UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate samples from the Turtle Canyon Wilderness Study Area (UT-060-067), Emery County, Utah

By

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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 values, if any. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Turtle Canyon Wilderness Study Area, Emery County, Utah.

INTRODUCTION

In July 1986, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Turtle Canyon Wilderness Study Area (UT-060-067), Emery County, Utah.

The U.S. Geological Survey studied 33,690 acres, about 52.6 mi^2 (136 km^2) of the Turtle Canyon Wilderness Study Area in northeastern Emery County, Utah. The study area is bounded on the north by the Emery County line and on the east by the Range Creek Road extending from the Emery County line to Turtle Canyon. The study area lies about 10 mi (16 km) northeast of Woodside, Utah (fig. 1). Access to the study area is provided from U.S. highway 6 which runs west of the study area and from Utah state highway 124 northwest of the study area. Both highways connect with a road that runs to the northwest corner and along the eastern border of the study area and which continues as a jeep trail along the southern boundary of the study area.

The geology of the Turtle Canyon Wilderness Study Area is described by Cashion (1967). The study area lies on the southern and southwestern structural limbs of the Uinta Basin. Rocks exposed in the study area are sedimentary, deposited in marine, lacustrine, and continental environments, and range in age from Late Cretaceous to Middle Eocene. The rocks dip 1° to 10° approximately northward and northeastward toward the trough of the basin and are interrupted by only minor faults and folds.

Relief in the study area is about 4,400 ft (1,341 m), rising from about 4,950 ft (1,509 m) on Range Creek in the southeastern part of the study area to approximately 9,342 ft (2,847 m) on the crest of an unnamed peak near the northwest corner of the study area. The climate is arid to semiarid.

METHODS OF STUDY

Sample Medium

Heavy-mineral-concentrate samples provide information about the chemistry of heavy minerals in rock material eroded from the drainage basin upstream from each sample site. The selective concentration of minerals, many of which may be ore related, permits determination of some elements that are not easily detected in conventional minu-80-mesh stream-sediment samples.

Sample Collection

Samples were collected at all 30 sites shown on figure 2. The average density was about one sample site per 1.8 mi^2.

