Geological and Historical Archaeology
Phase 1 Reconnaissance
of
Routes R1 and R2
within the
Clear Creek Management Area,
San Benito County, California

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1. Executive Summary

A reconnaissance survey was conducted to identify possible naturally occurring and commercial amphiboles in those portions of the Clear Creek Management Area that formed the basis for most of the EPA's recent sampling study (EPA, 2008). The reconnaissance study macroscopically surveyed 18 locations and identified possible amphibole at nine of those locations. Materials suspected to be amphiboles were found in five natural mineral samples and four possible imported commercial asbestos samples. No naturally occurring asbestiform amphibole was macroscopically observed at any of the collection locations. However, four samples of possible commercial asbestos were observed at Staging Area 2, Staging Area 3, in tributary at Staging Area 4 and at the edge of road R2 which may have contained asbestiform amphibole.

Table 1: Summary of Locations Found to Contain Possible Amphibole Material

Location	Collection Point[1]	Natural[2]	Commercial
Staging Area 1	2	X	
Staging Area 2 (furnace site)	3		X
Staging Area 3 (milling site)	5		X
Serpentine dike crossing R1	7	X	
Franciscan Formation exposure	8	X	
Possible jadeite site (Coleman, 1986)	9	X	
Jade Mill glaucophane	15	X	
Rotary kiln insulation (R2)	17		X
Victor Claim (nearby retort)	19		X

1. See "Data Collection Points within Study Area" on page 22 for details.
2. No asbestiform observed.

The reconnaissance collected 22 mineral specimens and 4 commercial samples for further analysis. Preliminary observations identified five potential geological transition zones that may contain amphibole and samples from these locations will be analyzed. The isolated historic sites with potential commercial amphibole asbestos will also be analyzed.

The presence of naturally occurring and commercially used amphibole asbestos, if confirmed through further analysis of the samples, could account for the finding of amphibole fibers in some of the EPA air samples.

Our initial observations, pending formal mineralogical analysis, clearly suggest that the EPA's sampling route was highly misrepresentative of the vast majority of the New Idria serpentinite, and probably more representative of the commercial complex that supported 150 years of mining activity and the naturally occurring contact zones from which these mineable minerals were taken.

2. Introduction

A reconnaissance survey to collect specimen samples of possible naturally occurring and commercial amphibole was conducted for that portion of the Clear Creek Management Area that formed the basis of most of the EPA's recent sampling study (EPA, 2008). This was conducted during a three-day period in early spring of 2008. An effort was made to determine macroscopically whether the amphibole was non-asbestiform (massive / non fibrous) or asbestiform (fibrous). The survey collected samples from geological transition zones and historical former industrial sites most likely to produce evidence of non-asbestiform or asbestiform amphibole material. Preliminary observations identified localized geological transition zones along isolated areas of parts of the EPA sampling study route that when disturbed, could account for the finding of naturally occurring cleavage fragment derived non-asbestiform amphibole "fibers" in some of the EPA's air samples. Preliminary observations also identified isolated areas of historical industrial potential amphibole asbestos contamination which when disturbed could also have accounted for the finding of amphibole asbestos fibers found in other EPA air samples. Taken together, these observations, whilst requiring formal mineralogical confirmatory analysis, clearly support the notion that the EPA's sampling route was highly misrepresentative of the vast majority of the New Idria serpentinite. This is not surprising since the sampling area was largely characterized by the geology of the peripheral rock walls that bound the serpentinite and which have served in turn as the host rocks for most of the historical industrial mining activity noted in the area over more than a 150 year period.

3. Purpose of the Reconnaissance

This reconnaissance was conducted to collect geological and archaeological data associated with possible naturally occurring and imported commercial amphibole within Clear Creek canyon area. The reconnaissance followed the upper and lower San Benito County roads within Clear Creek Management Area, known by BLM designations as R1 and R2. This survey collects data from a portion of the Human Health Risk Assessment study area conducted by the United States Environmental Protection Agency (EPA) during 2004-2005.

4. Methodology

A preliminary desktop reconnaissance was conducted utilizing historic documents, publications, topographic maps and satellite photography. Areas of geological change were identified as the most likely points to produce evidence of amphibole minerals and appropriate data collection areas were selected, with specific collection points determined on site. Computer models from topographic maps such as TOPO USA and Google Earth were used to pinpoint locations before going into the field. Field locations coordinated with preliminary map locations were found to be very accurate

Additionally, physical reconnaissance was conducted along approximately 17 miles of roadway and trails where additional samples were retrieved. All six staging areas and other historical sites were also inspected along the route, including suspected historical sites identified from satellite photography.

Data samples were collected and bagged on site. Samples were bagged into resealable quart-size polyethylene bags. Suspected industrial asbestos samples were double-bagged. Most specimen samples are wet or contain high moisture content due to rainy weather or sampling location. Sample collection was accomplished using a clean steel trowel, or a clean aluminum hand spade, or a freshly latex gloved hand. Tools were cleaned by wiping with a fresh paper towel before and after each sample collection. Used paper towels and latex gloves were disposed into a large black plastic garbage bag. Data logging was recorded redundantly by two individuals and written on each collection bag. A photographic record was made purposely by two individuals and by an independent photographer at will.

5. Area Background

Clear Creek Management Area is an area of public land administered by the Bureau of Land Management. The area is located at the southern end of the Diablo Mountains in central California and consists of about 74,000 acres. The northwestern portion consists primarily of serpentine, California's official “State Rock,” and the eastern and southern area consists of Franciscan and sandstone formations. The southern portion contains the large sandstone monoliths known as Joaquin Rocks. Historic mining, which began in the 1850s, created a network of dirt roads, trails, abandoned cabins, historic sites, and a large ghost town, all of which attracts and facilitates area recreation.

A closure order issued by the Bureau of Land Management on May 1, 2008 closed 31,000 acres of this region, which also provided access to an additional 50,000 acres of land, thus closing nearly 80,000 of public land. This public land provides a multi-use area where people interested in a variety of pursuits visit each year. The area supports a wide variety of recreation and business, including off highway vehicle recreation, rock hunting, bicycling, hiking, hunting, hang-gliding and mining. Areas of naturally barren serpentine, steep slopes and loose rocks create a recreational “mecca” for off-highway vehicle (OHV) recreation. Landslides caused by steep slopes and various geologic intrusions expose a rich diversity of minerals that attract mineralogist from around the world. The area also supports a unique forest of *Pinus sabiniana*, *Pinus jeffreyi*, *Pinus coulteri*, and *Calocedrus decurrens* (Griffin, 1974) and the protected San Benito Mountain Natural Area attract many botanist and environmentalist to the area. The area's elevations range from about 670 meters (2,200 ft.) in the lower areas to 1600 meters (5,241 ft.) on San Benito Mountain, the highest point in San Benito County.

The area's popularity with public recreation increased rapidly after the Bureau of Land Management closed Panoche Hills / Tumey Hills area in 1970. Since then public access and use of Clear Creek Management Area has slowly become more restrictive. The San Benito Natural Area, created in 1971 as a 1,500-acre botanic preserve has since grown to over 4,000 acres and roads leading into an additional 40,000 acres of public land, including the San Carlos Bolsa and Joaquin Rocks have been allowed to erode away or have been gated to restrict vehicle access, thus eliminating public use.

The Bureau of Land Management has maintained several roads in the area, including San Benito County roads R1, R2 and R11. Within the serpentine area, the BLM recently constructed an improved campground at Jade Mill and it has added toilet facilities to the recreation staging areas.

