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National Uranium Resource Evaluation

NEUTRON-ACTIVATION AND OTHER ANALYTICAL DATA FOR PLUTONIC ROCKS FROM NORTH AMERICA AND AFRICA

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PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Nuclear Energy
Grand Junction Area Office, Colorado

DISCLAIMER

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ASSISTANT SECRETARY FOR NUCLEAR ENERGY
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CONTENTS

PROLOGUE

The objective of this report is to retrieve the elements of an analytical study of granites and associated other plutonic rocks which was begun as a part of the U. S. Department of Energy's National Uranium Resource Evaluation (NURE) program.

A discussion of the Savannah River Laboratory (SRL) neutron activation analysis system is given so that a user will understand the limitations of the data. Enough information is given so that an experienced geochemist can clean up the data set to the extent required by any project. The data are generally good as they are presented.

It is intended that the data be read from a magnetic tape written to accompany this report. Microfiche tables of the data follow the text. These tables were prepared from data on the tape, and programs which will read the tape are presented in the section THE DATA TAPE.

It is our intent to write a later paper which will include a thoroughly scrubbed data set and a technical discussion of results of the study.

ACKNOWLEDGEMENTS

Harry Posey, Professors Paul Fullagar and John Rogers of the University of North Carolina and Professor Kent C. Condie of the New Mexico School of Mines, Mining, and Technology compiled data and supplied samples. C. B. Bennett of the University of Texas and Professor Bill Ranson of Furman University entered pluton descriptions and major/minor element data into the SRL computer. C. B. Bennett also designed the storage format and wrote programs to retrieve the data.

Walter R. Averett of Bendix Field Engineering Corporation provided a critical review of the manuscript.

INTRODUCTION

The National Uranium Resource Evaluation Program was established to evaluate uranium resources in the United States and to identify areas favorable for uranium exploration. The United States Department of Energy (DOE) and its predecessors, ERDA and AEC, conceived and administered the program which ran from 1973 through 1981. The Grand Junction Office of DOE and its operating contractor, Bendix Field Engineering Corporation, received input from many sources and were charged with compiling the final resource estimates.

One such input phase of the NURE program was a geochemical reconnaissance using sampling strategies and techniques adapted from exploration geochemistry. This phase of NURE, called the Hydrogeochemical and Stream Sediment Reconnaissance Survey (HSSR), was conducted by four DOE laboratories.

Each laboratory was assigned an area of the United States and charged with the responsibility of designing and conducting a survey appropriate for its area.

The Savannah River Laboratory conducted a reconnaissance of 1.5 million square miles in portions of thirty-seven eastern and western states. Prior to beginning reconnaissance sampling, an extensive development program including field pilot studies was begun. After reconnaissance sampling was underway approximately ten percent of SRL's effort was devoted to data interpretation and other continuing development. This study was initiated as a part of this development.

PROJECT OBJECTIVE

The association of uranium deposits with granitic source or host rocks has been documented by many workers from around the world. SRL workers conceived the idea of acquiring splits of granite samples for which petrographic, major element, and isotopic data were available. The samples would be analysed by neutron activation at SRL for the same suite of elements being determined in HSSR reconnaissance samples. The resulting combined data set could then be computer processed through pattern recognition programs in hopes of discerning relationships which would provide: (1) a measure of uranium favorability for granites and (2) ways to relate HSSR stream sediment or soil geochemistry data to bedrock geochemistry in granitic terranes.

A similar project is discussed by Watterson and Sellschop, 1977 (reference 88). They use in-core irradiation with an epithermal to thermal neutron ratio of .034 and a flux of $5 \cdot 10^{13} n \cdot cm^{-2} \cdot sec^{-1}$. The corresponding SRL values are 10^{-4} and $5 \cdot 10^{12}$. They determined Zr and Ba by NAA which SRL was not able to do routinely. This illustrates the point that analytical data from different sources may be amenable to similar multivariate interpretation, but specific results or equations of one study may not be directly applicable to another.

SOURCES OF SAMPLES AND DATA

SRL contracted with the Department of Geology of the University of North Carolina to supply and document samples. Harry Posey, then a PhD student in that department, was the principal person involved in this effort.

Most samples came from the collections of Professors Paul D. Fullagar and John J. W. Rogers of UNC or Professor Kent W. Condie of the New Mexico School of Mines. Eighty-seven plutons were represented by 467 samples.

Major element data are reasonably complete for all samples. Minor and trace element data were available for only a limited number of samples.

Original references for each pluton are given in Appendix A. In some cases these are not published sources and in some cases an incomplete reference may be given. The authors regret these problems but remind the reader that our objective is to salvage the project in its present state for later refinement.

QUALITY OF DATA

Major element, minor element, and petrographic data were transcribed from original sources by Harry Posey. We have not checked the data as they currently exist against original sources.

Neutron activation data were obtained at SRL using production-mode techniques described in a number of SRL documents. SRL developed several reference materials usually designated SRL 2.2, SRL 3.1, and SRL 4.1, one of which was analysed with each batch of twenty-five samples. Analytical results for these SRL standards were reported as a part of each NURE data report generated at SRL. These standards are discussed below.

The neutron activation system at SRL was designed to have high sample throughput and yield accurate uranium analyses. Up to 22,000 sediment samples per month were analysed with a sensitivity for uranium of better than 0.1 ppm. Very good data were obtained for a number of other elements when this was consistent with the program objectives. The entire system was controlled by a SEL 32/55 computer. Samples were loaded in lots of 2500 into the pneumatic transport system, and a telephone line to an office area eight miles away was used to monitor system performance.

The irradiation assembly contained six sample ports, three directed to each of two neutron/gamma detector stations designated NDET 1 and GDET 1. During the time over which the samples for this report were analysed only one of these stations was operational as indicated by the value for NDET 1 in the data set being consistently "2" and GDET 1 being "160".

Uranium and very short half life gamma emitters were analysed by a series of six-second irradiations and six-second counting periods. After this recycling period samples were irradiated for five minutes and transported to GDET 3 which could be any one of four gamma detectors designated 16, 32, 48, and 64. These were variable geometry stations at which computer controlled pins could be pulled to allow a sample to drop as close to a detector as consistent with good counting results.

After the GDET 3 counting period, samples were sent to a matrix of tubes for storage. A final counting period occurred nominally five days later at one of eight detectors designated GDET 4 (16···128).

A variable designated "analysed" in the data set is a Julian date related to system start-up. It is the irradiation date and is useful in scrubbing the data to determine when detector drift or problems in the irradiation process have occurred.

An example of a problem in the irradiation process was a sticking valve in the pneumatic transport system which allowed samples to pass the last photocell check point but not quite reach the high flux area. Checking sample and standard values against "analysed" allowed us to spot any period during which such a problem might have occurred and re-analyse samples from that period. The neutron activation data in this report appear to be very good, and we know of no periods during which bad data were generated.

Because the data appear to be good, information on detector numbers and date analysed have not been given in the data tape supplied with this report or in the microfiche tables. Each of the authors has access to a printout with this information which can be supplied upon request; however, we do not feel that it will be useful.

Spurious data do exist in this data set (and for that matter in all data sets). The serious user of the data will have to develop data checking schemes such as the one discussed below. The final test of any single datum anomaly may be whether or not it makes sense geologically.

Figure 1 is a plot of ppm Na determined by NAA _vs_ %Na_2O as reported for these samples. Three samples have NAA values for Na in excess of sixteen percent; the corresponding values by other methods range between seven and ten percent.

