

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

**Analytical results and sample locality map
of stream-sediment and eolian samples
from the Kelso Dunes Wilderness Study Area (CDCA 250),
San Bernardino County, California**

By

David E. Detra, Richard J. Goldfarb,
Allen L. Meier, and Sarah C. Weaver

Open-File Report 84-103

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

1984

STUDIES RELATED TO WILDERNESS

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 a mineral survey of the Kelso Dunes Wilderness Study Area, California Desert Conservation Area (250), San Bernardino County, California.

CONTENTS

	Page
Studies related to wilderness.....	i
Introduction.....	1
Methods of study.....	1
Sand samples.....	1
Stream-sediment samples.....	1
Heavy-mineral-concentrate samples.....	1
Sample preparation.....	2
Sample analysis.....	2
Spectrographic method.....	2
RASS.....	5
References cited.....	5

TABLES

TABLE 1. Limits of determination for spectrographic analysis of eolian and stream sediments.....	4
TABLE 2. Spectrographic results from the analysis of stream-sediment and eolian samples from the Kelso Dunes Wilderness Study Area, California.....	6

ILLUSTRATIONS

PLATE 1. Map showing geochemical sample sites from the Kelso Dunes Wilderness Study Area, San Bernardino County, California.....	in pocket
--	-----------

INTRODUCTION

In April 1982 we conducted a reconnaissance geochemical survey of the Kelso Dunes Wilderness Study Area, San Bernardino County, California.

The Kelso Dunes Wilderness Study Area comprises about 73 mi² (218.4 km²) in the northwest corner of the Needles 2° sheet, California. It lies within the Devils Playground area at the southern end of the Death Valley depression within the Basin and Range geologic province (plate 1). Access to the vicinity of the study area is provided on the east by the local access road between Baker, Kelso, and Amboy. Access to the Kelso Dunes Wilderness Study Area is provided by unimproved dirt roads and jeep trails.

The area is characterized by Quaternary alluvium overlain by a cover of active sand dunes. There is a small exposure of Mesozoic granite in the southeast corner of the study area which is probably related to the granites of the Providence Mountains five miles to the east.

The topographic relief in the study area is about 1500 ft (457 m), with a maximum elevation of 3114 ft (949 m). The area is covered by active sand dunes which are cut by a few intermittent streams. The climate is semi-arid.

METHODS OF STUDY

Sand samples

We collected samples of sand at 15 random sites across the sand dunes (plate 1). At each of these sites, a separate eolian sample was collected from the dune crest, slope face, trough, and windward face. Designation on the data listing as to the location of the sample site on the dune are as follows: cs--crest sediment; es--east face sediment; ns--north face sediment; ss--south face sediment; vs--trough sediment; and ws--west face sediment. Samples were obtained from approximately one foot below the dune surface.

Stream-sediment samples

Seven sediment samples were collected along Cottonwood Wash on the eastern edge of the Wilderness Study Area and eight were taken along Devils Playground Wash to the south (plate 1). Each of these samples were composited from several localities within an area that may extend as much as 500 ft from the site plotted on the map. Active sediment in the two washes combines eolian material with reworked alluvial fan material.

Heavy-mineral-concentrate samples

We panned heavy-mineral-concentrate samples from the same active alluvium as the 15 sediment samples. Additionally, concentrates were panned from 30 liters of sand at each eolian site. We felt this necessary as the dunes contained abundant visible mafic lenses, especially enriched in magnetite and amphibole. Panning of samples continued until most of the quartz, feldspar, organic material, and clay-sized material was removed.

Sample Preparation

We sieved the stream-sediment and sand samples at the collection site through a 2 mm screen and the minus 2 mm material was retained. The samples were air dried and sieved to minus-80-mesh using stainless steel sieves. The portion of the sediment passing through the sieve was saved for analysis.