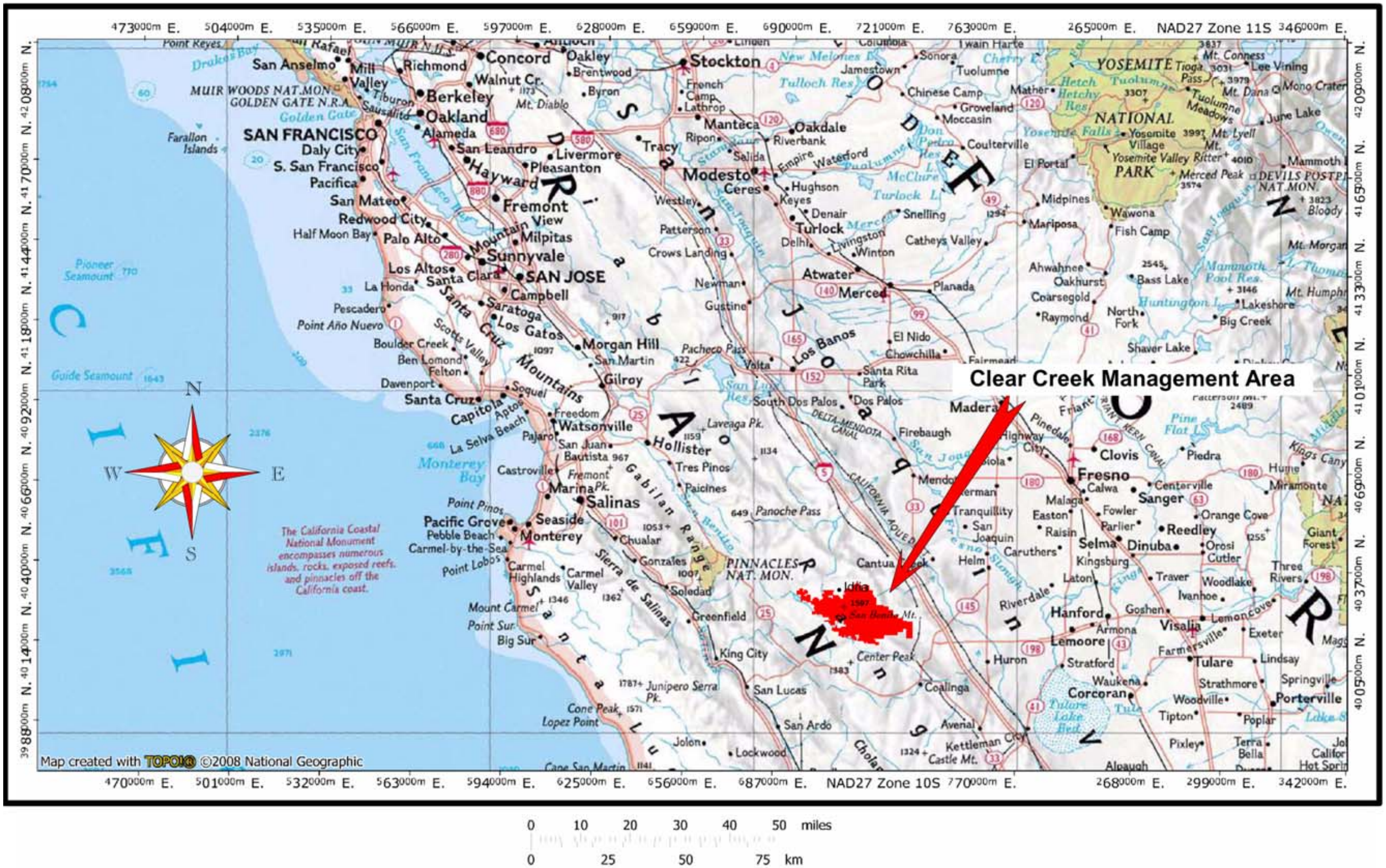

Figure 1: Location Map for Clear Creek Management Area

Historically this highly mineralized region supported several mining operations. The area is also known as the New Idria Mining District because the New Idria Quicksilver Mining Company began operation here in 1852 and became the world's fourth largest producer of mercury. During the 1900s, mining expanded to include gems, chromite, magnesite and chrysotile. With the closure of the New Idria Quicksilver Mine in 1972, chrysotile became the principal mineral extracted from the area by three major mining operations. The Coalinga Asbestos Mine shut down in 1977. The Atlas Asbestos Mine closed in 1980. The KCAC Mine, the last operating chrysotile mine in the United States, ceased operations in 1998. Gems are still actively mined in the region. The most notable is the semi-precious gem benitoite, California's official state gemstone, was discovered here in 1907. Benitoite is still mined on a 40-acre private parcel.

For a short while following 1907, this area became the San Benito National Forest and it was incorporated into the Monterey National Forest by President Roosevelt in 1908, but it was transferred back to public domain in 1910 (Sloan, 1914). During the peak years of the 1880s, this region was home to about 4,000 people who lived in various small communities and outlying cabins.

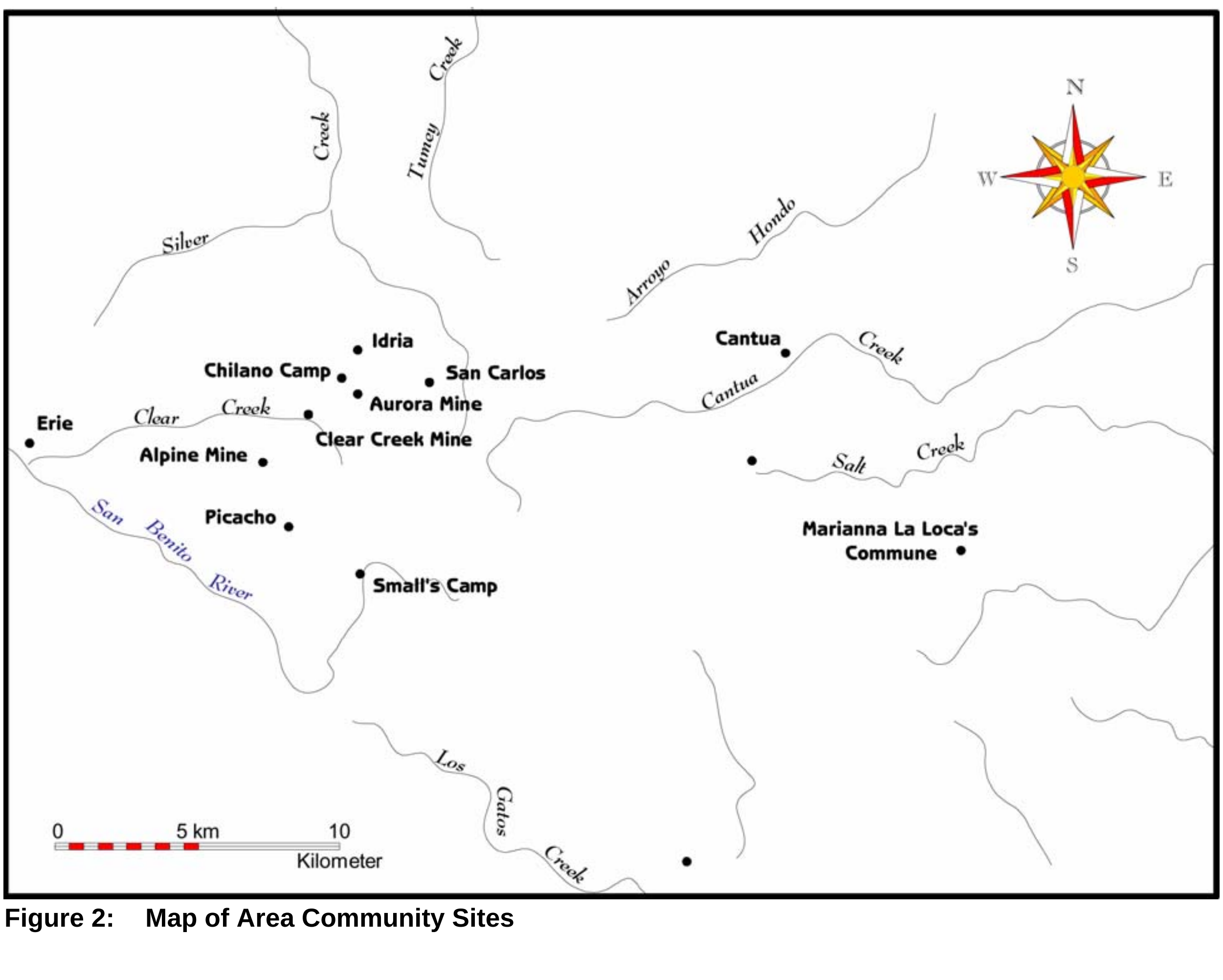

Figure 2: Map of Area Community Sites

6. Survey Area

The survey area consists of approximately nine square miles of the lower Clear Creek canyon and northern ridge above the canyon along routes R1 and R2 as shown on the map in Figure 4 on page 7.

Figure 3: Collecting Serpentine-Chrysotile Specimen Samples at Collection Point 16 (page 22)