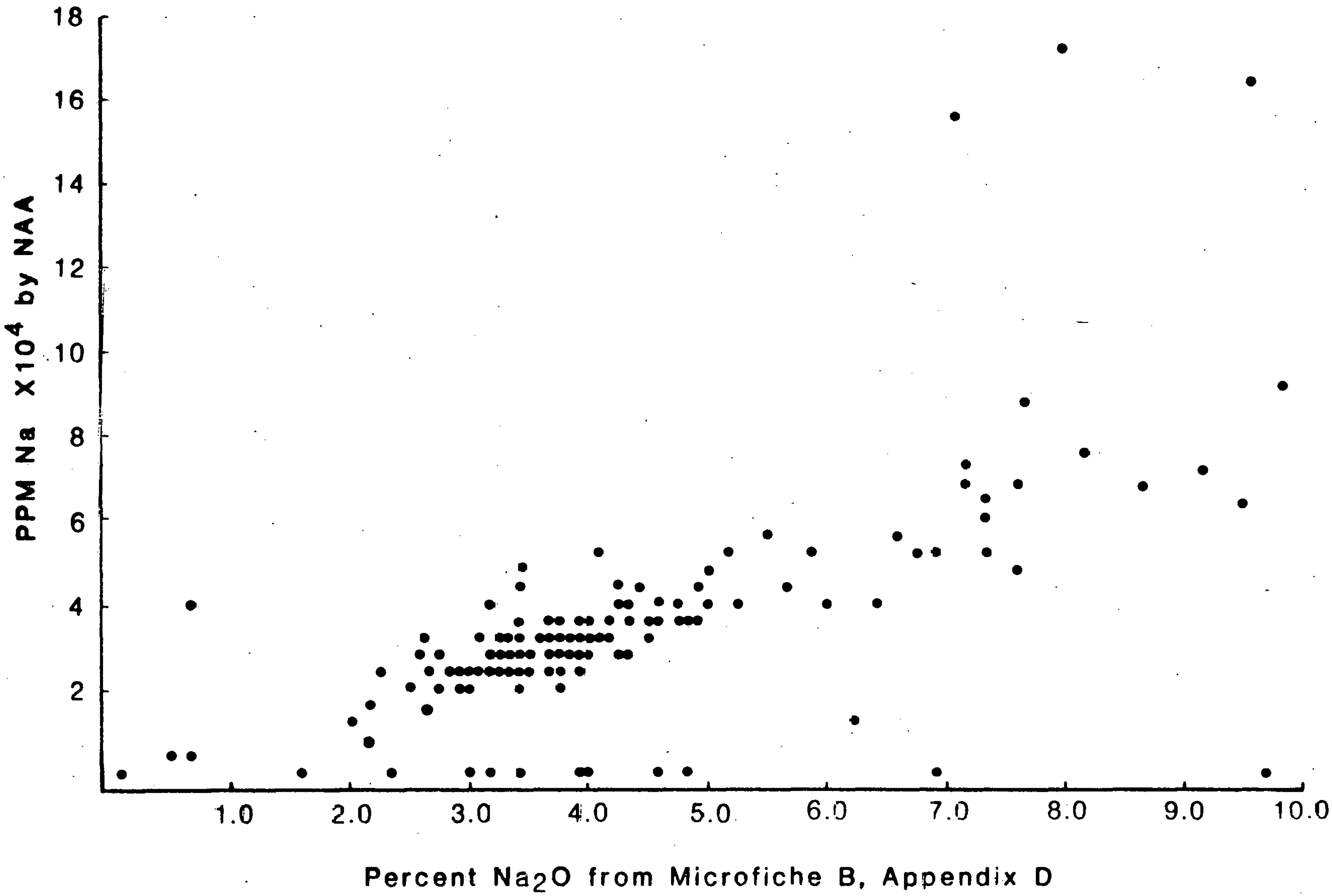

Figure 1. Comparison of NAA and Other Analyses for Sodium.

While the samples are high in sodium by both methods it may be necessary to delete the anomalously high NAA results for some applications.

A more common problem than spurious high numbers is numbers reported below detection (-X, where X is some number). The detection limit for a given element may vary from sample to sample and is related to the ability of a computer program to identify an analytical peak in a complex gamma-ray spectrum. High concentrations of elements which activate strongly, such as sodium and aluminum, raise the general spectral background and increase the likelihood that stringent peak-seeking routines would reject a small analytical peak so that the concentration would be reported as -X where X is the background level.

One approach to establishing values for the missing analyses is to use a multiple regression program on samples without missing analyses. The derived regression equation could then be used to estimate missing values from other elements present in a sample. For some elements it may be adequate to choose a number approximately equal to the lowest reported number.

SRL STANDARDS

The three SRL stream sediment standards referred to above were well characterized for uranium and thorium in about 1977. Reference values for other elements, however, were never properly established. The NAA system was checked early on and found to give reasonable values for standard reference materials. Values reported thereafter for SRL standards were the average of values obtained when the activation system was operating smoothly.

Portions of the SRL standards were sent out to a number of laboratories for analysis in 1978. Analyses were done by a number of methods, some of which involved only a partial digestion of the sample. All of the reported analyses are presented in Appendix B. Table 1, below.

It is beyond the scope of this paper to recalibrate the granite analyses based on evaluation of standard data. Some users of these data may find such recalibration necessary for their purposes. The reference analyses are not included in the data tape made to accompany this report. The only extant copy of these data is a print-out in the first author's possession which was used to generate Table B-1.

A summary of data for the SRL standards run with the granite samples is given in Appendix B Table 2.

THE DATA TAPE

The data tape contains two files. File one is the major and minor element data supplied with the samples or gathered from the literature. File two is neutron activation analysis data generated at SRL. Not all samples have data for every element or oxide listed. Each file is started with a header which lists the format of the data in that file. The tape itself is 9-track, 1600 BPI, fixed binary, with a block size of 3200, and a logical record length of 80.

FORTRAN and SAS programs were written to read the data tape and produce printed output. These programs were run successfully on the original data tape which was sent to Bendix Field Engineering Corporation for duplication. There are four programs, one in each language for each file. These programs are listed in Appendix C, Tables C-3 through C-6. Table C-7 lists the plutons by a two-letter designator given them in the SRL data base.

Pluton descriptive data are not on the tape and are available only from Appendix D, Fiche A.

APPENDIX A

REFERENCES

The following sources of data were compiled primarily by Harry Posey during 1979-1980. They are numbered one through eighty-eight. These references are cited by number for each pluton on microfiche 4. For example information on the Quincy, Massachusetts granite, designated pluton AO, may be found in references # 1, 72, 73, 2, and 75.

Major and minor element data in this report are taken from these references.

Many of the references are not in a standard form for formal citations. They are presented as they were supplied to us and, we feel it is beyond the scope of our objectives to modify them.

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APPENDIX B

STANDARD DATA

Table B-1 presents results of independent analyses of SRL stream sediment standards. One to three splits of the three samples were sent to five laboratories for analysis. The columns in Table B-1 are: oxide or element, laboratory, method, split #, 2.2 results, 2.2 duplicate results, 3.1 results, 3.1 duplicate results, 4.1 results, and 4.1 duplicate results. ND means Not Done.

The laboratories are: Kansas Geological Survey, Skyline Laboratories, U. S. Geological Survey, Barringer Laboratories, and the University of North Carolina.

The Method codes are:

AA	atomic absorption
ESA	emission spectrographic analysis
AQ1	"aqueous one"
LIBO2	lithium borate fusion
HHH	HF, HNO_3, $HClO_3$ leach
RR	rapid rock
XRF	X-ray fluorescence
COLOR	colorimetry
SPEC	colorimetry
INAA	neutron activation.

We acknowledge especially the cooperation of B. P. Fabbi of the USGS and G. W. James of the Kansas Geological Survey for providing analyses. Linda P. Ward tabulated the data.
It is our intent to write a future report describing analytical methods in more detail and evaluating the data. Because most of the methods are commercially available, we feel that a seriously interested user can get better descriptions of each from the laboratory involved than we currently have at our disposal.

Concentrations are in percent or ppm as appropriate.

OXEL				SRL 2.2		SRL 3.1		SRL 4.1	
AG	SKLL	AA	1	-.2		-.2		-.2	
	SKLL	AA	2	-.2		.2		-.2	
	SKLL	AA	3	.2		.2		-.2	
	USGS	ESA	1	1.1	.80	-.10	-.10	-.10	-.10
	USGS	ESA	2	.89	.89	-.10	-.10	-.10	-.10
	USGS	ESA	3	.93	.94	-.10	-.10	-.10	-.10
	BARR	AQ1	1	ND	ND	ND	ND	ND	ND
	BARR	AQ1	2	ND	ND	ND	ND	ND	ND
	BARR	LIBO2	1	ND	ND	ND	ND	ND	ND
	BARR	LIBO2	2	ND	ND	ND	ND	ND	ND
	SKLL	ESA	1	-1		-1		-1	
	SKLL	ESA	2	-1		-1		-1	
	SKLL	ESA	3	-1		-1		-1	
AL2O3	KGS	XRF	1	1.6		9.1		12.0	
	SKLL	HHH	1	.51		4.0		12.5	
	SKLL	HHH	2	.53		4.2		12.5	
	SKLL	HHH	3	.51		4.0		12.3	
	USGS	XRF	1	2.15	2.26	7.18	7.32	13.55	13.31
	USGS	XRF	2	2.14	2.32	7.85	7.20	13.20	13.68
	USGS	XRF	3	2.29	2.25	7.62	7.86	13.58	13.39
	USGS	RR	1	2.4	2.3	7.8	7.7	14.1	14.0
	USGS	RR	2	2.3	2.5	7.7	7.7	13.9	14.1
	USGS	RR	3	2.4	2.4	7.8	7.7	14.1	14.0
	USGS	ESA	1	1.2	1.0	5.3	4.7	11	13
	USGS	ESA	2	1.0	1.0	5.5	5.3	13	12
	USGS	ESA	3	1.0	.95	4.5	6.2	13	13
	BARR	AQ1	1	.722	.723	4.78	4.81	12.9	12.5
	BARR	AQ1	2	.723	.723	4.78	4.64	12.8	12.9
	BARR	LIBO2	1	1.3	1.4	7.7	7.5	13.8	13.9
	BARR	LIBO2	2	1.4	1.4	8.0	8.0	14.0	13.6
	UNC	AA	1	1.57		5.86		13.69	
	UNC	AA	2	1.59		5.70		13.38	
	UNC	AA	3	1.65		5.75		13.29	
AS	SKLL	COLOR	1	10		-10		-10	
	SKLL	COLOR	2	-10		-10		-10	
	SKLL	COLOR	3	-10		-10		-10	
	USGS	ESA	1	-150	-150	-150	-150	-150	-150
	USGS	ESA	2	-150	-150	-150	-150	-150	-150
	USGS	ESA	3	-150	-150	-150	-150	-150	-150
	BARR	LIBO2	1	ND	ND	ND	ND	ND	ND
	BARR	LIBO2	2	ND	ND	ND	ND	ND	ND
	SKLL	ESA	1	-500		-500		-500	
	SKLL	ESA	2	-500		-500		-500	
	SKLL	ESA	3	-500		-500		-500	

Table B-1. Reference Analyses of SRL Standards.