After panning the sediment or sand sample, we used bromoform to separate and remove the remaining quartz and feldspar from the heavy-mineral concentrate. The heavy minerals (specific gravity 2.8) were separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material (largely magnetite) and the second fraction (largely ferromagnesian silicates and iron oxides) were saved for analysis. The third fraction (the least magnetic material including nonmagnetic ore minerals, zircon, sphene, etc.) was divided into two splits using a Jones splitter. One split was hand ground for spectrographic analysis; the other split was saved for mineralogical analysis.

The magnetic separates discussed are the same separates that would be produced by removing the magnetite with a hand magnet and then using a Frantz Isodynamic Separator set at a slope of 15° and a tilt of 10° with a current of 0.1 ampere to remove the ilmenite, and a current of 1.0 ampere to split the remainder of the sample into magnetic and nonmagnetic fractions.

Sample Analysis

Spectrographic method

We analyzed the stream-sediments and sand samples for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. The precision of the analytical method is approximately plus or minus one reporting unit at the 83 percent confidence level and plus or minus two reporting units at the 96 percent confidence level (Motooka and Grimes, 1976). Values determined for the major elements (iron, magnesium, calcium, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram) (table 1). Analytical results are listed in Table 2.

Additionally, we analyzed many of the magnetic and nonmagnetic heavy-mineral-concentrate fractions for the same 31 elements. There was little variance in the data for any element in either fraction. Hence, these data are not included in the report.

Because there are a number of active gold claims within the dunes area, gold concentrations were determined by atomic-absorption (Thompson and others, 1968) in a number of randomly selected samples. These samples included a representative number of sediment or sand samples in addition to samples from all three fractions from the heavy-mineral concentrates including magnetic, semi-magnetic, and nonmagnetic fractions. No gold was detected at the 0.05 part per million (ppm) detection limit of the analytical method in any of the selected samples. Therefore, none of this data has been included in the report. The data listings do not include elements for which all analytical values were reported as N, meaning that particular element was not detected at the limit of determination.

TABLE 1.--Limits of determination for the spectrographic analysis of eolian and stream sediments, based on a 10-mg sample

Elements	Lower determination limit	Upper determination limit
Percent		
Iron (Fe)	0.05	20
Magnesium (Mg)	.02	10
Calcium (Ca)	.05	20
Titanium (Ti)	.002	1
Parts per million		
Manganese (Mn)	10	5,000
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	1,000
Molybdenum (Mo)	5	2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Vanadium (V)	10	10,000
Tungsten (W)	50	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
Thorium (Th)	100	2,000

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results for the sediments and sand samples were entered into a computer-based file called RASS (Rock Analysis Storage System). This RASS file contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a standard form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1976).

REFERENCES CITED

- Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.
- Motooka, J. M., and Grimes, D. J., 1976, Analytical precision of one-sixth order semiquantitative spectrographic analyses: U.S. Geological Survey Circular 738, 25 p.
- Thompson, C. E., Nakagawa, H. M., and Van Sickle, G. H., 1968, Rapid analysis for gold in geologic materials, in Geological Survey research 1968: U.S. Geological Survey Professional Paper 600-B, p. B130-B132.
- VanTrump, George, Jr., and Miesch, A. T., 1976, The U.S. Geological Survey RASS-STATPAC system for management and statistical reduction of geochemical data: Computers and Geosciences, v. 3, p. 475-488.

Table 2.---Spectrographic results from the analysis of stream-sediment and eolian samples from the Kelso Dunes Wilderness Study Area, California