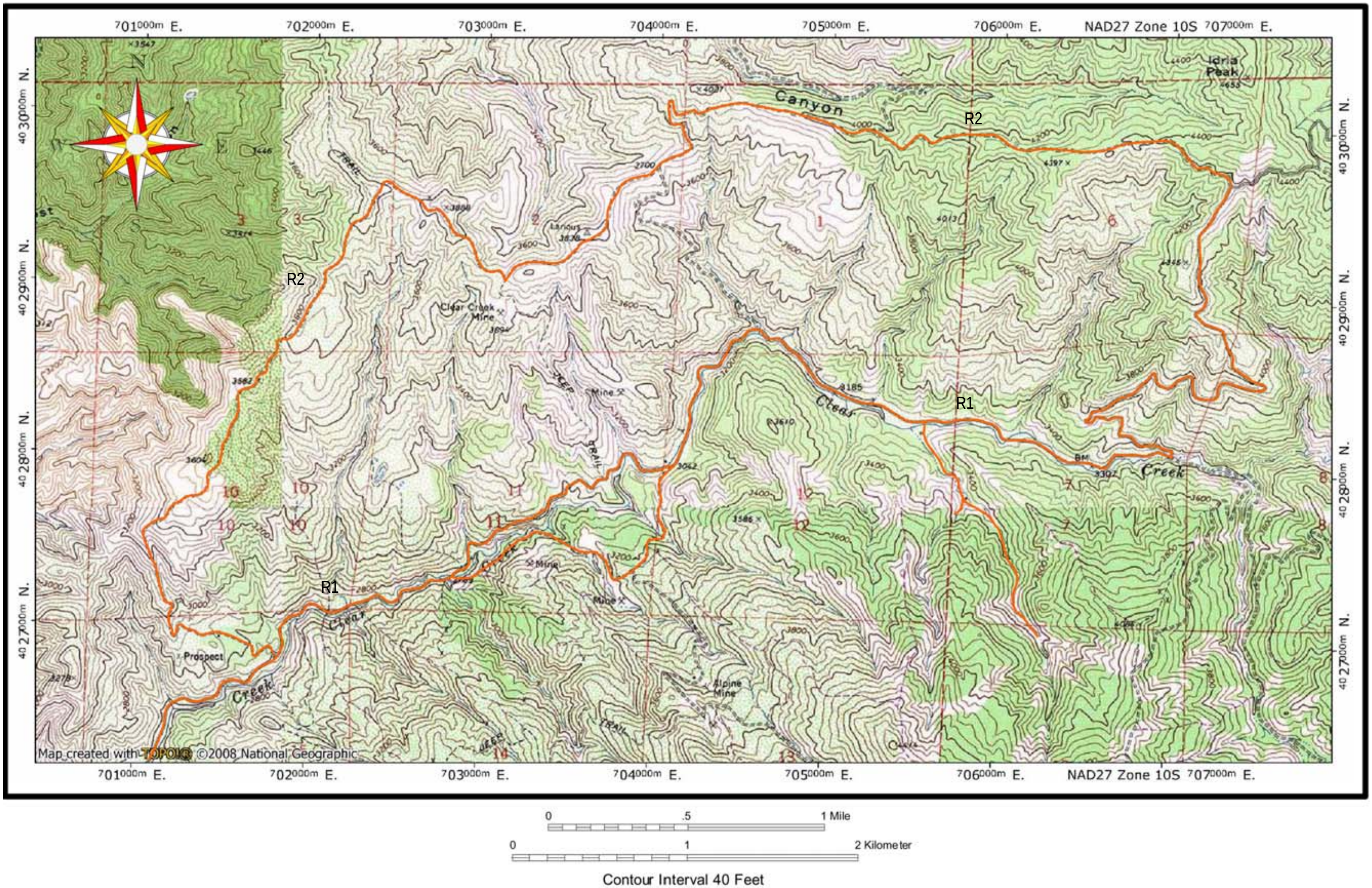

Figure 4: Map of Reconnaissance Area

The area geology contains Jurassic Franciscan formations, Cretaceous Waltham shale (Panoche shale), serpentine and silicified carbonate intrusions with evidence of naturally occurring massive amphibole. The area historic archaeology demonstrates mining, industrial and residential utilization including potential evidence of commercial amphibole asbestos.

6.1. Coordinate Convention for Site Locations

Location data references within this report utilize the Universal Transverse Mercator (UTM) coordinate system based on the 1927 North American Datum (NAD27). The NAD27 datum is used because it coincides with the datum used on currently available United States Geological Survey (USGS) topographical maps for this region. Appendix A includes a column for latitude and longitude coordinates utilizing the 1983 North American Datum (NAD83). Location data is confirmed using a Magellan handheld GPS receiver, model Triton 400 with 3-meter resolution. Data was plotted onto USGS topographical maps using National Geographic Holdings TOPO! Version 4.4.3.

6.2. Geology of the Study Area

The study area for this reconnaissance is located within the Clear Creek Management Area in the northwest portion of the New Idria serpentine intrusion. The intrusion is approximately 14 miles long and 6 miles wide and shaped like a football trending from the northwest to the southeast. It is a large exposure of serpentine and, because of its *window-like* exposure, it is sometimes called by the geologic term *diapir*. It is bounded by faults and is the result of tectonic movement that injected this mass into its present position as the core of the Joaquin Ridge Anticline, as it is named on geologic maps of the area.

Figure 5: New Idria Serpentine Intrusion, North Ridge above Clear Creek

This mass was probably upper mantle material consisting of pyroxene and peridotite before being initially moved upward by a late Jurassic collision of the Farallon and American tectonic plates (Dickinson and Ingersoll, 1978). Further uplift occurred when alteration of the mantle material by mineralizing fluids caused a volume expansion and subsequent shearing of the whole mass. Further alteration of the mantle material resulted in the formation of serpentine.

Figure 6: Glaucophane Schists at Collection Point 15 (page 22)

Associated with the serpentine is the Franciscan Formation, which was deposited upon mantle material in the subduction zone resulting from the plate collision during the Jurassic age. These rocks consist of a disturbed complex of sandstone (greywacke), shale and jasper intermingled with metamorphic rocks formed during the plate collision. The metamorphic rocks are abundantly exposed in and around the New Idria serpentine intrusion and are mapped as the Franciscan Formation. Because the uplift pushed the mantle material upward the Franciscan Formation would be above this mass and erosion would later remove most of the overlying material leaving the Franciscan as “roof pendants” in the intrusion. Presently, these “roof pendants” are seen scattered throughout the intrusion and are mostly composed of non-asbestiform amphiboles glaucophane (or crossite) schists and lesser amounts of non-asbestiform actinolite and chlorite schists along with mineralized vein materials. Mineralization took place in this geologic time period (Tertiary Miocene).

Alteration of the mantle material into serpentine by water solutions resulted in the removal of iron from the mantle rock causing a gradation from perioditite to bastite then to serpentine, which is nearly entirely composed of a hydrous magnesium silicate. The shearing of the serpentine allowed fractures to become sites for the formation of chrysotile asbestos having the same composition as the parent serpentine. Fracture zones became passageways for mineralizing solutions to deposit cinnabar (mercury sulfide) ore into metasomatic pods and veins in the serpentine, especially in the rich New Idria area, and the unique and rare minerals in other areas. These minerals are found in the gem mine area associated with non-asbestiform glaucophane amphibole schist and to a much lesser extent in the Victor claim area where they are associated with albite veins rather than glaucophane-natrolite. They consist of benitoite, natrolite, and neptunite (plus joaquinite, etc.) and minute amounts of many other minerals including non-asbestiform tremolite. It should be noted that many elements received infusions of titanium from the mantle to form such unique minerals as benitoite, neptunite, melanite (black garnet), joaquinite, and perovskite (found with syenite).

Chromite and magnetite are also found in the area in great quantities because of their association with upper mantle material. They are generally found in serpentine in an olivine matrix or as massive deposits at the Butler Estate Chromite Mine (Mistake Mine) area. Well formed magnetite crystals are often found within serpentine deposits.

Igneous intrusions of syenite are found just south of the Gem Mine and at the extreme southeast end of the serpentine intrusion. This rock is a silica deficient "granite" and is noted for containing relatively large crystals of non-asbestiform hornblende (barkevikite) amphibole and albite plagioclase. Its emplacement was probably during the late Miocene epoch, after the uplift of the serpentine. It was probably the source of the mineralizing fluids that flooded the serpentine intrusion.

The specific geologic study of Clear Creek Management Area may be seen more clearly by noting locations of the important geologic outcrops on the enclosed geologic map shown in Figure 9 on page 12. The *Jf* labels mark the locations of Franciscan Formation exposures. Here the glaucophane amphibole schists may be found. Associated minerals at each location are listed in the collections list. Outcrops on the geologic map labeled as *ar* (Coleman designations) or *sc* are silicified carbonates and are metasomatic pods with minerals deposited, via mineralizing solutions, separately from the main serpentine mass. These outcrops are often called "quicksilver rock" because of the occurrence of cinnabar, the ore for mercury, in them. Other minerals, which may be found in these dikes or pods, are quartz, chalcedony (banded quartz), magnesite, and some non-asbestiform tremolite.

Figure 7: Silicified Carbonate Outcropping, "Quicksilver Rock"

The major rock present in the study area is serpentine, designated as *sp* on the geologic map. It is mainly massive antigorite and chrysotile asbestos, which was probably formed in association with the shearing of the serpentine during emplacement. Non-asbestiform tremolite may also be present in small amounts in this area.