CXEL	REST								
AU	SKLL AA	1	-.02		-.02		-.02	
	SKLL AA	2	-.02		-.02		-.02	
	SKLL AA	3	-.02		-.02		-.02	
	USGS ESA	1	-10	-10	-10	-10	-10	-10
	USGS ESA	2	-10	-10	-10	-10	-10	-10
	USGS ESA	3	-10	-10	-10	-10	-10	-10
B	USGS ESA	1	120	110	55	39	-10	-10
	USGS ESA	2	96	96	41	41	-10	-10
	USGS ESA	3	110	110	31	46	-10	-10
	SKLL ESA	1	30		20		-10	
	SKLL ESA	2	50		10		10	
	SKLL ESA	3	30		10		10	
BA	KGS XRF	1	89.6		358		89.6	
	SKLL HHH	1	-50		-50		-50	
	SKLL HHH	2	-50		-50		-50	
	SKLL HHH	3	-50		-50		-50	
	USGS ESA	1	300	240	330	380	130	150
	USGS ESA	2	210	220	390	380	140	140
	USGS ESA	3	230	210	330	440	150	140
	USGS INAA	1	-500	196	444	455	170	144
	USGS INAA	2	-500	202	348	278	-400	159
	USGS INAA	3	-500	-500	459	356	142	-400
	BARR AQ1	1	39	38	236	232	159	149
	BARR AQ1	2	39	37	236	234	150	168
	BARR LIB02	1	ND	ND	220	220	110	110
	BARR LIB02	2	ND	ND	220	220	110	110
	UNC XRF	1	35		226		128	
	UNC XRF	2	24		254		150	
	UNC XRF	3	15		224		158	
	SKLL ESA	1	-5		20		5	
	SKLL ESA	2	-5		20		5	
	SKLL ESA	3	-5		10		10	
BE	SKLL AA	1	-2		-2		3	
	SKLL AA	2	-2		-2		3	
	SKLL AA	3	-2		-2		3	
	USGS ESA	1	1.3	1.1	1.6	1.5	1.6	1.5
	USGS ESA	2	1.0	1.1	1.5	1.7	1.5	1.5
	USGS ESA	3	1.1	1.2	1.5	1.6	1.5	1.6
	BARR AQ1	1	.4	.4	.7	.7	.9	.9
	BARR AQ1	2	.4	.4	.6	.6	.9	.9
	BARR LIB02	1	ND	ND	ND	ND	ND	ND
	BARR LIB02	2	ND	ND	ND	ND	ND	ND
	SKLL ESA	1	-2		-2		-2	
	SKLL ESA	2	-2		-2		-2	
	SKLL ESA	3	-2		-2		-2	

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:20 THURSDAY, AUGUST 13, 1981

OXEL	REST								
BI	SKLL	AA	1	-1		-1		-1	
	SKLL	AA	2	-1		-1		-1	
	SKLL	AA	3	-1		-1		-1	
	USGS	ESA	1	-15	-15	-15	-15	-15	-15
	USGS	ESA	2	-15	-15	-15	-15	-15	-15
	USGS	ESA	3	-15	-15	-15	-15	-15	-15
	SKLL	ESA	1	-10		-10		-10	
	SKLL	ESA	2	-10		-10		-10	
	SKLL	ESA	3	-10		-10		-10	
CAO	KGS	XRF	1	.02		.17		6.6	
	SKLL	HHH	1	.038		.18		5.7	
	SKLL	HHH	2	.031		.18		5.9	
	SKLL	HHH	3	.031		.16		5.8	
	USGS	XRF	1	.14	.15	.22	.22	6.29	6.37
	USGS	XRF	2	.16	.15	.23	.21	6.31	6.26
	USGS	XRF	3	.10	.12	.27	.27	6.24	6.30
	USGS	RR	1	.04	.03	.19	.19	6.1	6.3
	USGS	RR	2	.04	.02	.17	.17	6.2	6.1
	USGS	RR	3	.04	.03	.16	.17	6.2	6.3
	USGS	ESA	1	.038	.032	.25	.27	3.6	4.3
	USGS	ESA	2	.060	.043	.20	.22	4.2	3.8
	USGS	ESA	3	.035	.032	.24	.24	3.9	4.3
	BARR	AQ1	1	.034	.033	.169	.169	5.74	5.55
	BARR	AQ1	2	.020	.019	.156	.150	5.62	5.67
	BARR	LIB02	1	ND	.04	.15	.15	6.28	6.36
	BARR	LIB02	2	ND	ND	.16	.16	6.42	6.20
	UNC	XRF	1	.12		.20		6.76	
	UNC	XRF	2	.12		.20		6.76	
	UNC	SRF	3	.12		.20		6.75	
	SKLL	ESA	1	.028		.21		4.2	
	SKLL	ESA	2	.028		.21		7.0	
	SKLL	ESA	3	.028		.014		7.0	
CD	SKLL	AA	1	-.1		-.1		-.1	
	SKLL	AA	2	-.1		-.1		-.1	
	SKLL	AA	3	-.1		-.1		-.1	
	USGS	ESA	1	-32	-32	-32	-32	-32	-32
	USGS	ESA	2	-32	-32	-32	-32	-32	-32
	USGS	ESA	3	-32	-32	-32	-32	-32	-32
	BARR	AQ1	1	ND	ND	ND	ND	ND	4
	BARR	AQ1	2	ND	ND	ND	ND	4	3
	SKLL	ESA	1	5		5		20	
	SKLL	ESA	2	5		5		20	
	SKLL	ESA	2	5		-5		30	

OXEL	REST								
CE	KGS	XRF	1	325.6		569.8		81.4	
	USGS	ESA	1	1000	830	670	890	98	110
	USGS	ESA	2	820	810	850	860	120	110
	USGS	ESA	3	840	750	650	1000	110	100
	USGS	INAA	1	603	612	894	970	40	43
	USGS	INAA	2	625	626	886	903	44	45
	USGS	INAA	3	564	611	862	888	41	42
CL	KGS	XRF	1	0.0		100		100	
	SKLL	IE	1	-200		-200		-200	
	SKLL	IE	2	-200		-200		-200	
	SKLL	IE	3	-200		-200		-200	
CO	SKLL	AA	1	5		5		25	
	SKLL	AA	2	-5		10		25	
	SKLL	AA	3	5		5		20	
	USGS	ESA	1	5.4	5.9	3.2	3.3	29	32
	USGS	ESA	2	5.1	4.9	2.9	3.0	31	29
	USGS	ESA	3	5.4	4.7	2.9	3.8	30	31
	USGS	INAA	1	4.7	4.6	3.4	3.6	35.4	35.9
	USGS	INAA	2	4.7	4.6	3.6	3.4	37.3	36.5
	USGS	INAA	3	4.6	4.5	3.3	3.3	36.1	36.4
	BARR	AQ1	1	24	21	28	26	61	61
	BARR	AQ1	2	25	25	25	27	64	66
	BARR	LIBO2	1	ND	ND	ND	ND	ND	ND
	BARR	LIBO2	2	ND	ND	100	ND	ND	ND
	SKLL	ESA	1	5		5		20	
	SKLL	ESA	2	5		5		20	
	SKLL	ESA	3	5		-5		30	
CO2	SKLL	HCL	1	.1		-.1		-.1	
	SKLL	HCL	2	.2		.1		.2	
	SKLL	HCL	3	.1		-.1		.2	
	USGS	RR	1	-.1	-.1	-.1	-.1	-.1	-.1
	USGS	RR	2	-.1	-.1	-.1	-.1	-.1	-.1
	USGS	RR	3	-.1	-.1	-.1	-.1	-.1	-.1
CR	KGS	XRF	1	56.5		56.5		56.5	
	SKLL	AA	1	25		20		25	
	SKLL	AA	2	30		25		25	
	SKLL	AA	3	30		20		25	
	USGS	ESA	1	31	24	16	21	51	54
	USGS	ESA	2	31	29	18	18	54	56
	USGS	ESA	3	29	26	16	20	51	46
	USGS	INAA	1	38.0	42.0	43.8	39.3	64.8	63.9
	USGS	INAA	2	39.2	39.9	40.9	42.2	71.7	68.9
	USGS	INAA	3	41.0	37.2	43.3	39.2	66.7	65.6
	BARR	AQ1	1	30.3	29.7	39.7	39.7	60.9	60.4
	BARR	AQ1	2	30.6	30.7	39.6	33.7	64.2	62.8
	BARR	LIBO2	1	40	40	30	50	120	110
	BARR	LIBO2	2	40	50	40	30	120	110
	UNC	XRF	1	0		0		57	
	UNC	XRF	2	0		0		59	