Sample		[N, not detected; <, detected but below limit of determination shown; >, determined to be greater than the value shown.]																
		Fe-pct.	Mg-pct.	Ca-pct.	Ti-pct.	Mn-ppm	Ag-ppm	B-ppm	Ba-ppm	Co-ppm	Cr-ppm	Cu-ppm	La-ppm	Nb-ppm	S	S		
K001CS	15	1.5		5	>1.0	1,500	N	10	1,000	15	70	20	150	<20				
K001NS	10	1.0		3	1.0	700	N	10	1,000	10	50	10	100	N				
K001SS	15	1.5		3	1.0	1,000	3.0	10	1,000	10	100	20	100	N				
K001VS	10	1.0		5	>1.0	1,000	N	20	1,000	10	50	20	150	N				
K002CS	15	2.0		5	1.0	2,000	N	30	1,000	20	70	20	200	<20				
K002NS	3	1.0		5	.7	500	N	20	1,000	10	30	7	100	N				
K002SS	10	1.0		5	1.0	1,500	N	20	1,000	15	70	20	150	N				
K002VS	10	1.5		5	1.0	1,000	N	15	1,000	15	70	15	150	N				
K003CS	20	2.0		10	>1.0	1,500	N	10	1,000	15	70	20	200	N				
K003NS	7	1.0		10	1.0	1,000	N	10	1,000	10	50	7	100	<20				
K003SS	10	1.0		3	>1.0	1,500	<.5	20	1,000	15	150	20	150	20				
K003VS	3	.7		5	.7	500	N	15	1,000	10	20	15	70	N				
K004CS	5	.7		5	1.0	500	N	10	1,000	5	30	5	50	N				
K004ES	10	1.5		10	>1.0	1,000	N	10	1,500	10	50	15	150	<20				
K004VS	10	1.0		7	>1.0	700	N	20	1,500	7	70	10	100	N				
K004WS	5	1.0		5	1.0	700	<.5	20	1,500	7	50	10	100	<20				
K005CS	10	1.0		7	>1.0	1,500	N	50	1,500	10	200	15	150	<20				
K005SS	5	.5		5	1.0	1,000	N	30	1,500	7	70	10	70	N				
K005VS	3	1.0		3	.7	700	.5	20	1,500	5	30	7	50	N				
K005WS	5	.7		5	1.0	700	N	20	1,500	5	70	10	70	N				
K006CS	20	1.5		5	>1.0	2,000	N	20	1,000	30	70	20	200	<20				
K006ES	10	2.0		7	>1.0	3,000	N	30	2,000	50	100	30	200	N				
K006VS	10	1.0		3	1.0	2,000	N	10	1,000	15	150	20	100	<20				
K006WS	>20	2.0		7	>1.0	2,000	N	20	1,000	50	100	50	200	30				
K007CS	10	1.0		5	>1.0	1,500	N	30	2,000	15	150	20	70	20				
K007ES	7	1.0		7	1.0	3,000	N	20	3,000	10	100	10	100	<20				
K007VS	7	1.0		5	1.0	1,000	N	50	1,000	10	70	7	500	20				
K007WS	10	.7		5	1.0	1,500	N	20	2,000	10	100	10	70	20				
K008CS	10	1.0		7	>1.0	2,000	N	20	2,000	20	150	20	200	20				
K008ES	7	1.0		5	>1.0	1,500	N	20	1,500	15	100	30	200	<20				
K008VS	5	1.0		5	.3	1,000	N	30	3,000	10	100	20	300	N				
K008WS	15	1.5		5	>1.0	3,000	N	20	1,000	15	150	30	100	20				
K009CS	7	1.5		5	1.0	700	N	10	1,000	15	50	15	20	<20				
K009ES	7	2.0		7	1.0	2,000	N	20	1,000	10	100	10	700	<20				
K009VS	3	2.0		10	.5	1,500	N	50	1,000	10	100	10	100	N				
K009WS	7	1.5		7	1.0	1,500	N	30	500	15	70	15	100	<20				
K010CS	20	1.0		5	>1.0	2,000	N	15	1,500	20	100	50	200	200				
K010NS	10	.7		5	>1.0	1,000	N	50	1,500	15	70	7	100	<20				
K010SS	20	1.5		5	>1.0	2,000	N	10	2,000	15	70	50	100	30				
K011CS	>20	1.5		5	>1.0	2,000	N	20	1,000	30	100	20	200	70				
K011ES	7	.7		5	>1.0	1,000	N	10	1,500	10	50	10	70	<20				
K011VS	10	1.0		7	>1.0	1,000	N	10	1,500	10	50	10	100	20				
K011WS	20	1.0		5	>1.0	2,000	N	10	1,000	30	100	30	200	70				
K012CS	5	1.0		3	1.0	500	N	N	1,000	10	50	7	70	<20				
K012ES	7	1.5		7	1.0	1,000	N	10	1,500	15	50	10	100	<20				