Figure 8: Clear Creek Canyon within the Clear Creek Management Area

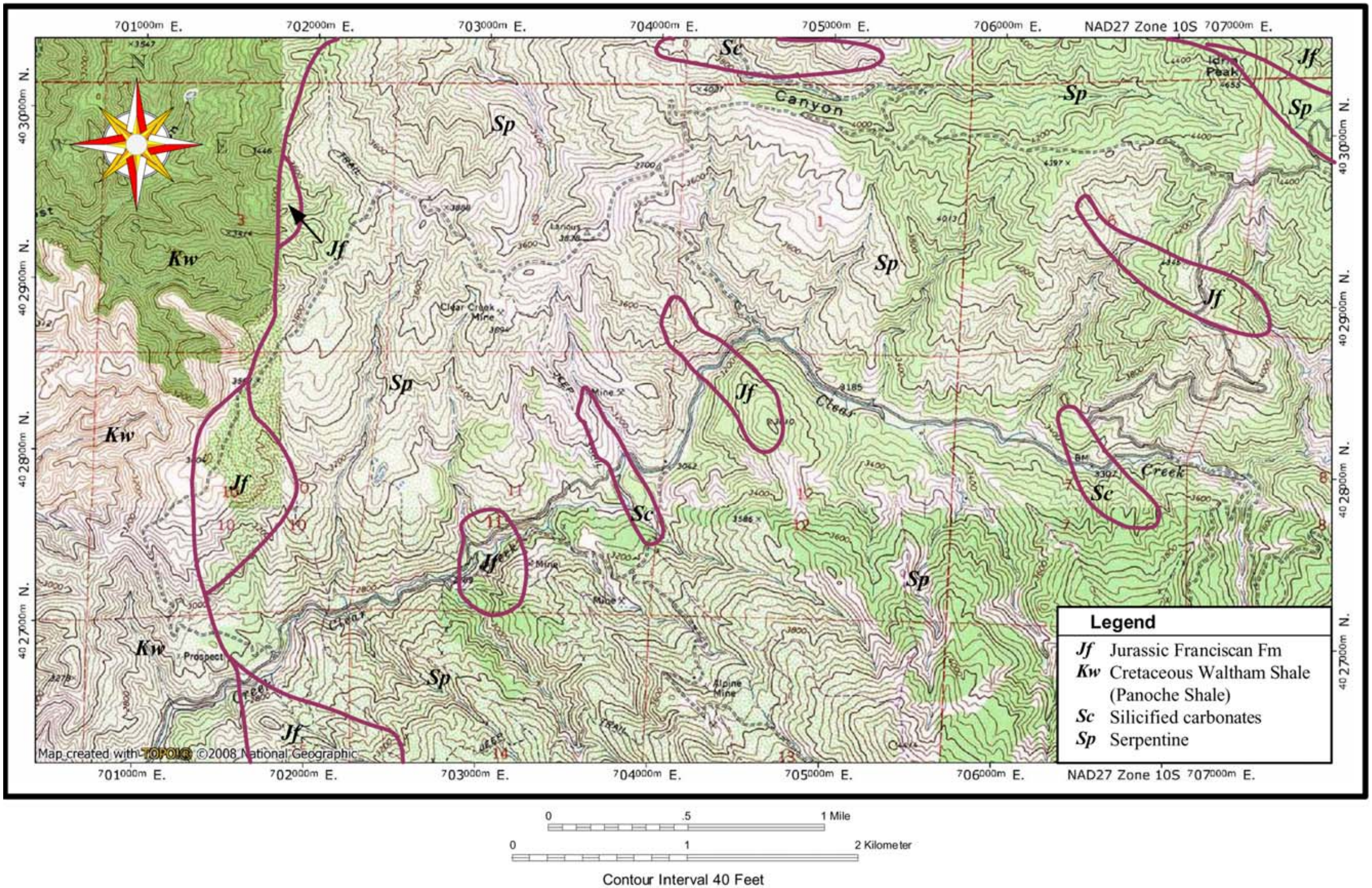

Figure 9: Map Showing Geological Features

6.3. Mines & Prospects within the Study Area

The study area, and the region in general, was a historically active mining and ore processing area between about 1855 and 1970, and as such, supported a diverse community of social, civic and industrial activity. As shown in Figure 11 on page 14, twenty-eight historic mines and prospects are identified within the study area. Although there are currently no active claims or operation, the study area does contain two sections of private property: The 137.7 acres Clear Creek Mine claim and the 23.0 acres Boston Mine claim. Industrial machinery and kilning could account for importation of commercial amphibole asbestos material used as insulation on kilns and as additives in industrial lubricants, gaskets, seals, tires, conveyor belts, building materials and appliances associated with the various mining and milling operations.

Figure 10: Photograph of Industrial Artifact (Rotary Kiln) Associated with Clear Creek Mine showing Braided Asbestiform Pipe Seal (imported asbestos).

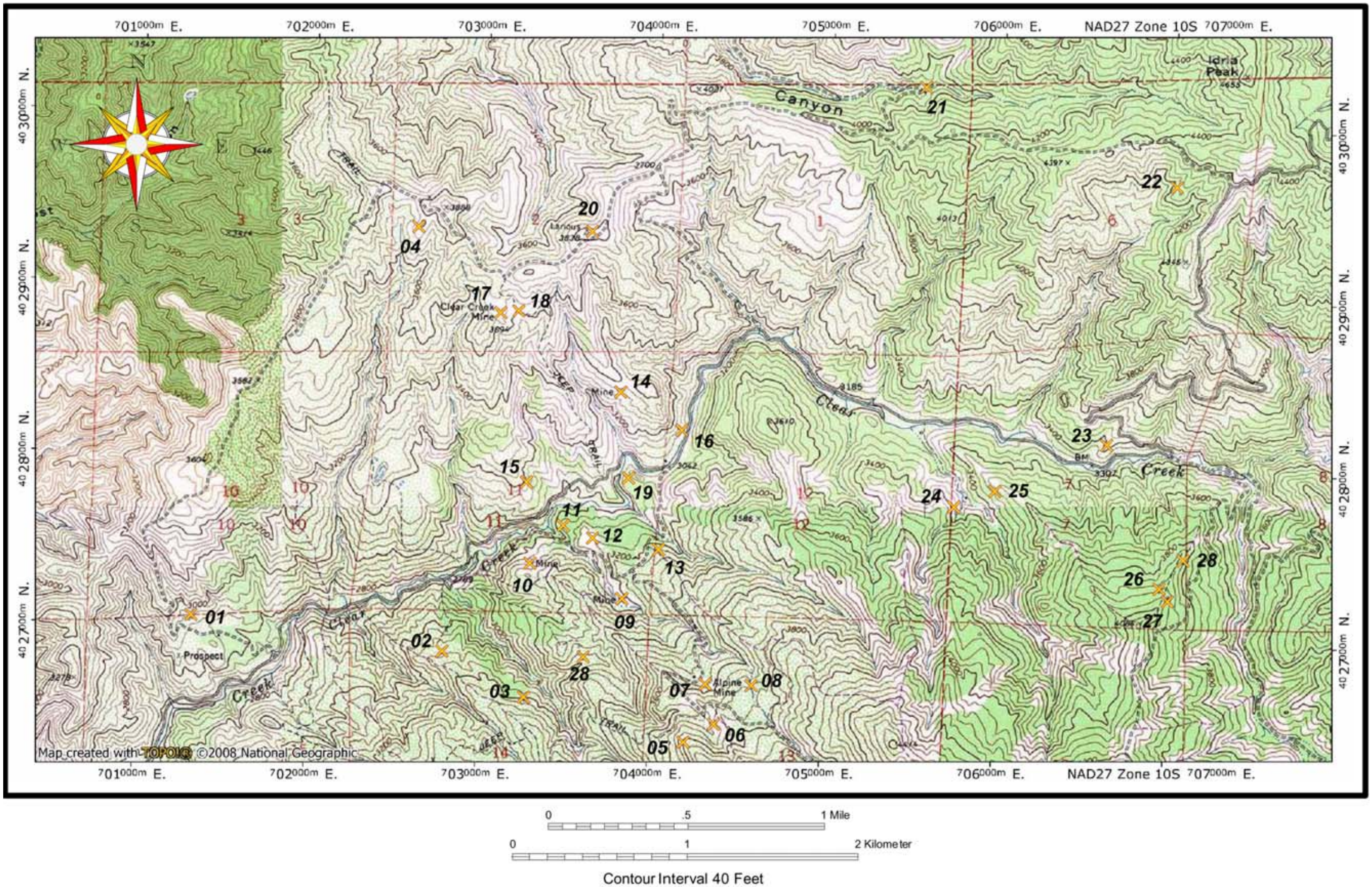

Figure 11: Map of Historic Mines and Prospects within the Study Area

Historic mine and prospect sites found within the immediate study area are listed below:

- 01 - San Benito Asbestos Company located at UTM 701310mE 4027033mN was formed as a California common stock corporation in 1917 (Root, 1926 and stock certificate on file) to mine chrysotile. This location later became known as the Jade Mill where Leza Junilla processed jadite (pyroxene) into jewelry.

Figure 12: Satellite Photograph of San Benito Asbestos Company Site, aka Jade Mill

- 02 - Unnamed prospect is identified on USGS Map, San Benito Mountain, CA, at UTM 702602mE 4026379mN.
- 03 - Unnamed chromium prospect is located at UTM 703290mE 4026616mN (Jenkins, 1942).
- 04 - Unnamed chromite prospect was located at UTM 702597mE 4029379mN by field reconnaissance.
- 05 - Alpine Deposit, located at UTM 704193mE 4026391mN, contains chromium, Franciscan, Josephine peridotite, and serpentinite (Walker and Griggs. 1953; Eckel and Myers, 1946).
- 06 - Unnamed mine located by physical reconnaissance at UTM 704396mE 4026491mN.
- 07 - Alpine Mine, also known as the Esmeralda is located at UTM 704335mE 4026702mN. The mine was discovered in 1910 with its principle production during 1912-17 (Eckel and Myers, 1946; Homes, 1965; Averill, 1947; Bradley, 1918; Ransome and Kellogg, 1939).