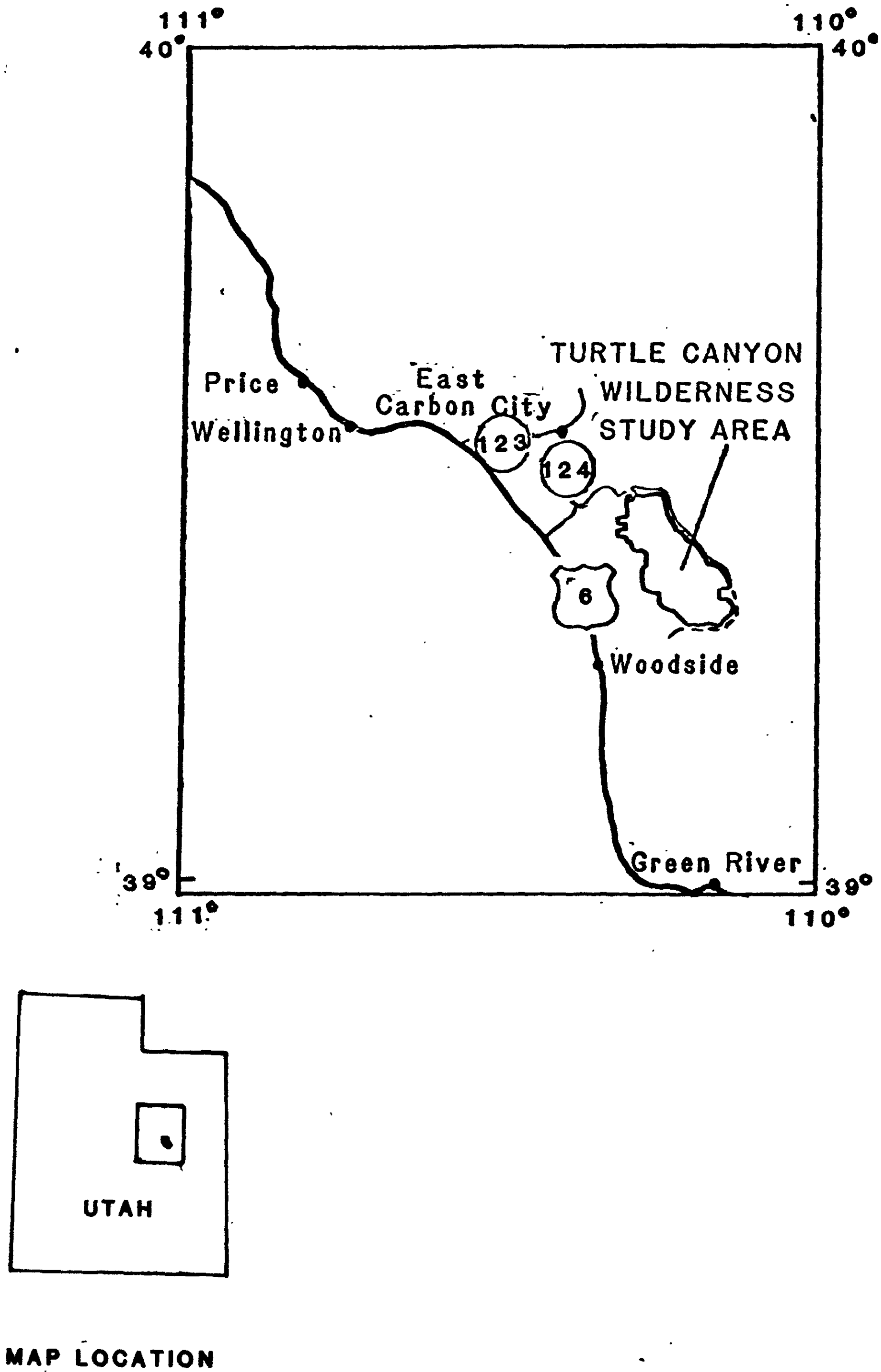

Figure 1. Location of the Turtle Canyon Wilderness Study Area (UT-060-067), Emery County, Utah.

