are no obvious differences in substrate that can explain the persistence of the soft and hard chaparral areas after numerous fires. Humans have undoubtedly aided the process with annual community preservation efforts that can be documented from 1911 onward.

Imported "fire-resistant" vegetation and an extensive network of metal check dams and other projects to reduce erosion have helped to maintain the vegetation difference. Interestingly, now that the annual community projects have apparently ended, it appears a substantial portion of the landmark's left side is becoming difficult to differentiate from the background area.

Conclusions

The arrowhead landmark is a local cultural icon and appears in the names and logos of innumerable local organizations. There is a large number of legends that explain why it exists. A common theme of these legends is that the arrowhead is a natural landmark. The widespread public acceptance of its natural origin has been enhanced because the arrowhead has persisted despite several major fires that have burnt across it. The arrowhead landmark has been periodically maintained by the community since at least 1911.

The soft-chaparral vegetation inside the arrowhead clearly differs from the hard chaparral surrounding it. To examine the possible causes of this difference, 21 soil samples were collected from inside and around the arrowhead. The concentrations of 32 elements for 15 samples were examined statistically. Only phosphorus and lead levels are elevated in the arrowhead, and it has lower levels of potassium, lanthanum, and scandium compared to the surrounding areas. The chemical and field measurements strongly suggest that there is no difference in the substrate that can explain the arrowhead's persistence. Consequently, a manmade origin must be considered.

The earliest photographic record of the arrowhead is from 1864. No mention of the landmark has yet been found in the railroad survey or Mormon narratives written during the 1850s, although it is discussed in at least one newspaper column in 1867. A tentative conclusion of this work is that the arrowhead may be a human-made advertisement created sometime in the late 1850s or early 1860s, perhaps by the founder of the hot springs resort.

Acknowledgments

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