- 08 - S. L. Mead Chromite prospect is located at UTM 704584mE 4026708mN.
- 09 - Monterey Group is located at UTM 703817mE 4027197mN (Root, 1918; Hamiliton, 1917).
- 10 - Monterey Group is located at UTM 703292mE 4027401mN (Root, 1918; Hamiliton, 1917).

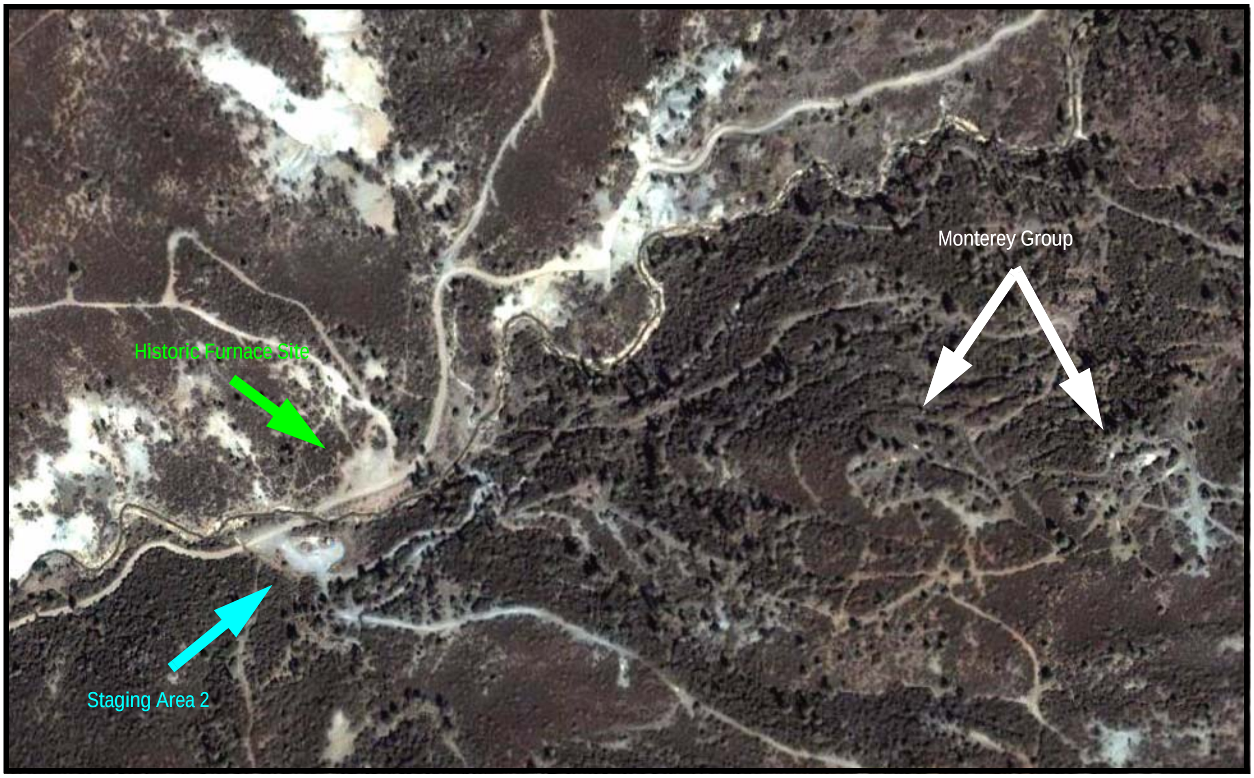

Figure 13: Satellite Photograph showing scars from Monterey Group (right half of photo)

- 11 - Unnamed prospect is located at UTM 703490mE 4027620mN on the USGS Map, San Benito Mountain, CA.
- 12 - Unnamed mine is found at UTM 703644mE 4027537mN by field reconnaissance.
- 13 - Tirado and Shear Mine is a mercury mine located at UTM 704038mE 4027484mN (Eckel and Myers, 1946; Averil,l 1947; Ransome and Kellogg, 1939).
- 14 - North Star Mine is a mercury deposit located at UTM 703800mE 4028405mN (Holmes, 1965).
- 15 - Nickel Magnesium Group prospect is located at UTM 703259mE 4027899mN (Ralph, 2008).

- 16 - Boston Mine is located at UTM 704166mE 4028193mN (Eckel and Myers, 1946). Historically part of The Flint Group, Also See Fourth of July, Monterey, Andy Johnson, Red Rock, Clear Creek.

Figure 14: Satellite Photograph Boston Mine Site

- 17 - Clear Creek Mine, also known as the Clear Creek Claim is located at UTM 703085mE 4028854mN (Hamilton, 1917; McCray, 1891; Erd *et al,* 1993; Roberts *et al*, 1993).
- 18 - Flint Group located at UTM 703177mE 4028867mN was also part of Boston, Fourth of July, Monterey, Andy Johnson, Red Rock, Clear Creek (Eckel and Myers, 1946).
- 19 - Unnamed Mine is located at UTM 703858mE 4027906mN. Leza Junilla remembers seeing remains of an adit at this location.
- 20 - Bright Future Claims is a chromium deposit located at UTM 703599mE 4029343mN (Ralph, 2008).
- 21 - Unnamed prospect located by physical reconnaissance at UTM 705534mE 4030219mN.
- 22 - Tirado Prospect located by physical reconnaissance at UTM 706985mE 4029646mN. The site, located in 1914, consisted of two claims and was worked in 1919 and 1942 (Holmes, 1965; Bradley, 1918; Hamilton, 1917; Averil,l 1947; Ransome and Kellogg, 1939).
- 23 - Black Hawk Mine location is confirmed by its pervious owner, Leza Junilla, to be located at UTM 706640mE 4028162mN.

- 24 - Victor Claim located by physical reconnaissance at UTM 705795mE 4027829mN (*Cooper*). Cooper et al describe finding very small samples of non-asbestiform actinolite and tremolite among other minerals reported near the Victor Claim.

Figure 15: Victor Claim

- 25 - Unnamed prospect is identified on USGS Map, San Benito Mountain, CA, at UTM 705947mE 4027895mN.
- 26 - Unnamed prospect is identified on USGS Map, San Benito Mountain, CA, at UTM 706953mE 4027344mN.
- 27 - Unnamed prospect is identified on USGS Map, San Benito Mountain, CA, at UTM 707020mE 4027270mN.
- 28 - Unnamed prospect is identified on USGS Map, San Benito Mountain, CA, at UTM 707090mE 4027500mN.

6.4. Historic Sites within the Study Area

Identification of historic sites within the study area is important because it establishes historic activity that may have imported industrial asbestos material, thus accounting for non-native amphibole asbestiform in the area. Field reconnaissance located nineteen historic structure sites with the study area, with evidence that several more exist.