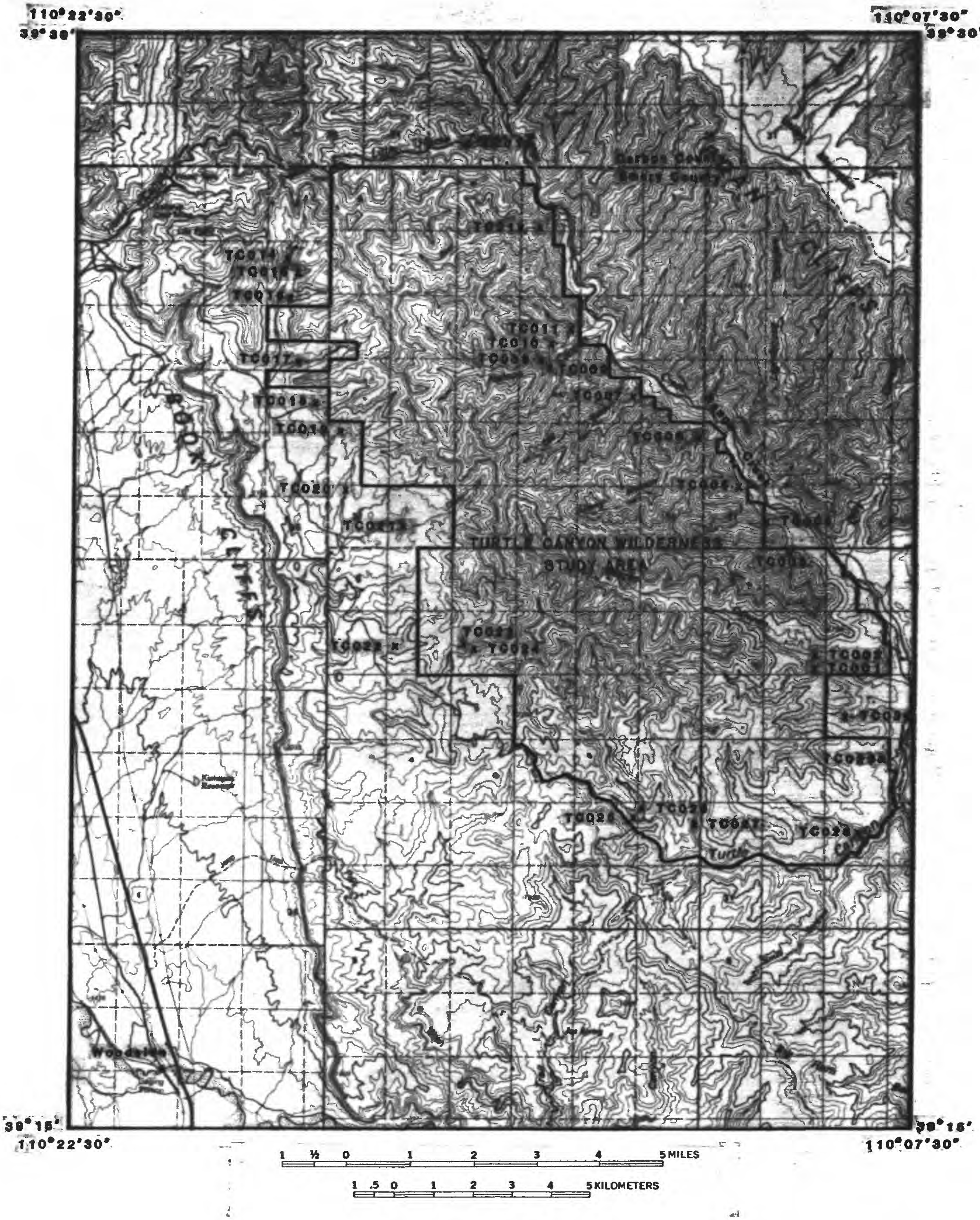

Figure 2. Localities of heavy-mineral-concentrate samples, Turtle Canyon Wilderness Study Area (UT-060-067), Emery County.

Heavy-mineral-concentrate samples

Bulk alluvium samples were collected from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic maps (scale = 1:24,000). Each sample was a composite of alluvium taken from several localities within about 50 ft of the site plotted on the map. Each bulk sample was screened with a 2.0-mm (10-mesh) screen to remove the coarse material. The less than 2.0-mm fraction was panned until most of the quartz, feldspar, organic material, and clay-sized material were removed.

Sample Preparation

After air drying the panned-concentrate sample, heavy minerals were further concentrated by separation in bromoform (specific gravity 2.9). The resultant heavy-mineral sample was separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material, primarily magnetite, was not analyzed. The second fraction, largely ferromagnesian silicates and iron oxides, was saved for archival storage. The third fraction (the least magnetic material which may include the nonmagnetic ore minerals, zircon, sphene, etc.) was split using a Jones splitter. One split of the third fraction was hand ground for spectrographic analysis; the other split was saved for mineralogical analysis. These magnetic separates are the same separates that would be produced by 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 magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Sample Analysis

Spectrographic method

The heavy-mineral-concentrate samples were analyzed for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their lower limits of determination are listed in table 1. 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. 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). Analytical data for samples from the Turtle Canyon Wilderness Study Area are listed in table 2.

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called Rock Analysis Storage System (RASS). 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) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

DESCRIPTION OF DATA TABLES

The results of analyses for the nonmagnetic heavy-mineral-concentrate fraction are listed in table 2. The data are arranged so that column 1 contains the USGS-assigned sample numbers which correspond to the numbers shown on the sample locality map (fig. 2). A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in table 1. A "less than" symbol (<) indicates that an element was observed but was below the lowest reporting value shown in table 1. A "greater than" symbol (>) indicates that an element was observed but was above the highest reporting value shown in table 1. Because of the formatting in the computer program used to produce table 1, some of the elements listed in the table (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

REFERENCES CITED

Cashion, W. B., 1967, Geology and fuel resources of the Green River Formation, southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Professional Paper 548, 48 p.

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.

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.