OXEL	REST								
CR	UNC	XRF	3	0		63		0	
	SKLL	ESA	1	10		20		15	
	SKLL	ESA	2	20		30		20	
	SKLL	ESA	3	10		10		50	
CS	USGS	INAA	1	-2.0	-2.0	1.4	1.3	-2.0	.7
	USGS	INAA	2	-2.0	-2.0	1.3	1.4	.7	-2.0
	USGS	INAA	3	-2.0	-2.0	1.3	1.3	-2.0	-2.0
CU	SKLL	AA	1	-5		5		10	
	SKLL	AA	2	-5		5		10	
	SKLL	AA	3	-5		5		10	
	USGS	ESA	1	-1.5	1.5	3.2	3.6	15	15
	USGS	ESA	2	8.1	1.5	3.4	3.3	14	13
	USGS	ESA	3	1.5	-1.5	3.3	3.7	16	14
	BARR	AQ1	1	3	3	8	6	15	14
	BARR	AQ1	2	2	2	6	6	14	14
	BARR	LIB02	1	ND	ND	ND	ND	30	30
	BARR	LIB02	2	ND	ND	ND	ND	30	30
	SKLL	ESA	1	3		3		10	
	SKLL	ESA	2	3		5		15	
	SKLL	ESA	3	3		2		20	
DY	USGS	ESA	1	-22	-22	47	54	-22	-22
	USGS	ESA	2	-22	-22	45	52	-22	-22
	USGS	ESA	3	-22	-22	44	58	-22	-22
ER	USGS	ESA	1	28	29	36	37	-10	-10
	USGS	ESA	2	23	24	28	42	-10	-10
	USGS	ESA	3	23	19	34	49	-10	-10
EU	USGS	ESA	1	3.0	2.5	2.6	4.8	-1.5	-1.5
	USGS	ESA	2	2.9	3.2	4.8	2.8	-1.5	-1.5
	USGS	ESA	3	2.8	2.5	2.9	4.9	-1.5	-1.5
	USGS	INAA	1	2.19	2.27	3.86	4.06	1.11	1.16
	USGS	INAA		2.23	2.35	3.93	3.95	1.18	1.17
	USGS	INAA	3	2.11	2.31	3.82	3.94	1.14	1.19
F	SKLL	IE	1	210		230		300	
	SKLL	IE	2	180		230		290	
	SKLL	IE	3	200		250		300	
FE2O3	KGS	XRF	1	1.0		3.1		14.0	
	SKLL	HHH	1	1.21		3.32		17.18	
	SKLL	HHH	2	1.15		3.24		17.05	
	SKLL	HHH	3	1.02		3.23		17.15	
	USGS	XRF	1	1.07	1.05	2.18	2.30	11.49	11.57
	USGS	XRF	2	1.08	1.10	2.29	2.26	11.57	11.51
	USGS	XRF	3	.99	.97	2.35	2.31	11.33	11.35
	USGS	RR	1	1.17	1.17	3.43	3.5	18.08	18.08
	USGS	RR	2	1.35	1.35	3.43	3.4	17.88	17.75
	USGS	RR	3	1.17	1.35	3.5	3.5	17.98	17.88
	USGS	ESA	1	1.10	1.00	2.1	2.0	14	14

OXEL	REST								
FE2O3	USGS	ESA	2	.97	.97	2.0	2.0	13	14
	USGS	ESA	3	.99	.99	2.0	2.3	14	13
	USGS	INAA	1	.90	.96	2.12	2.20	11.48	11.83
	USGS	INAA	2	.93	.91	2.23	2.12	12.30	11.83
	USGS	INAA	3	.90	.90	2.16	2.13	11.77	11.83
	BARR	AQI	1	.97	.93	2.34	2.30	12.8	12.6
	BARR	AQI	2	.92	.91	2.34	2.32	12.6	12.8
	BARR	LIBO2	1	.76	.79	2.17	2.11	11.8	11.9
	BARR	LIBO2	2	.78	.77	2.13	2.24	11.7	11.5
	UNC	AA	1	.92		2.12		11.31	
	UNC	AA	2	.87		2.14		11.41	
	UNC	AA	3	.89		2.14		11.23	
	SKLL	ESA	1	1.001		2.86		10.01	
	SKLL	ESA	2	1.001		4.29		10.01	
	SKLL	ESA	3	1.001		1.43		14.3	
GA	USGS	ESA	1	3.2	2.6	6.8	6.7	12	16
	USGS	ESA	2	2.8	2.6	6.8	6.8	15	14
	USGS	ESA	3	2.7	2.5	5.6	7.5	15	15
	SKLL	ESA	1	-10		10		10	
	SKLL	ESA	2	-10		10		10	
	SKLL	ESA	3	-10		-10		10	
GD	USGS	ESA	1	63	49	46	55	-6.8	-6.8
	USGS	ESA	2	47	43	56	58	-6.8	-6.8
	USGS	ESA	3	43	38	45	65	-6.8	-6.8
	USGS	INAA	1	38.4	37.5	60.9	65.5	2.6	-5.0
	USGS	INAA	2	35.6	37.7	60.9	60.2	4.3	-4.0
	USGS	INAA	3	34.8	39.7	58.3	62.7	4.0	3.8
GE	USGS	ESA	1	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
	USGS	ESA	2	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
	USGS	ESA	3	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
	SKLL	ESA	1	-20		-20		-20	
	SKLL	ESA	2	-20		-20		-20	
	SKLL	ESA	3	-20		-20		-20	
HF	USGS	ESA	1	300	180	-15	-15	-15	-15
	USGS	ESA	2	220	200	-15	-15	-15	-15
	USGS	ESA	3	250	210	-15	-15	-15	-15
	USGS	INAA	1	151.7	154.5	7.8	7.6	2.7	3.8
	USGS	INAA	2	156.6	160.9	6.6	6.9	3.7	3.1
	USGS	INAA	3	154.3	157.1	7.6	7.0	3.0	3.3
HG	SKLL	AA	1	.025		.045		.035	
	SKLL	AA	2	.035		.045		.025	
	SKLL	AA	3	.035		.035		.035	

OXEL	REST								
HO	USGS	ESA	1	-15	-15	12	13	-6.8	-6.8
	USGS	ESA	2	-15	-15	11	14	-6.8	-6.8
	USGS	ESA	3	-15	-15	11	16	-6.8	-6.8
	USGS	INAA	1	5.8	6.8	11.1	13.3	.6	-2.0
	USGS	INAA	2	8.7	7.9	14.7	12.6	.8	-2.0
	USGS	INAA	3	6.0	5.9	9.9	12.5	-2.0	1.0
IN	SKLL	AA	1	-1		-1		-1	
	SKLL	AA	2	-1		-1		-1	
	SKLL	AA	3	-1		-1		-1	
	USGS	ESA	1	-6.8	-6.8	-6.8	-6.8	-6.8	-6.8
	USGS	ESA	2	-6.8	-6.8	-6.8	-6.8	-6.8	-6.8
	USGS	ESA	3	-6.8	-6.8	-6.8	-6.8	-6.8	-6.8
IR	USGS	ESA	1	-15	-15	-15	-15	-15	-15
	USGS	ESA	2	-15	-15	-15	-15	-15	-15
	USGS	ESA	3	-15	-15	-15	-15	-15	-15
K2O	KGS	XRF	1	.03		1.07		.39	
	SKLL	HHH	1	.04		.89		.41	
	SKLL	HHH	2	.04		.91		.40	
	SKLL	HHH	3	.04		.90		.40	
	USGS	XRF	1	.04	.05	.82	.85	.35	.39
	USGS	XRF	2	.06	.05	.86	.83	.35	.41
	USGS	XRF	3	.04	.08	.83	.83	.34	.34
	USGS	RR	1	.01	.02	.83	.85	.38	.40
	USGS	RR	2	.01	.00	.84	.85	.39	.37
	USGS	RR	3	.01	.02	.83	.83	.38	.37
	USGS	ESA	1	-.082	-.082	.60	.64	.28	.34
	USGS	ESA	2	-.082	.086	.59	.64	.35	.29
	USGS	ESA	3	-.082	.088	.55	.70	.31	.31
	BARR	AQ1	1	.021	.023	.773	.794	.326	.315
	BARR	AQ1	2	.015	.015	.778	.763	.309	.326
	BARR	LIBO2	1	.8	.7	1.1	1.1	1.2	1.8
	BARR	LIBO2	2	ND	.5	.6	.4	1.5	1.7
	UNC	AA	1	.03		.83		.35	
	UNC	AA	2	.03		.83		.35	
	UNC	AA	3	.03		.82		.36	
LA	USGS	ESA	1	390	390	380	360	28	27
	USGS	ESA	2	360	390	400	360	32	31
	USGS	ESA	3	390	350	380	410	24	22
	USGS	INAA	1	300	303	432	472	18	19
	USGS	INAA	2	313	315	439	447	20	21
	USGS	INAA	3	282	302	425	441	19	19
	SKLL	ESA	1	500		500		-20	
	SKLL	ESA	2	300		700		-20	
	SKLL	ESA	3	500		500		-20	