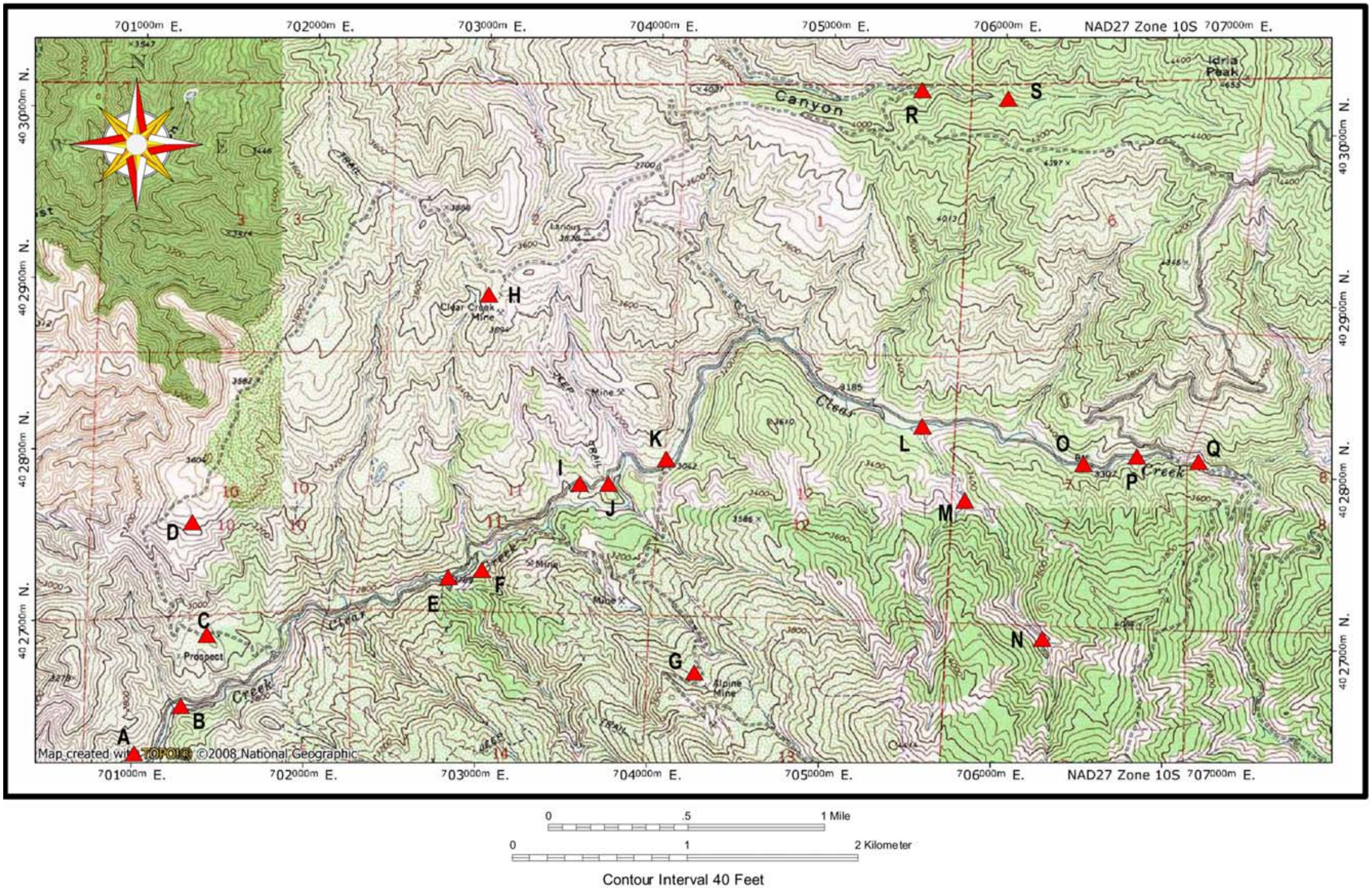

Figure 16: Map of Historic Sites within the Study Area

List of historic site with the immediate study area follows:

- A - Brick Kiln and Oak Flat is located at UTM 700936mE 4025936mN and at UTM 701007mE 4026176mN (Hamilton, 1917).

Figure 17: Brick Kiln Site near Oak Flat, pile of red brick can be seen near center left of oak tree

- B - Furnace was located about 460 meters northeast from Oak Flat at 701264mE 4026510mN (Goodyear, 1886).
- C - Jade Mile site, established by Leza Junilla, is located at UTM 701514mE 4026985mN on the historic San Benito Asbestos Company site.
- D - Adobe structure site, marked by stone foundation and soil mound located by reconnaissance, is located at 701329mE 4027557mN.

- E - Furnace site was located by reconnaissance at UTM 702873mE 4027324mN. This site is now known as Staging Area 2 (Goodyear, 1886).

Figure 18: Foundation Bricks of Historic 40'x20' Furnace at Staging Area 2

- F - Brick Retort site was located by reconnaissance at UTM 702731mE 4027317mN, near Staging Area 2.
- G - Alpine Mine Scotts Furnace, barracks, cookhouse and buildings were located at UTM 704254mE 4026759mN.
- H - Clear Creek Mine furnace, barracks, cookhouse and buildings were located at 703026mE 4028928mN.
- I - Chromite Mill site, currently known as Staging Area 3, is located at UTM 703577mE 4027845mN. The site contains several concrete foundation pads.
- J - Undefined historic site, probably associated with I - Chromite Mill, is located at UTM 703757mE 4027833mN.
- K - Structure foundation is located at the Boston Mine site at UTM 704078mE 4028009mN. This site also had a furnace and cabins.

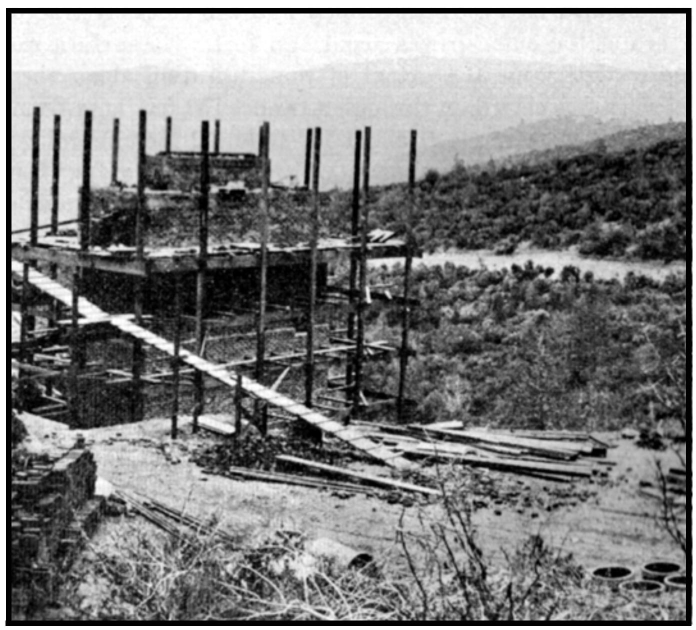

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Figure 19: Scotts Furnace Construction at Alpine Mine, ca. 1916

- L - Historic community site, now known as Staging Area 4 is located at UTM 705510mE 4028232mN.
- M - Cabin Site and Quicksilver Retort was located by reconnaissance at UTM 705825mE 4027845mN.
- N - Prospect cabin and retort site was located by reconnaissance at UTM 706282mE 4027030mN.
- O - Brick Retort debris was located by reconnaissance at UTM 706502mE 4028044mN. This site is now known as Staging Area 5.
- P - Brick Retort debris was located by reconnaissance at UTM 706800mE 4028084mN. This site is now known as Staging Area 6.
- Q - Jade Mill was an historic jadite (pyroxene) milling location and recreation site located at UTM 707076mE 4028124mN.
- R - Prospect Retort and cabin site located by reconnaissance at UTM 705529mE 4030202mN (Idria, 1969).
- S - Prospect Retort and cabin site located by reconnaissance at UTM 705987mE 4030169mN (Becker, 1887).

6.5. Data Collection Points within Study Area

Data samples were collected from geological locations and historic archaeological sites. The sample collection points are illustrated on the map shown in Figure 21 on page 23.

Figure 20: Data Collection near Staging Area 2.

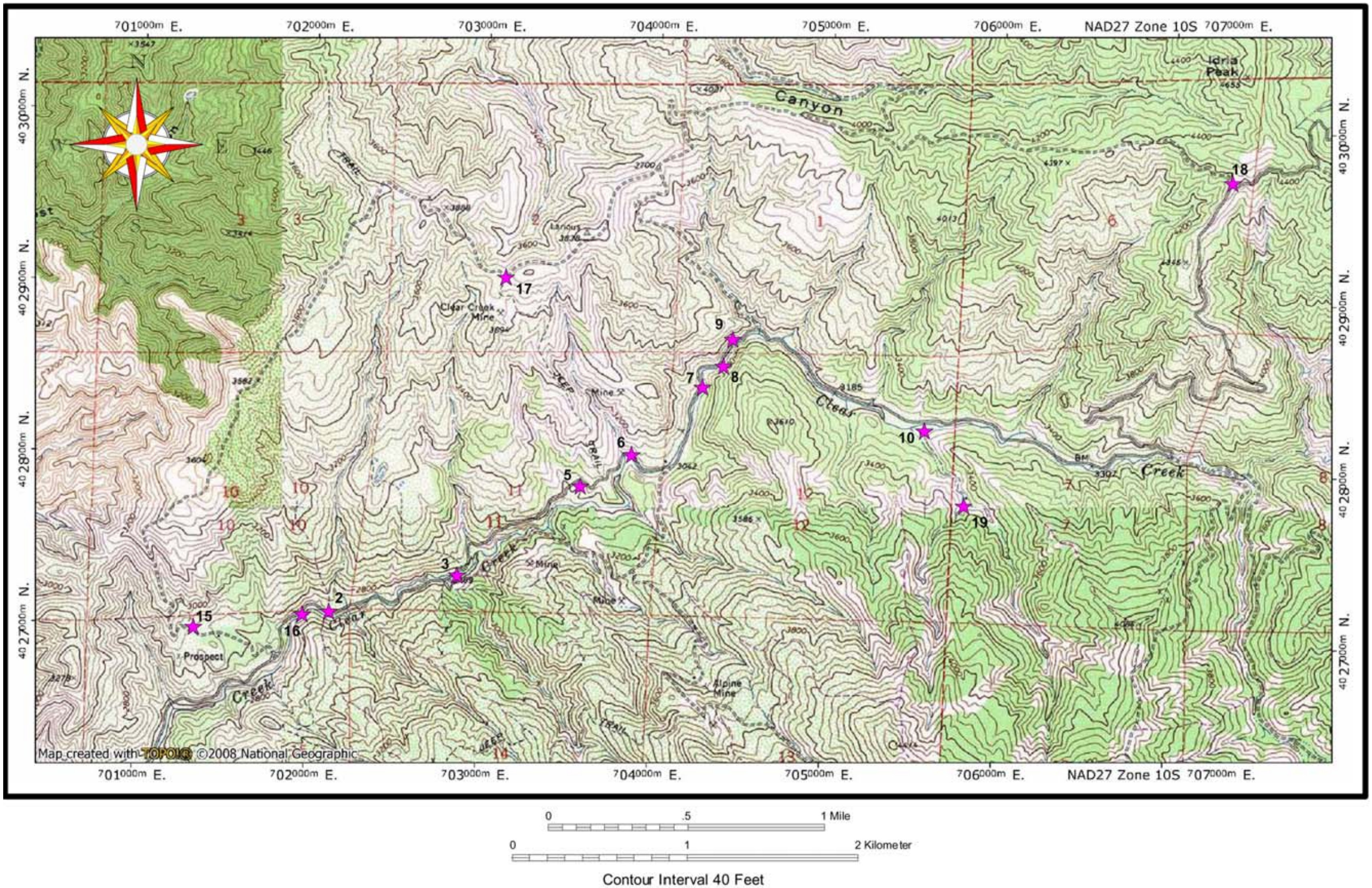

Figure 21: Map of Data Collection Points within the Study Area

The following list describes each collection point associated with the map in Figure 21 on page 23.