TABLE 1.--Limits of determination for the spectrographic analysis of nonmagnetic heavy-mineral concentrates based on a 5-mg sample

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	.1	50
Magnesium (Mg)	.05	20
Calcium (Ca)	.1	50
Titanium (Ti)	.005	2
	Parts per million	
Manganese (Mn)	20	10,000
Silver (Ag)	1	10,000
Arsenic (As)	500	20,000
Gold (Au)	20	1,000
Boron (B)	20	5,000
Barium (Ba)	50	10,000
Beryllium (Be)	2	2,000
Bismuth (Bi)	20	2,000
Cadmium (Cd)	50	1,000
Cobalt (Co)	10	5,000
Chromium (Cr)	20	10,000
Copper (Cu)	10	50,000
Lanthanum (La)	50	2,000
Molybdenum (Mo)	10	5,000
Niobium (Nb)	50	5,000
Nickel (Ni)	10	10,000
Lead (Pb)	20	50,000
Antimony (Sb)	200	20,000
Tin (Sn)	20	2,000
Strontium (Sr)	200	10,000
Vanadium (V)	20	20,000
Tungsten (W)	100	20,000
Yttrium (Y)	20	5,000
Zinc (Zn)	500	20,000
Zirconium (Zr)	20	2,000
Thorium (Th)	200	5,000

TABLE 2.--Results of analyses of nonmagnetic heavy-mineral-concentrate samples from the Turtle Canyon Wilderness Study Area, Emery County, Utah

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

Sample	Lat	Long	Fe	Mg	Ca	Ti	Mn	Ag	As	Au	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo	Nb
TC001H	39 21 23	110 9 7	.20	.15	2.0	.7	150	N	N	N	<20	>10,000	N	N	N	N	N	10	50	N	<50
TC002H	39 21 28	110 9 7	.20	.50	1.0	2.0	150	N	N	N	20	>10,000	N	N	N	N	N	10	200	N	<50
TC003H	39 22 57	110 9 45	.20	.10	.5	.5	150	N	N	N	<20	>10,000	N	N	N	N	N	10	50	N	N
TC004H	39 23 21	110 10 10	.50	.50	1.0	2.0	150	N	N	N	70	>10,000	N	N	N	N	50	10	500	N	70
TC005H	39 23 48	110 10 35	.30	.15	2.0	2.0	150	N	N	N	20	>10,000	N	N	N	N	N	10	200	N	50
TC006H	39 24 28	110 11 16	.50	1.00	1.0	2.0	150	N	N	N	100	>10,000	N	N	N	N	70	10	1,500	N	50
TC007H	39 25 4	110 12 41	.50	.05	.5	1.5	150	N	N	N	70	>10,000	N	N	N	N	20	10	500	N	70
TC008H	39 25 33	110 14 8	.50	.20	2.0	>2.0	150	N	N	N	100	>10,000	N	N	N	N	50	70	500	N	50
TC009H	39 25 30	110 14 2	1.0	.50	1.5	>2.0	200	N	N	N	100	>10,000	N	N	N	N	50	20	300	N	70
TC010H	39 25 41	110 13 56	.50	.20	1.0	2.0	150	N	N	N	<20	>10,000	N	N	N	N	N	10	300	N	50
TC011H	39 26 2	110 13 43	.50	.10	1.5	>2.0	150	N	N	N	100	>10,000	N	N	N	N	20	30	1,000	N	50
TC012H	39 27 18	110 14 18	.50	.10	1.0	2.0	200	N	N	N	70	>10,000	N	N	N	N	150	15	500	N	70
TC013H	39 28 28	110 15 36	.50	.05	1.0	2.0	150	N	N	N	200	>10,000	N	N	N	N	N	10	700	N	<50
TC014H	39 26 52	110 18 42	.07	.15	1.0	2.0	100	N	N	N	<20	>10,000	N	N	N	N	N	10	150	N	<50
TC015H	39 26 43	110 18 37	.20	.10	.5	1.0	100	N	N	N	<20	>10,000	N	N	N	N	N	<10	100	N	<50
TC016H	39 26 23	110 18 40	.50	.50	1.0	2.0	150	N	N	N	50	>10,000	N	N	N	N	50	10	1,000	N	50
TC017H	39 25 30	110 18 21	.30	.10	1.0	2.0	100	N	N	N	20	>10,000	N	N	N	N	N	20	50	N	<50
TC018H	39 24 57	110 18 3	1.00	.50	1.0	2.0	150	N	N	N	150	>10,000	N	N	N	N	150	20	1,000	N	50
TC019H	39 24 28	110 17 50	.50	.20	.5	1.5	150	N	N	N	20	>10,000	N	N	N	N	N	10	200	N	<50
TC020H	39 23 47	110 17 36	.30	.20	1.5	1.5	150	N	N	N	50	>10,000	N	N	N	N	N	10	150	N	50
TC021H	39 23 15	110 16 35	.50	.50	1.0	2.0	100	N	N	N	20	>10,000	N	N	N	N	N	10	200	N	<50
TC022H	39 21 37	110 16 37	.50	.05	.2	.1	150	N	N	N	<20	>10,000	N	N	N	N	N	10	N	N	N
TC023H	39 21 37	110 15 30	.50	.10	1.0	2.0	150	N	N	N	50	>10,000	N	N	N	N	N	50	300	N	50
TC024H	39 21 33	110 15 23	.30	.15	2.0	2.0	150	N	N	N	20	>10,000	N	N	N	N	N	10	150	N	<50
TC025H	39 19 17	110 12 22	.15	.05	.5	.2	50	N	N	N	<20	>10,000	N	N	N	N	N	10	50	N	N
TC026H	39 19 19	110 12 18	.20	.10	.5	.7	100	N	N	N	<20	>10,000	N	N	N	N	N	<10	50	N	<50
TC027H	39 19 8	110 11 22	.20	.20	1.0	.5	150	N	N	N	<20	>10,000	N	N	N	N	N	10	100	N	N
TC028H	39 19 0	110 8 23	.20	.10	1.0	.7	100	N	N	N	<20	>10,000	N	N	N	N	N	10	50	N	<50
TC029H	39 20 7	110 7 58	.20	.05	.5	1.0	150	N	N	N	<20	>10,000	N	N	N	N	N	10	100	N	<50
TC030H	39 20 39	110 8 32	.20	.05	1.0	.2	50	N	N	N	<20	>10,000	N	N	N	N	N	10	50	N	N