Table 2.---Spectrographic results from the analysis of stream-sediment and eolian samples from the Kelso Dunes Wilderness Study Area, California (continued)

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

Sample	Ni-ppm S	Pb-ppm S	Sr-ppm S	V-ppm S	Y-ppm S	Zn-ppm S
K001CS	15	30	1,000	200	70	N
K001NS	10	30	500	200	50	N
K001SS	10	50	500	200	50	N
K001VS	10	30	1,000	200	50	N
K002CS	20	30	1,000	200	70	N
K002NS	5	30	700	100	20	N
K002SS	15	30	1,000	150	70	N
K002VS	10	30	1,000	100	50	N
K003CS	20	70	700	300	100	<200
K003NS	7	50	700	150	50	N
K003SS	15	70	500	200	70	N
K003VS	10	30	500	100	20	N
K004CS	5	30	500	100	30	N
K004ES	15	50	700	200	50	N
K004VS	10	30	1,000	200	50	N
K004WS	15	70	1,000	150	50	N
K005CS	15	50	700	200	70	N
K005SS	10	30	700	100	50	N
K005VS	10	50	700	100	30	N
K005WS	10	50	700	100	50	N
K006CS	20	20	1,000	500	150	<200
K006ES	30	70	1,000	500	70	N
K006VS	20	50	500	700	70	N
K006WS	20	20	1,500	500	100	200
K007CS	20	70	1,000	500	70	N
K007ES	15	70	1,500	200	70	N
K007VS	10	50	700	300	50	N
K007WS	10	50	1,000	300	50	N
K008CS	20	50	700	300	100	N
K008ES	20	70	1,000	200	70	N
K008VS	10	100	700	200	50	N
K008WS	20	100	1,000	500	100	N
K009CS	10	20	500	150	30	N
K009ES	20	70	1,000	200	100	N
K009VS	20	150	1,500	100	30	N
K009WS	20	150	1,000	200	50	N
K010CS	20	30	700	300	100	<200
K010NS	10	30	700	200	50	N
K010SS	10	30	1,000	300	70	N
K011CS	20	30	700	500	150	<200
K011ES	15	50	1,000	150	50	N
K011VS	15	20	1,000	200	50	N
K011WS	20	50	700	300	100	N
K012CS	10	30	500	100	50	N
K012ES	15	20	1,000	150	50	N

Table 2.---Spectrographic results from the analysis of stream-sediment and eolian samples from the Kelso Dunes Wilderness Study Area, California (continued)