- 1 - Deep cut to Clear Creek, 100m before Jade Mill area at about UTM 701583mE 4026692mN. Samples were not collected at this because of access difficultly.
- 2 - Staging Area 1 is located at UTM 702125mE 4027111mN. Loose surface soil containing serpentine flakes, chrysotile, pebbles were collected from southwest flat portion of Staging Area 1.
- 3 - Staging Area 2 is located at UTM 702873mE 4027324mN. Loose serpentine material containing flakes was collected north of Staging Area 2. A potential commercial asbestos specimen was collected from a debris mound on the south bank of Clear Creek stream.
- 4 - Franciscan Formation located at about UTM 703163mE 4027580mN. Samples were not collected.
- 5 - Staging Area 3 is located at UTM 703580mE 4027843mN. Fibrous material, possible associated with historic context was collected from near a concrete pad east of the metal fence rail. Soil samples were collected from historic chromite mill dumpsite or mound on hill about 20 feet east of Staging Area 3.
- 6 - Geological dike crossing road R1 at UTM 703861mE 4028064mN. Mineral sample was collected from an outcrop of silicified carbonate.
- 7 - Serpentine dike crosses R1 at UTM 704279mE 4028457mN. Non-asbestos glaucophane amphibole schist samples were collected.
- 8 - Serpentine located at UTM 704381mE 4028571mN. Platy and fibrous serpentine were collected.
- 9 - Coleman location for jadeite and possible non-asbestiform tremolite located at UTM 704437mE 4028738mN. Possible lawsonite and possible chlorite schist samples were collected.
- 10 - Staging Area 4 is located at UTM 705542mE 4028191mN. Creek bed material from tributary to Clear Creek draining from Victor claim area was collected.
- 11 - Staging Area 5 is located at UTM 706141mE 4028187mN. No samples were collected because of heavy rain.
- 12 - Silicified carbonates are located at UTM 706414mE 4028045mN. No samples were collected because of heavy rain.
- 13 - Staging Area 6 is located at UTM 706816mE 4028110mN. No samples were collected because of heavy rain.
- 14 - Victor Mining Claim is located at UTM 706105mE 4027187mN. Initially no samples were collected because of heavy rain. Sample were collected later and recorded as entry 19.

- 15 - The Jade Mill on route R2 is located at UTM 701380mE 4026981mN. Various mineral samples were collected from historic mine tailings.
- 16 - Serpentine-chrysotile-hydromagnesite slide material at edge of R1 at UTM 701983mE 4027101mN.
- 17 - Historic small rotary kiln is located on route R2 at the Clear Creek Mine entrance road at UTM 703102mE 4029063mN. Potential asbestos containing gasket and kiln insulation material was collected.
- 18 - Serpentine at Junction of routes R1 and R2 is located at UTM 707328mE 4029693mN. Loose serpentine samples were collected.
- 19 - Victor Claim is located at UTM 705749mE 4027754mN where serpentine slide material from was collected. Stream gravel was collected down steam from Victor Claim at UTM 705793mE 4027809mN.

Figure 22: Fibrous Seal Material on Rotary Kiln.

7. Survey Results

The collection included 27 specimens: 22 mineral samples and 5 archaeological samples. The collection includes 15 redundant mineral samples and 4 redundant archaeological samples. The total collection weighs 5198.2 grams. The specimen collection is tabulated in “Appendix A - List of Collection Samples” on page 31. Some samples could not be collected because of intermittent heavy rain. However, information about these areas was available from previous visits to the missed sample sites and could be useful. See “Appendix B- Geology at Unsampled Sites” on page 39. Non-asbestiform amphibole appeared to occur at 5 of the 18 locations examined. Possible commercial asbestos appeared at 4 of the 18 locations examined.

8. Conclusion

Naturally occurring asbestiform amphibole was not found. However, historic ore processing equipment was found to contain potential asbestiform amphibole that had been imported into the area for commercial purposes. Oxidation and decay of the equipment due to weathering appeared to have caused localized dispersion of the commercial asbestos. Improper remediation efforts may have caused this material to be carried away by runoff water or wind-blown erosion into traveled roadways within the EPA study sampling area. Similarly, weathering may also have caused disintegration of naturally occurring amphibole which may also have been locally dispersed by run off water or wind blown erosion onto other parts of the EPA sampling routes.

Coleman's sample location 9 (see list on page 24) which was on R001 between EPA's staging area 3 and staging area 4 contained non-asbestiform tremolite in shear zones around jadeite pods and adjacent to Franciscan material. Loose (landslide) serpentine-chrysotile material was present in the western part of the Clear Creek area. More massive bedrock was present to the east. Spotty exposures of Franciscan material and dikes of silicified carbonates, called “quicksilver rock” by miners because of its association with mercury ore, may also be a source of amphibole but this must be confirmed by further mineralogical study.

9. Recommendation for Further Study

The samples will be mineralogically characterized to determine fiber type and fiber habit. Additional samples along the EPA study sampling routes may be taken to fill in potential data gaps.

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11. Appendix A - List of Collection Samples

Table 2: List of Collection Samples

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
01	1	—	No Samples Collected.	Deep cut to Clear Creek, 100m before Jade Mill area.	36° 21.928; 120° 45.252	701582mE 4026632mN	—
02-1A	1	12:12	Loose surface soil from SW flat portion of Staging Area 1, containing serpentine flakes, chrysotile, pebbles.	EPA Staging Area 1	36º 22.180; 120º 44.881	702125mE 4027111mN	166.0
02-1B	1	12:13	Loose surface soil from SW flat portion of Staging Area 1, containing serpentine flakes, chrysotile, pebbles. Redundant of sample 02-1A.	EPA Staging Area 1	36º 22.180; 120º 44.881	702125mE 4027111mN	100.1
03-1A	1	12:34	Fibrous material, possible piece of industrial seal containing asbestos from north of Staging Area 2, south bank of Clear Creek stream. Historic site of Scotts Furnace and Retort on both sides of stream.	EPA Staging Area 2	36º 22.280; 120º 44.379	702872mE 4027314mN	10.3
03-2A	1	13:17	Loose serpentine material containing flakes taken north of Staging Area 2, North Quicksilver Hill.	EPA Staging Area 2	36º 22.328; 120º 44.369	702885mE 4027403mN	65.9

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
03-2B	1	13:18	Loose serpentine material containing flakes taken north of Staging Area 2, North Quicksilver Hill. Redundant of sample 03-2A.	EPA Staging Area 2	36º 22.328; 120º 44.369	702885mE 4027403mN	47.1
04	1	—	No Samples Collected.	Franciscan Formation	36° 22.42; 120° 44.18	703163mE 4027580mN	—
05-1A	1	—	Fibrous material, possible piece of industrial asbestos seal from about 10 feet east of Staging Area 3.	EPA Staging Area 3	36º 22.56; 120º 43.89	703591mE 4027849mN	11.3
05-1B	1	—	Fibrous material, possible piece of industrial asbestos seal from about 10 feet east of Staging Area 3. Redundant of sample 05-1A.	EPA Staging Area 3	36º 22.56; 120º 43.89	703591mE 4027849mN	31.0
05-2A	1	—	Material from historic chromite mill dump site or mound on hill about 20 feet east of Staging Area 3.	EPA Staging Area 3	36º 22.56; 120º 43.89	703591mE 4027849mN	109.2
05-2B	1	—	Material from historic chromite mill dump site or mound on hill about 20 feet east of Staging Area 3. Redundant of sample 05-2A.	EPA Staging Area 3	36º 22.56; 120º 43.89	703591mE 4027849mN	68.5

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
06-1A	1	—	Prominent outcrop of silicified carbonate (sc) dike crossing R1 and Clear Creek, heavily iron stained white rock, generally containing chalcedony, ankerite?, magnesite, green stains of serpentine.		36º 22.673; 120º 43.706	703861mE 4028064mN	202.8
06-1B	1	14:10	Prominent outcrop of silicified carbonate (sc) dike crossing R1 and Clear Creek, heavily iron stained white rock, generally containing chalcedony, ankerite?, magnesite, green stains of serpentine. Redundant of sample 06-1A.		36º 22.673; 120º 43.706	703861mE 4028064mN	42.6
07-1A	1	—	Serpentine dike crossing R1, sheared, some hydromagnesite.		36º 22.88; 120º 43.42	704279mE 4028457mN	66.0
07-1B	1	—	Glaucophane schist samples 10 ft. north of 7-1a.		36º 22.88; 120º 43.42	704279mE 4028457mN	152.5
08-1A	1	—	Platy serpentine samples west side of Clear Creek.		36º 22.94; 120º 43.35	704381mE 4028571mN	183.7
08-1B	1	—	Platy serpentine samples west side of Clear Creek. Redundant of sample 08-1A.		36º 22.94; 120º 43.35	704381mE 4028571mN	59.7
08-2A	1	—	Fibrous serpentine 10 meters west of site 8-1A.		36º 22.94; 120º 43.35	704381mE 4028571mN	257.4