OXEL	REST								
LI	SKLL	AA	1	-10		20		10	
	SKLL	AA	2	-10		20		10	
	SKLL	AA	3	-10		20		10	
	USGS	ESA	1	-68	-68	-68	-68	-68	-68
	USGS	ESA	2	-68	-68	-68	-68	-68	-68
	USGS	ESA	3	-68	-68	-68	-68	-68	-68
LU	USGS	ESA	1	-22	-22	-22	-22	-22	-22
	USGS	ESA	2	-22	-22	-22	-22	-22	-22
	USGS	ESA	3	-22	-22	-22	-22	-22	-22
	USGS	INAA	1	2.90	2.71	4.13	4.39	.22	.25
	USGS	INAA	2	2.70	2.93	4.75	4.38	.23	.23
	USGS	INAA	3	2.66	2.95	4.11	4.60	.24	.24
MGO	KGS	XRF	1	.2		.6		4.9	
	SKLL	HHH	1	.025		.33		4.4	
	SKLL	HHH	2	.021		.34		4.4	
	SKLL	HHH	3	.018		.34		4.3	
	USGS	XRF	1	0.0	0.0	.08	.06	4.59	4.47
	USGS	XRF	2	0.0	0.0	.07	0.0	4.38	4.53
	USGS	XRF	3	0.0	.01	0.0	0.0	4.55	4.51
	USGS	RR	1	.01	.00	.26	.21	4.6	4.7
	USGS	RR	2	.01	.00	.21	.24	4.6	4.6
	USGS	RR	3	.01	.02	.23	.23	4.6	4.6
	USGS	ESA	1	.05	.037	.32	.30	6.6	7.1
	USGS	ESA	2	.05	.040	.30	.30	7.0	7.1
	USGS	ESA	3	.040	.040	.25	.35	6.8	7.3
	BARR	AQ1	1	.0395	.0358	.476	.473	6.57	6.38
	BARR	AQ1	2	.0245	.0245	.473	.469	6.47	6.62
	BARR	LIB02	1	.02	.02	.32	.32	4.33	4.38
	BARR	LIB02	2	.02	.02	.33	.33	4.36	4.30
	UNC	AA	1	.05		.34		4.09	
	UNC	AA	2	.05		.34		4.19	
	UNC	AA	3	.04		.33		4.13	
	SKLL	ESA	1	.083		.332		3.32	
	SKLL	ESA	2	.083		.332		3.32	
	SKLL	ESA	3	.083		.332		3.32	
MLOI	KGS	XRF	1	.48		1.54		1.77	
	SKLL		1	.40		1.22		1.44	
	SKLL		2	.30		1.20		1.40	
	SKLL		3	.32		1.08		1.37	
	USGS	RR	1	.64	.64	1.64	1.47	1.76	1.83
	USGS	RR	2	.65	.55	1.50	1.59	1.83	1.76
	USGS	RR	3	.54	.52	1.61	1.50	1.86	1.86

OXEL	REST								
MNO	KGS	XRF	1	.04		.04		.23	
	SKLL	HHH	1	.039		.037		.232	
	SKLL	HHH	2	.036		.039		.232	
	SKLL	HHH	3	.036		.037		.232	
	USGS	XRF	1	.04	.04	.04	.04	.24	.24
	USGS	SRF	2	.04	.04	.04	.04	.23	.24
	USGS	XRF	3	.04	.05	.04	.04	.24	.24
	USGS	RR	1	.07	.08	.11	.08	.29	.30
	USGS	RR	2	.07	.08	.09	.11	.27	.29
	USGS	RR	3	.08	.08	.08	.09	.28	.27
	USGS	ESA	1	.062	.059	.058	.054	.32	.39
	USGS	ESA	2	.059	.059	.053	.059	.36	.37
	USGS	ESA	3	.056	.058	.057	.061	.36	.37
	BARR	AQ1	1	.038	.037	.037	.036	.216	.207
	BARR	AQ1	2	.037	.036	.037	.036	.214	.217
	BARR	LIBO2	1	.035	.037	.037	.036	.241	.241
	BARR	LIBO2	2	.037	.037	.036	.038	.243	.236
	UNC	XRF	1	.03		.02		.25	
	UNC	XRF	2	.03		.02		.25	
	UNC	SRF	3	.02		.02		.25	
	SKLL	ESA	1	.025		.039		.193	
	SKLL	ESA	2	.025		.039		.193	
	SKLL	ESA	2	.025		.026		.193	
MO	SKLL	AA	1	2		2		2	
	SKLL	AA	2	2		2		2	
	SKLL	AA	3	2		2		-2	
	USGS	ESA	1	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
	USGS	ESA	2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
	USGS	ESA	3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
	BARR	AQ1	1	-5	-5	5	5	5	5
	BARR	AQU	2	-5	-5	10	10	5	5
	BARR	LIBO2	1	ND	ND	ND	ND	ND	ND
	BARR	LIBO2	2	ND	ND	ND	ND	ND	ND
	SKLL	ESA	1	-2		-2		-2	
	SKLL	ESA	2	-2		-2		2	
	SKLL	ESA	3	-2		-2		-2	
NA2O	KGS	XRF	1	0.0		.1		1.6	
	SKLL	HHH	1	.03		.12		2.3	
	SKLL	HHH	2	.01		.13		2.3	
	SKLL	HHH	3	.01		.13		2.3	
	USGS	XRF	1	0.0	0.0	0.0	0.0	2.54	2.75
	USGS	XRF	2	.13	.11	0.0	0.0	2.33	2.84
	USGS	XRF	3	0.0	0.0	0.0	0.0	2.34	2.35
	USGS	RR	1	.01	.01	.17	.15	2.5	2.5
	USGS	RR	2	.00	.01	.15	.16	2.5	2.5
	USGS	RR	3	.00	.01	.16	.14	2.4	2.5
	USGS	ESA	1	-.006	-.006	.057	.063	1.8	1.8
	USGS	ESA	2	-.006	-.006	.058	.059	1.8	1.6
	USGS	ESA	3	-.006	-.006	.054	.069	1.8	2.0
	USGS	INAA	1	-.095	-.095	.135	.149	2.35	2.36
	USGS	INAA	2	-.135	-.27	.108	.175	2.48	2.40

OXEL	REST								
NA20	USGS	INAA	3	-.067	-.081	.135	.149	2.42	2.39
	BARR	AQ1	1	.048	.046	.178	.169	2.09	2.02
	BARR	AQ1	2	.030	.016	.170	.163	2.06	2.10
	BARR	LIB02	1	1.0	.6	.6	.4	3.6	4.0
	BARR	LIB02	2	.2	.5	ND	ND	4.0	4.2
	UNC	AA	1	.02		.12		2.44	
	UNC	AA	2	.02		.12		2.44	
	UNC	AA	3	.02		.12		2.42	
NB	SKLL	SPEC	1	30		20		20	
	SKLL	SPEC	2	20		30		20	
	SKLL	SPEC	3	30		20		20	
	USGS	ESA	1	96	99	32	29	26	32
	USGS	ESA	2	110	92	26	30	26	37
	USGS	ESA	3	110	100	27	44	32	31
	UNC	XRF	1	63		46		15	
	UNC	XRF	2	67		51		14	
	UNC	XRF	3	68		46		10	
	SKLL	ESA	1	30		20		20	
	SKLL	ESA	2	20		30		20	
	SKLL	ESA	3	30		20		20	
ND	USGS	ESA	1	500	380	340	460	-46	-46
	USGS	ESA	2	390	390	460	420	-46	-46
	USGS	ESA	3	330	350	320	520	-46	-46
	USGS	INAA	1	279	254	406	439	22	24
	USGS	INAA	2	281	270	403	412	27	23
	USGS	INAA	3	246	266	397	391	23	24
NI	SKLL	AA	1	5		15		20	
	SKLL	AA	2	5		15		25	
	SKLL	AA	3	5		15		30	
	USGS	ESA	1	8.4	6.4	11	10	51	55
	USGS	ESA	2	9.0	6.5	8.6	9.9	52	50
	USGS	ESA	3	7.6	9.1	9.2	11	51	49
	BARR	AQ1	1	3	4	14	10	48	45
	BARR	AQ1	2	3	3	10	10	46	46
	BARR	LIB02	1	ND	ND	ND	ND	60	50
	BARR	LIB02	2	ND	ND	ND	ND	60	90
	UNC	XRF	1	3		8		53	
	UNC	XRF	2	4		12		55	
	UNC	XRF	3	3		12		54	
	SKLL	ESA	1	70		5		20	
	SKLL	ESA	2	100		5		30	
	SKLL	ESA	3	70		5		50	
OS	USGS	ESA	1	-22	-22	-22	-22	-22	-22
	USGS	ESA	2	-22	-22	-22	-22	-22	-22
	USGS	ESA	3	-22	-22	-22	-22	-22	-22

OXEL	REST								
PB	SKLL	AA	1	10		10		-5	
	SKLL	AA	2	15		5		-5	
	SKLL	AA	3	10		5		-5	
	USGS	ESA	1	14	12	9.5	11	13	12
	USGS	ESA	2	13	12	11	10	11	12
	USGS	ESA	3	12	11	13	12	11	11
	BARR	AQ1	1	10	10	10	10	ND	ND
	BARR	AQ1	2	10	10	10	10	ND	ND
	BARR	LIBO2	1	500	ND	ND	400	600	300
	BARR	LIBO2	2	ND	ND	ND	700	ND	500
	SKLL	ESA	1	-10		10		-10	
	SKLL	ESA	2	-10		10		-10	
	SKLL	ESA	3	-10		-10		10	
PD	SKLL	SPEC	1	-.01		-.01		-.01	
	SKLL	SPEC	2	-.01		-.01		-.01	
	SKLL	SPEC	3	-.01		-.01		-.01	
	USGS	ESA	1	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
	USGS	ESA	2	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
	USGS	ESA	3	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
PR	USGS	ESA	1	-150	-150	89	160	-68	-68
	USGS	ESA	2	-150	-150	170	150	-68	-68
	USGS	ESA	3	-150	-150	93	180	-68	-68
PT	SKLL	SPEC	1	-.01		-.01		-.01	
	SKLL	SPEC	2	-.01		-.01		-.01	
	SKLL	SPEC	3	-.01		-.01		-.01	
	USGS	ESA	1	-6.8	-6.8	-6.8	-6.8	-6.8	-6.8
	USGS	ESA	2	-6.8	-6.8	-6.8	-6.8	-6.8	-6.8
	USGS	ESA	3	-5.8	-6.8	-6.8	-6.8	-6.8	-6.8
P205	KGS	XRF	1	.06		.10		.17	
	SKLL	COLOR	1	-.023		-.023		.069	
	SKLL	COLOR	2	-.023		-.023		.092	
	SKLL	COLOR	3	-.023		-.023		.092	
	USGS	XRF	1	.11	.10	.20	.19	.15	.17
	USGS	XRF	2	.11	.08	.18	.17	.13	.14
	USGS	XRF	3	.11	.13	.14	.15	.14	.13
	USGS	RR	1	.10	.10	.19	.19	.15	.16
	USGS	RR	2	.14	.13	.23	.19	.15	.17
	USGS	RR	3	.12	.10	.19	.18	.16	.17
	USGS	ESA	1	-.16	-.16	.25	.23	-.16	-.16
	USGS	ESA	2	-.16	-.16	.22	.28	-.16	-.16
	USGS	ESA	3	-.16	-.16	.22	.32	-.16	-.16
	BARR	AQ1	1	.10	.07	.14	.12	.10	.12
	BARR	AQ1	2	.08	.10	.15	.15	.10	.12
	BARR	LIBO2	1	ND	ND	ND	ND	ND	ND
	BARR	LIBO2	2	ND	ND	ND	ND	ND	ND
	UNC	SPEC	1	.10		.14		.12	
	UNC	SPEC	2	.10		.14		.10	
	UNC	SPEC	3	.09		.12		.10	