TABLE 2.--Continued

Sample	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Th
TC001H	N	N	N	N	N	5,000	20	N	70	N	>2,000	N
TC002H	N	<20	N	70	N	5,000	50	N	300	N	>2,000	N
TC003H	N	N	N	20	N	5,000	20	N	70	N	>2,000	N
TC004H	N	20	N	50	N	2,000	70	N	300	N	>2,000	N
TC005H	N	<20	N	30	N	3,000	50	N	300	N	>2,000	N
TC006H	N	50	N	70	N	500	70	N	500	N	>2,000	N
TC007H	N	50	N	30	N	2,000	50	N	300	N	>2,000	N
TC008H	N	30	N	70	N	1,000	70	N	300	N	>2,000	N
TC009H	N	20	N	50	N	700	70	N	500	N	>2,000	N
TC010H	N	30	N	30	N	5,000	70	N	300	N	>2,000	N
TC011H	N	50	N	70	N	1,000	70	N	500	N	>2,000	N
TC012H	N	50	N	70	N	2,000	70	N	500	N	>2,000	N
TC013H	N	30	N	50	N	2,000	70	N	300	N	>2,000	N
TC014H	N	N	N	30	N	2,000	30	N	200	N	>2,000	N
TC015H	N	<20	N	20	N	5,000	50	N	200	N	>2,000	N
TC016H	N	30	N	50	N	700	70	N	300	N	>2,000	N
TC017H	N	30	N	50	N	5,000	50	N	300	N	>2,000	N
TC018H	N	30	N	50	N	2,000	50	N	300	N	>2,000	<200
TC019H	N	20	N	50	N	5,000	70	N	300	N	>2,000	N
TC020H	N	<20	N	N	N	5,000	50	N	150	N	>2,000	N
TC021H	N	<20	N	30	N	3,000	50	N	150	N	>2,000	N
TC022H	N	<20	N	N	N	5,000	20	N	20	N	>2,000	N
TC023H	N	30	N	50	N	2,000	70	N	300	N	>2,000	N
TC024H	N	<20	N	30	N	1,000	30	N	200	N	>2,000	N
TC025H	N	30	N	N	N	5,000	<20	N	50	N	>2,000	N
TC026H	N	<20	N	20	N	5,000	20	N	100	N	>2,000	N
TC027H	N	<20	N	20	N	5,000	30	N	100	N	>2,000	N
TC028H	N	N	N	N	N	5,000	20	N	100	N	> 2,000	N
TC029H	N	50	N	N	N	5,000	20	N	150	N	>2,000	N
TC030H	N	N	N	N	N	5,000	<20	N	50	N	>2,000	N