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
08-2B	1	—	Fibrous serpentine 10 meters west of site 8-1A. Redundant of sample 08-2A.		36º 22.94; 120º 43.35	704381mE 4028571mN	25.9
09-1A	1	—	Coleman location for jadeite and possible tremolite.		36º 23.03; 120º 43.31	704437mE 4028738mN	493.4
09-1B	1	—	Lawsonite?		36º 23.03; 120º 43.31	704437mE 4028738mN	59.1
09-1C	1	—	Chlorite schist?		36º 23.03; 120º 43.31	704437mE 4028738mN	238.5
10-1A	1	—	Creek bed material from tributary to Clear Creek draining from Victor claim area.	EPA Staging Area 4	36º 22.72; 120º 42.58	705542mE 4028191mN	124.5
10-1B	1	—	Creek bed material from tributary to Clear Creek draining from Victor claim area. Redundant of sample 10-1A.	EPA Staging Area 4	36º 22.72; 120º 42.58	705542mE 4028191mN	97.3
11	1	—	No Samples Collected - heavy rain.	EPA Staging Area 5.	36° 22.71; 120° 42.18	706141mE 4028187mN	—
12	1	—	No Samples Collected - heavy rain.	Silicified carbonates	36° 22.63; 120° 42.00	706414mE 4028045mN	—
13	1	—	No Samples Collected - heavy rain.	EPA Staging Area 6	36° 22.66; 120° 41.73	706816mE 4028110mN	—

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
14	1	—	No Samples Collected - heavy rain.	Victor Mining Claim	36° 22.17; 120° 42.22	706105mE 4027187mN	—
15-1A	1	11:11	Tailing waste from historic San Benito Asbestos Company mill site, upper Jade Mill.	R2 at Jade Mill	36º 22.119; 120º 45.381	701380mE 4026981mN	41.6
15-1B	1	11:11	Tailing waste from historic San Benito Asbestos Company mill site, upper Jade Mill. Redundant of sample 15-1A.	R2 at Jade Mill	36º 22.119; 120º 45.381	701380mE 4026981mN	63.1
15-2A	1	11:16	Yellow stained altered serpentine from historic San Benito Asbestos Company mill site, upper Jade Mill. About 30 m west from sample 15-1.	R2 at Jade Mill	36º 22.138; 120º 45.410	701336mE 4027015mN	127.7
15-2B	1	—	Yellow stained altered serpentine from historic San Benito Asbestos Company mill site, upper Jade Mill. About 30 m west from sample 15-1. Redundant of sample 15-2A.	R2 at Jade Mill	36º 22.138; 120º 45.410	701336mE 4027015mN	66.2
15-3A	1	11:28	Upper Jade Mill serpentine with brown stains.	R2 at Jade Mill	36º 22.156; 120º 45.415	701328mE 4027048mN	370.1
15-3B	1	11:29	Upper Jade Mill serpentine with brown stains. Redundant of sample 15-3A.	R2 at Jade Mill	36º 22.156; 120º 45.415	701328mE 4027048mN	165.3
15-4A	1	11:36	Glaucophane schist with shiny flaky blue sheen on surface.	R2 at Jade Mill	36º 22.147; 120º 45.411	701334mE 4027032mN	123.6

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
15-4B	1	11:37	Glaucophane or micaceous schist with shiny flaky blue sheen on surface.	R2 at Jade Mill	36º 22.147; 120º 45.411	701334mE 4027032mN	37.8
16-1A	1	11:58	Serpentine-chrysotile-hydromagnesite slide material at edge of R1.		36º 22.176; 120º 44.976	701983mE 4027101mN	131.2
16-1B	1	11:59	Serpentine-chrysotile-hydromagnesite slide material at edge of R1. Redundant of sample 16-1A.		36º 22.176; 120º 44.976	701983mE 4027101mN	67.0
17-1A	2	10:23	Fibrous gasket material, probably asbestos seal, from small rotary kiln abandoned next to R2 at Clear Creek Mine entrance.	R2 at Clear Creek Mine Entrance	36º 23.223; 120º 44.198	703102mE 4029063mN	172.3
17-1B	2	10:24	Fibrous gasket material, probably asbestos seal, from small rotary kiln abandoned next to R2 at Clear Creek Mine entrance. Redundant of sample 17-1A.	R2 at Clear Creek Mine Entrance	36º 23.223; 120º 44.198	703102mE 4029063mN	91.3
17-2A	2	10:25	Fibrous insulation material, probably asbestos, from inside (outer shell rusted through) small rotary kiln abandoned next to R2 at Clear Creek Mine entrance.	R2 at Clear Creek Mine Entrance	36º 23.223; 120º 44.198	703102mE 4029063mN	39.6

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
17-2B	2	10:26	Fibrous insulation material, probably asbestos, from inside (outer shell rusted through) small rotary kiln abandoned next to R2 at Clear Creek Mine entrance. Redundant of sample 17-2A.	R2 at Clear Creek Mine Entrance	36º 23.223; 120º 44.198	703102mE 4029063mN	25.9
18-1A	2	11:26	Natural chrysotile material from road cut at edge of junction of R1 & R2.	North Junction of R1 & R2	36º 23.509; 120º 41.363	707328mE 4029693mN	16.0
18-1B	2	11:27	Natural chrysotile material from road cut at edge of junction of R1 & R2. Redundant of sample 18-1A.	North Junction of R1 & R2	36º 23.509; 120º 41.363	707328mE 4029693mN	11.2
18-2A	2	11:28	Natural serpentine material from road cut at edge of junction of R1 & R2.	North Junction of R1 & R2	36º 23.509; 120º 41.363	703102mE 4029063mN	88.3
18-2B	2	11:29	Natural serpentine material from road cut at edge of junction of R1 & R2. Redundant of sample 18-2A.	North Junction of R1 & R2	36º 23.509; 120º 41.363	703102mE 4029063mN	97.3
19-1A	3	8:55	Insulation material from historic retort remnants at stream confluence edge about 500 meters south from Staging Area 4.	Victor Mining Claim	36º 22.521; 120º 42.417	705795mE 4027829mN	48.2

Table 2: List of Collection Samples (Continued)

Sample #	Day	Time	Description	Location	Lat. / Lon. (NAD83)	UTM (NAD 27)	Grams
19-1B	3	8:55	Insulation material from historic retort remnants at stream confluence edge about 500 meters south from Staging Area 4. Redundant of sample 19-1A.	Victor Mining Claim	36º 22.521; 120º 42.417	705795mE 4027829mN	110.9
19-2A	3	9:03	Serpentine slide material from Victor Claim.	Victor Mining Claim	36º 22.481; 120º 42.449	705749mE 4027754mN	118.1
19-2B	3	9:04	Serpentine slide material from Victor Claim. Redundant of sample 19-2A.	Victor Mining Claim	36º 22.481; 120º 42.449	705749mE 4027754mN	80.9
19-3A	3	9:20	Stream gravel down steam from Victor Claim.	Victor Mining Claim	36º 22.510; 120º 42.419	705793mE 4027809mN	279.4
19-3B	3	9:21	Stream gravel down steam from Victor Claim. Redundant of sample 19-3A.	Victor Mining Claim	36º 22.510; 120º 42.419	705793mE 4027809mN	212.4

12. Appendix B- Geology at Unsampled Sites

Actual samples at sites 1, 4, 11, 12, 13 were not taken but the geology has been studied by Dr. E. J. Fowkes during personal surveys in previous years. The geology only is given for these sample locations; however, clues to amphibole or asbestos presence may be indicated.

- Sample Location 1: UTM 701582mE 4026632mN. Boulders of jadeite “float” are found at the bottom of Clear Creek gorge just off the main roadway. These have come from the jade mill area a short distance away. Glaucophane schist is also present here. (Glaucophane is a variety of amphibole.)
- Sample Location 4: UTM 703163mE 4027580mN. Franciscan Formation outcrops near EPA Staging Area 3. Exposures of glaucophane schist, generally gray or bluish in color. Foliated structure common.
- Sample Location 11: UTM 706141mE 4028187mN. EPA Staging Area 5. Road material.
- Sample Location 12: UTM 706414mE 4028045mN. Silicified carbonate dike crossing roadway (similar to site 6). Veins of quartz and chalcedony (banded quartz) present. Small cavities of drusey (small crystals) of quartz. No asbestiform tremolite seen.
- Sample Location 13: UTM 706816mE 4028110mN. EPA Staging Area 6. Road material.
- Sample Location 14: UTM 706105mE 4027187mN. Victor claim. (See location 19)