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

Sample	Fe-pct. S	Mg-pct. S	Ca-pct. S	Ti-pct. S	Mn-ppm S	Ag-ppm S	B-ppm S	Ba-ppm S	Co-ppm S	Cr-ppm S	Cu-ppm S	La-ppm S	Nb-ppm S
K012VS	10	2.0	10	>1.0	200	N	10	2,000	10	70	10	50	<20
K012WS	10	2.0	7	>1.0	1,000	N	10	1,500	10	70	10	100	20
K013CS	15	3.0	5	>1.0	1,000	N	N	1,000	20	150	30	100	<20
K013ES	10	3.0	10	>1.0	1,500	N	10	1,500	20	100	20	150	20
K013VS	7	2.0	7	1.0	700	N	10	1,000	15	70	15	70	<20
K013WS	10	2.0	7	>1.0	1,000	N	10	1,000	20	100	20	100	<20
K014CS	7	1.5	5	1.0	1,000	N	N	700	15	30	10	70	<20
K014ES	7	1.0	5	1.0	1,000	N	N	700	15	50	15	100	<20
K014VS	3	.7	3	.7	500	N	20	700	10	20	7	70	N
K014WS	5	1.0	7	1.0	700	N	10	1,000	10	20	10	50	N
K015CS	15	1.5	7	>1.0	1,500	N	10	700	20	100	20	200	30
K015ES	15	1.5	5	>1.0	1,500	N	10	700	15	70	10	100	20
K015VS	3	1.0	3	.7	500	N	10	700	10	20	7	50	N
K015WS	2	.7	5	1.0	500	N	10	1,000	5	20	7	50	N
K020S	7	3.0	5	1.0	1,000	N	20	1,000	15	70	20	150	N
K021S	10	2.0	5	1.0	1,000	N	10	700	10	70	20	100	N
K022S	5	2.0	7	1.0	700	N	20	1,500	10	50	20	150	N
K023S	7	2.0	3	>1.0	700	N	20	1,000	15	70	20	150	N
K024S	7	2.0	7	1.0	1,000	N	20	1,500	15	50	20	150	<20
K025S	7	1.5	5	1.0	1,000	N	10	1,000	10	50	15	150	N
K026S	5	2.0	5	1.0	700	N	10	1,500	10	50	15	100	N
K040S	10	5.0	7	1.0	1,000	N	<10	700	20	200	20	100	N
K041S	5	3.0	5	1.0	700	N	10	1,000	10	50	20	100	N
K042S	10	2.0	7	>1.0	1,000	N	10	1,000	10	70	20	150	N
K043S	15	2.0	7	>1.0	1,500	N	10	1,000	20	100	20	200	N
K044S	15	3.0	5	>1.0	1,000	N	10	700	20	100	30	150	N
K045S	15	3.0	7	>1.0	1,500	N	10	1,000	20	70	30	150	N
K046S	10	3.0	3	>1.0	1,000	N	10	1,000	15	70	15	100	N
K047S	15	3.0	5	1.0	1,000	N	10	700	20	100	20	150	N
K010VS	10	1.0	5	.7	1,500	N	20	1,500	15	150	10	200	<20

Table 2.--Spectrographic results from the analysis of stream-sediment and eolian samples from the Kelso Dunes Wilderness Study Area, California (continued)

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

Sample	Ni-ppm S	Pb-ppm S	Sr-ppm S	V-ppm S	Y-ppm S	Zn-ppm S
K012VS	10	20	500	200	20	N
K012WS	15	30	700	200	50	N
K013CS	20	20	500	200	70	N
K013ES	20	30	1,000	200	70	N
K013VS	20	30	700	150	50	N
K013WS	20	50	500	200	50	N
K014CS	10	10	700	200	50	N
K014ES	10	20	700	200	70	N
K014VS	7	10	700	100	30	N
K014WS	10	10	1,000	100	30	N
K015CS	20	20	700	300	70	N
K015ES	15	20	700	200	70	N
K015VS	10	10	700	100	50	N
K015WS	5	20	1,000	70	20	N
K020S	20	30	700	150	50	N
K021S	10	50	500	150	70	N
K022S	15	70	1,500	100	50	N
K023S	15	70	1,000	100	70	N
K024S	15	50	1,500	100	70	N
K025S	15	50	1,000	150	70	N
K026S	10	70	1,000	100	30	N
K040S	20	50	500	150	70	N
K041S	10	50	700	100	50	N
K042S	15	30	1,000	200	50	N
K043S	20	30	1,000	200	70	N
K044S	20	50	700	200	50	N
K045S	20	30	1,000	200	70	N
K046S	15	30	500	150	50	N
K047S	20	30	700	200	50	N
K010VS	15	70	1,000	200	30	N