OXEL	REST								
RB	KGS	XRF	1	1		37		11	
	SKLL	HHH	1	27		100		73	
	SKLL	HHH	2	27		100		73	
	SKLL	HHH	3	27		100		73	
	USGS	INAA	1	-50	-50	-60	-70	-50	-50
	USGS	INAA	2	-50	-50	41	39	-50	-40
	USGS	INAA	3	-50	-50	-60	35	-40	-50
	UNC	XRF	1	0		20		16	
	UNC	XRF	2	0		21		16	
	UNC	XRF	3	0		19		14	
RE	USGS	ESA	1	-10	-10	-10	-10	-10	-10
	USGS	ESA	2	-10	-10	-10	-10	-10	-10
	USGS	ESA	3	-10	-10	-10	-10	-10	-10
RH	USGS	ESA	1	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
	USGS	ESA	2	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
	USGS	ESA	3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
RU	USGS	ESA	1	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
	USGS	ESA	2	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
	USGS	ESA	3	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
S	KGS	XRF	1	0.0		200		100	
SB	SKLL	AA	1	-1		-1		-1	
	SKLL	AA	2	-1		-1		-1	
	SKLL	AA	3	-1		-1		-1	
	USGS	ESA	1	-46	-46	-46	-46	-46	-46
	USGS	ESA	2	-46	-46	-46	-46	-46	-46
	USGS	ESA	3	-46	-46	-46	-46	-46	-46
	USGS	INAA	1	.4	.4	-2.0	-2.0	-2.0	-2.0
	USGS	INAA	2	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
	USGS	INAA	3	-2.0	.4	-2.0	-2.0	-2.0	-2.0
	SKLL	ESA	1	-100		-100		-100	
	SKLL	ESA	2	-100		-100		-100	
	SKLL	ESA	3	-100		-100		-100	
SC	USGS	ESA	1	4.3	3.6	2.4	3.2	20	22
	USGS	ESA	2	3.8	3.2	3.3	3.8	21	21
	USGS	ESA	3	4.3	4.2	3.0	3.7	19	20
	USGS	INAA	1	3.91	3.98	5.13	5.25	21.03	21.56
	USGS	INAA	2	3.95	4.01	5.34	5.14	22.15	21.48
	USGS	INAA	3	3.89	3.99	5.09	5.13	21.61	21.98
	SKLL	ESA	1	20		-10		20	
	SKLL	ESA	2	20		10		20	
	SKLL	ESA	3	20		-10		20	
SE	SKLL	COLOR	1	-2		-2		-2	
	SKLL	COLOR	2	-2		-2		-2	
	SKLL	COLOR	3	-2		-2		-2	

OXEL	REST								
SIO2	KGS	XRF	1	94.0		84.0		55.0	
	SKLL	AA	1	95.0		81.9		52.8	
	SKLL	AA	2	94.1		81.3		55.2	
	SKLL	AA	3	93.3		82.4		53.5	
	USGS	XRF	1	92.10	91.83	85.25	85.48	53.57	54.40
	USGS	XRF	2	91.90	91.69	85.30	85.85	53.83	54.02
	USGS	XRF	3	91.38	92.35	85.12	84.71	54.26	54.23
	USGS	RR	1	91.8	91.4	85.8	86.0	54.3	54.1
	USGS	RR	2	91.8	92.0	86.2	85.9	54.2	54.3
	USGS	RR	3	92.2	92.1	85.9	85.7	54.2	54.3
	USGS	ESA	1	>73	>73	>73	>73	47	51
	USGS	ESA	2	>73	>73	>73	>73	49	47
	USGS	ESA	3	>73	>73	>73	>73	54	49
	BARR	AQ1	1	86.8	89.5	81.7	78.2	53.4	53.4
	BARR	AQ1	2	89.2	89.2	86.8	85.7	53.6	52.2
	UNC	SPEC	1	88.78		82.24		54.11	
	UNC	SPEC	2	91.96		84.51		54.47	
	UNC	SPEC	3	90.84		83.73		53.27	
SM	USGS	ESA	1	60	52	53	64	-22	-22
	USGS	ESA	2	51	57	69	61	-22	-22
	USGS	ESA	3	50	47	51	75	-22	-22
	USGS	INAA	1	48.8	48.4	72.6	81.6	4.1	4.3
	USGS	INAA	2	53.8	53.8	78.8	76.4	4.1	4.4
	USGS	INAA	3	44.8	49.5	71.8	76.6	4.2	4.0
SN	SKLL	AA	1	-10		-10		-10	
	SKLL	AA	1	10		-10		-10	
	SKLL	AA	3	-10		-10		-10	
	USGS	ESA	1	3.9	5.4	1.7	2.0	-1.5	-1.5
	USGS	ESA	2	3.0	3.4	1.6	1.5	-1.5	-1.5
	USGS	ESA	3	20.0	4.5	1.9	2.7	-1.5	-1.5
	SKLL	ESA	1	20		-10		-10	
	SKLL	ESA	2	-10		-10		-10	
	SKLL	ESA	3	-10		-10		-10	
SR	KGS	XRF	1	14		34		640	
	SKLL	HHH	1	-17		-17		592	
	SKLL	HHH	2	-17		-17		592	
	SKLL	HHH	3	-17		-17		592	
	USGS	ESA	1	3.1	2.6	20	20	900	970
	USGS	ESA	2	2.4	2.7	18	19	910	900
	USGS	ESA	3	2.5	3.9	18	22	930	960
	BARR	AQ1	1	7.0	6.0	26.0	24.0	573	560
	BARR	AQ1	2	4.0	4.0	26.0	26.0	566	568
	BARR	LIBO2	1	ND	ND	30	30	620	640
	BARR	LIBO2	2	ND	ND	30	30	620	600
	UNC	XRF	1	2		19		669	
	UNC	XRF	2	1		25		666	
	UNC	XRF	3	2		22		696	
	SKLL	ESA	1	100		100		200	
	SKLL	ESA	2	200		200		100	
	SKLL	ESA	3	200		300		100	

OXEL	REST								
TA	USGS	ESA	1	-460	-460	-460	-460	-460	-460
	USGS	ESA	2	-460	-460	-460	-460	-460	-460
	USGS	ESA	3	-460	-460	-460	-460	-460	-460
	USGS	INAA	1	5.71	5.86	2.77	3.57	.96	1.38
	USGS	INAA	2	6.61	5.91	3.33	3.19	1.14	1.16
	USGS	INAA	3	6.06	6.36	3.04	3.22	1.15	1.04
TB	USGS	ESA	1	36	-32	-32	-32	-32	-32
	USGS	ESA	2	38	-32	-32	-32	-32	-32
	USGS	ESA	3	-32	-32	-32	-32	-32	-32
	USGS	INAA	1	5.64	5.44	10.29	11.18	-2.0	.68
	USGS	INAA	2	5.91	6.32	11.14	11.07	-2.0	.72
	USGS	INAA	3	5.27	5.88	10.28	11.30	-2.0	.79
TE	SKLL	AA	1	-.1		-.1		-.1	
	SKLL	AA	2	-.1		-.1		-.1	
	SKLL	AA	3	-.1		-.1		-.1	
TH	KGS	XRF	1	118		145		1	
	USGS	INAA	1	124	128	157	182	2.1	1.9
	USGS	INAA	2	131	134	163	163	1.5	2.7
	USGS	INAA	3	115	125	153	162	2.0	1.5
	USGS	ESA	1	320	310	150	220	-22	-22
	USGS	ESA	2	210	270	200	190	-22	-22
	USGS	ESA	3	240	250	160	240	-22	-22
	BARR	AQ1	1	163	149	216	218	ND	ND
	BARR	AQ1	2	155	153	218	213	ND	ND
	BARR	LIBO2	1	300	300	300	300	ND	200
	BARR	LIBO2	2	200	200	200	200	200	200
TIO2	KGS	XRF	1	2.0		.84		3.1	
	SKLL	COLOR	1	1.5		.92		4.6	
	SKLL	COLOR	2	1.6		.84		4.5	
	SKLL	COLOR	3	1.8		.96		4.7	
	USGS	XRF	1	2.43	2.45	1.05	1.07	4.41	4.48
	USGS	XRF	2	2.51	2.48	1.05	1.06	4.45	4.43
	USGS	XRF	3	2.48	2.50	1.04	1.03	4.35	4.40
	USGS	RR	1	2.5	2.5	1.0	1.0	4.4	4.5
	USGS	RR	2	2.5	2.5	1.0	1.0	4.5	4.5
	USGS	RR	3	2.4	2.5	1.1	1.1	4.5	4.4
	USGS	ESA	1	3.3	2.5	.73	.65	1.8	2.0
	USGS	ESA	2	3.2	3.0	.73	.75	2.0	2.3
	USGS	ESA	3	3.3	3.2	.72	.93	2.0	2.0
	BARR	AQ1	1	2.15	2.17	.904	.885	4.52	4.50
	BARR	AQ1	2	2.19	2.14	.917	.911	4.45	4.50
	BARR	LIBO2	1	2.55	2.61	1.14	1.12	5.09	5.09
	BARR	LIBO2	2	2.61	2.65	1.15	1.21	4.80	4.71
	UNC	XRF	1	2.52		1.09		3.79	
	UNC	XRF	2	2.60		1.06		3.81	
	UNC	XRF	3	2.43		1.09		3.84	
	SKLL	ESA	1	1.67		1.67		>1.67	
	SKLL	ESA	2	1.67		1.67		>1.67	
	SKLL	ESA	3	>1.67		1.17		>1.67	

OXEL	REST							
TL	SKLL AA	1	-1		-1		1	
	SKLL AA	2	-1		-1		1	
	SKLL AA	3	-1		-1		1	
	USGS ESA	1	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
	USGS ESA	2	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
	USGS ESA	3	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2
TM	USGS ESA	1	6.5	5.4	5.9	5.6	-4.6	-4.6
	USGS ESA	2	5.9	5.8	5.3	6.0	-4.6	-4.6
	USGS ESA	3	5.7	5.8	6.0	6.5	-4.6	-4.6
	USGS INAA	1	3.26	2.81	5.13	5.36	-.50	.34
	USGS INAA	2	2.79	3.23	6.16	5.89	-.50	-.40
	USGS INAA	3	3.10	3.15	5.06	5.91	.42	-.50
U	KGS XRF	1	18		31		1	
	SKLL FLURO	1	12		30		-2	
	SKLL FLURO	2	11		26		-2	
	SKLL FLURO	3	10		30		-2	
	USGS ESA	1	-320	-320	-320	-320	-320	-320
	USGS ESA	2	-320	-320	-320	-320	-320	-320
	USGS ESA	3	-320	-320	-320	-320	-320	-320
	USGS INAA	1	22.5	22.0	38.4	46.5	-2.0	-2.0
	USGS INAA	2	24.2	26.3	47.3	42.1	-2.0	-2.0
	USGS INAA	3	19.2	22.9	36.6	43.1	-2.0	-2.0
V	KGS XRF	1	0.0		56		168	
	SKLL SPEC	1	70		150		200	
	SKLL SPEC	2	70		150		300	
	SKLL SPEC	3	100		150		300	
	USGS ESA	1	38	35	45	43	160	170
	USGS ESA	2	37	38	45	47	170	160
	USGS ESA	3	39	38	44	50	170	170
	BARR AQ1	1	36.4	35.1	43.9	43.4	238	233
	BARR AQ1	2	36.0	35.1	43.4	43.4	239	240
	BARR LIBO2	1	69	59	63	61	312	304
	BARR LIBO2	2	54	58	56	56	308	297
	UNC XRF	1	18		25		281	
	UNC XRF	2	21		36		296	
	UNC XRF	3	23		28		278	
	SKLL ESA	1	70		150		200	
	SKLL ESA	2	70		150		300	
	SKLL ESA	3	100		150		300	
W	SKLL COLOR	1	3		5		3	
	SKLL COLOR	2	4		4		4	
	SKLL COLOR	3	3		5		3	
	USGS ESA	1	-10	-10	-10	-10	-10	-10
	USGS ESA	2	-10	-10	-10	-10	-10	-10
	USGS ESA	3	-10	-10	-10	-10	-10	-10
	SKLL ESA	1	-50		-50		-50	
	SKLL ESA	2	-50		-50		-50	
	SKLL ESA	3	-50		-50		-50	

OXEL	REST								
Y	KGS	XRF	1	180		370		15	
	USGS	ESA	1	270	210	290	300	14	14
	USGS	ESA	2	210	220	260	310	16	16
	USGS	ESA	3	200	180	270	320	15	16
	UNC	XRF	1	157		275		38	
	UNC	XRF	2	170		287		33	
	UNC	XRF	3	163		265		35	
	SKLL	ESA	1	200		300		10	
	SKLL	ESA	2	150		700		-10	
	SKLL	ESA	3	200		200		10	
YB	USGS	ESA	1	21	14	22	22	1.7	1.8
	USGS	ESA	2	14	14	16	21	1.8	1.6
	USGS	ESA	3	13	12	19	23	1.9	2.2
	USGS	INAA	1	19.0	16.8	29.7	30.9	1.5	1.5
	USGS	INAA	2	17.4	19.1	33.7	31.1	1.6	1.6
	USGS	INAA	3	17.2	19.0	29.0	32.5	1.5	1.4
ZN	USGS	ESA	1	H	H	10	11	89	100
	USGS	ESA	2	H	H	-10	-10	100	100
	USGS	ESA	3	H	H	11	14	85	100
	USGS	INAA	1	36	38	31	33	108	104
	USGS	INAA	2	38	32	30	32	112	102
	USGS	INAA	3	37	40	29	33	111	114
	BARR	AQ1	1	20	19	29	26	58	58
	BARR	AQ1	2	21	19	25	23	59	61
	BARR	LIBO2	1	60	ND	60	ND	90	70
	BARR	LIBO2	2	ND	ND	ND	ND	80	90
	SKLL	ESA	1	-200		-200		-200	
	SKLL	ESA	2	-200		-200		-200	
	SKLL	ESA	3	-200		-200		-200	
ZR	KGS	XRF	1	7400		296		148	
	USGS	ESA	1	32000	24000	280	240	67	110
	USGS	ESA	2	24000	24000	210	200	200	91
	USGS	ESA	3	28000	30000	160	280	180	120
	USGS	INAA	1	7214	7187	* 576	* 344	-400	-400
	USGS	INAA	2	7464	7848	* 306	* 417	-400	-400
	USGS	INAA	3	7243	7616	* 413	* 614	-400	-400
	BARR	AQ1	1	307	363	63	68	29	29
	BARR	AQ1	2	351	375	67	67	28	30
	BARR	LIBO2	1	7030	8250	260	260	160	160
	BARR	LIBO2	2	7410	7590	320	310	210	190
	UNC	XRF	1	6058		216		161	
	UNC	XRF	2	6380		224		154	
	UNC	XRF	3	6215		210		140	
	SKLL	ESA	1	2000		100		30	
	SKLL	ESA	2	3000		100		30	
	SKLL	ESA	3	1500		70		20	

Table B-2 presents SRL NAA results of the standards run with the samples of this study. All concentrations are in ppm of the element

The user is cautioned that the mean values reported for Th and rare earths in standard 4.1 are low because "-X" numbers are averaged in as though they were negative. The following values are suggested: Th 2.5, Dy<.5, Sm 4.2, Yb<.5, Lu<.2.

STATISTICAL SUMMARY OF SRL STANDARDS RUN WITH GRANITE SAMPLES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STANDARD=SRL 2.2							
U	12	21.0025000	2.74405846	17.1300000	26.9300000	7.52986	13.065
TH	12	106.4750000	13.32045443	85.1000000	133.7000000	177.43477	12.510
HF	12	131.0083333	12.27553244	111.6000000	145.3000000	150.68992	9.370
CE	12	489.8450000	49.10243920	399.4000000	564.1300000	2411.05445	10.024
FE	10	8383.2000000	2943.41403438	3675.0000000	11580.0000000	8663686.17778	35.111
MN	12	277.8000000	36.35271654	230.3000000	353.1000000	1321.52000	13.086
NA	12	140.4166667	17.82469346	107.0000000	159.0000000	317.71970	12.694
SC	12	2.9500000	0.59006933	2.2000000	4.3000000	0.34818	20.002
TI	12	12502.2166667	1438.38237351	10700.0000000	15660.0000000	2068943.85242	11.505
V	12	35.1166667	5.81030954	28.0000000	50.7000000	33.75970	16.546
AL	12	6676.9166667	871.58314247	4893.0000000	7740.0000000	759657.17424	13.054
DY	12	28.4500000	3.72790460	21.7000000	36.3000000	13.89727	13.103
LA	12	281.7575000	25.77303458	233.5300000	318.4000000	664.24931	9.147
SM	12	37.5833333	11.86766679	14.5000000	48.9000000	140.84152	31.577
YB	12	16.7258333	2.66501052	12.0500000	22.3800000	7.10228	15.933
LU	12	2.5358333	0.31436685	1.8300000	2.8900000	0.09883	12.397
STANDARD=SRL 3.1							
U	13	41.1961538	5.89261903	33.2700000	52.6900000	34.7230	14.304
TH	13	144.1769231	17.45652475	116.5000000	172.4000000	304.7303	12.108
HF	13	5.9000000	2.10039679	3.3000000	12.0030000	4.4117	35.600
CE	13	775.2461538	108.44758400	619.4700000	986.6700000	11760.8785	13.989
FE	13	17581.5384615	3310.16594789	11893.0000000	22380.0000000	10957198.6026	18.828
MN	13	257.6076923	33.77117759	204.7000000	321.3000000	1140.4924	13.110
NA	13	975.7692308	161.93679520	761.0000000	1359.0000000	26223.5256	16.596
SC	13	3.6384615	1.05793703	2.1000000	5.8000000	1.1192	29.076
TI	13	5566.5538462	955.81358182	3930.7000000	7160.0000000	913579.7944	17.171
V	13	45.9615385	7.11905172	34.7000000	56.7000000	50.6809	15.489
AL	13	34102.0769231	5219.00443031	22793.0000000	43760.0000000	27238007.2436	15.304
DY	13	51.8461538	9.81967543	26.5000000	64.3000000	96.4260	18.940
LA	13	454.1946154	43.99942985	392.4700000	531.8000000	1935.9498	9.687
SM	13	58.8076923	23.49239102	9.3000000	87.4000000	551.8924	39.948
YB	13	31.7792308	6.14762618	20.8500000	42.4000000	37.7933	19.345
LU	13	4.4323077	0.61740254	3.4000000	5.1900000	0.3812	13.930

Table B-2. Data for SRL Standards Run with Granite Samples.

STATISTICAL SUMMARY OF SRL STANDARDS RUN WITH GRANITE SAMPLES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STANDARD=SRL 4.1							
U	11	0.5345455	0.06713623	0.4200000	0.6400000	0.0045	12.559
TH	8	0.4250000	1.71443452	-1.0000000	2.8000000	2.9393	403.396
HF	10	2.8400000	1.18434229	1.3000000	4.9000000	1.4027	41.702
CE	10	33.2180000	13.11163588	17.2500000	57.6300000	171.9150	39.471
FE	11	85994.0000000	7183.51387553	77400.0000000	97333.0000000	51602871.6000	8.354
MN	11	1794.6090909	232.42680334	1438.7000000	2140.0000000	54022.2189	12.951
NA	11	17523.6363636	2162.96159341	13727.0000000	20513.0000000	4678402.8545	12.343
SC	11	15.3818182	2.28246278	12.7000000	20.5000000	5.2096	14.839
TI	11	24595.1545455	3983.97898774	18586.7000000	33113.3000000	15872088.5747	16.198
V	11	249.0909091	44.86070562	191.3000000	348.7000000	2012.4829	18.010
AL	11	61354.5454545	7402.28401730	49713.0000000	74200.0000000	54793808.6727	12.065
DY	11	-0.0636364	0.05045250	-0.1000000	0.0000000	0.0025	-79.282
LA	11	18.3872727	2.15781876	15.1900000	21.6200000	4.6562	11.735
SM	11	3.4454545	1.78458042	-0.1000000	4.7000000	3.1847	51.795
YB	11	0.3118182	0.86685429	-0.1100000	2.2000000	0.7514	278.000
LU	11	0.1718182	0.24498237	-0.0700000	0.7200000	0.0600	142.582

APPENDIX C

HEADER INFORMATION, COMPUTER PROGRAMS TO READ THE DATA TAPE, AND PLUTON CODES.

The following tables include computer programs which have been used to read the data tape.

Table C-1. Header for File 1:
Major and Minor Element Data.

The following is major and minor element data from the granite study by Price, Fay, and Cook (1982). Not all analyses are available for every sample. The data are arranged as three card images per sample with the following format:

*** CARD # 1 *** NOTE: DATA ON CARD # 1 ARE IN WEIGHT PERCENT.

COL	1-2	PLUTON DESIGNATOR CODE (ALPHANUMERIC)
COL	3-14	SAMPLE IDENTIFICATION NUMBER (ALPHANUMERIC)
COL	15-19	SIO2 (F5.2)
COL	20-24	AL2O3 (F5.2)
COL	25-29	TIO2 (F5.2)
COL	30-34	FE2O3 (F5.2)
COL	35-39	MGO (F5.2)
COL	40-44	MNO (F5.2)
COL	45-49	CAO (F5.2)
COL	50-54	NA2O (F5.2)
COL	55-59	K2O (F5.2)
COL	60-64	P2O5 (F5.2)
COL	65-70	LOSS ON IGNITION (F5.2)

*** CARD # 2 *** NOTE: DATA ON CARD # 2 ARE IN PPM.

COL	1-2	PLUTON DESIGNATOR CODE (ALPHANUMERIC)
COL	3-14	SAMPLE IDENTIFICATION NUMBER (ALPHANUMERIC)
COL	15-19	RB (F5.0)
COL	21-25	SR (F5.0)
COL	27-31	Y (F5.0)
COL	33-37	ZR (F5.0)
COL	39-43	NB (F5.0)
COL	45-49	BA (F5.0)
COL	51-55	V (F5.0)
COL	57-61	CR (F5.0)
COL	63-67	CO (F5.0)
COL	69-73	TA (F5.0)
COL	75-79	MN (F5.0)

*** CARD 3 *** NOTE: DATA ON CARD # 3 ARE IN PPM

COL	1-2	PLUTON DESIGNATOR CODE (ALPHANUMERIC)
COL	3-14	SAMPLE IDENTIFICATION NUMBER (ALPHANUMERIC)
COL	15-19	U (F5.0)
COL	21-25	TH (F5.0)
COL	27-31	EU (F5.0)
COL	33-37	LA (F5.0)
COL	39-43	CE (F5.0)
COL	45-49	TB (F5.0)
COL	51-55	YB (F5.0)

Table C-1. Continued.

```
COL  57-61  LU (F5.0)
COL  63-67  SM (F5.0)
COL  69-73  CS (F5.0)
COL  75-79  NI (F5.0)
      *****  DATA FOLLOW THIS CARD   *****
```

Table C-2. Header for File 2; Neutron Activation Analysis Data.

The following is neutron activation analysis data from the granite study by Price, Fay, and Cook (1982). The data are arranged as two card images per sample with the following format:

```
*** CARD # 1 ***   NOTE:  ALL DATA ARE REPORTED IN PPM.

COL  1-2    PLUTON DESIGNATOR CODE (ALPHANUMERIC)
COL  3-14   SAMPLE IDENTIFICATION NUMBER (ALPHANUMERIC)
COL 15-20   U (F6.1)
COL 22-27   TH (F6.0)
COL 29-34   HF (F6.0)
COL 36-41   CE (F6.0)
COL 43-48   FE (F6.0)
COL 50-55   MN (F6.0)
COL 57-62   NA (F6.0)
COL 64-68   SC (F5.1)
COL 70-76   TI (F7.0)

***  CARD # 2 ***   NOTE:  ALL DATA ARE REPORTED IN PPM.

COL  1-2    PLUTON DESIGNATOR CODE (ALPHANUMERIC)
COL  3-14   SAMPLE IDENTIFICATION NUMBER (ALPHANUMERIC)
COL 15-18   V (F4.0)
COL 20-26   AL (F7.0)
COL 28-33   DY (F6.1)
COL 35-39   LA (F5.0)
COL 41-45   SM (F5.0)
COL 47-51   YB (F5.1)
COL 53-57   LU (F5.1)

     *****  DATA FOLLOW THIS CARD  *****
```

Table C-3. FORTRAN program to read and write File 1:
Major and Minor Element Data.

```
      REAL*8 MGO(441),MNO(441),NA2O(441),K2O(441),LOI(441),NB(441),MN(4
     >41),LA(441),LU(441),NI(441)
      DIMENSION SIO2(441),AL2O3(441),TIO2(441),FE2O3(441),CAO(441),P2O5
     >(441),RB(441),SR(441),Y(441),ZR(441),BA(441),V(441),CR(441),CO(44
     >1),TA(441),U(441),TH(441),EU(441),CE(441),TB(441),YB(441),SM(441)
     >,CS(441)
      DIMENSION PLUDSG(441),ID1(441),ID2(441),ID3(441)
C     *****  SKIP 53 LINES TO GET PAST HEADER  *****
      READ(1,99)
   99 FORMAT(/////////////////////////////////////////////////////)
      DO 10 I=1,441
      READ(1,100) PLUDSG(I),ID1(I),ID2(I),ID3(I),SIO2(I),AL2O3(I),TIO2(I
     >),FE2O3(I),MGO(I),MNO(I),CAO(I),NA2O(I),K2O(I),P2O5(I),LOI(I),RB(I
     >),SR(I),Y(I),ZR(I),NB(I),BA(I),V(I),CR(I),CO(I),TA(I),MN(I),U(I),T
     >H(I),EU(I),LA(I),CE(I),TB(I),YB(I),LU(I),SM(I),CS(I),NI(I)
   10 CONTINUE
      DO 30 I=1,441
      WRITE(6,110) PLUDSG(I),ID1(I),ID2(I),ID3(I),SIO2(I),AL2O3(I),TIO2(
     >I),FE2O3(I),MGO(I),MNO(I),CAO(I),NA2O(I),K2O(I),P2O5(I),LOI(I),RB(
     >I),SR(I),Y(I),ZR(I),NB(I),BA(I),V(I),CR(I),CO(I),TA(I),MN(I),U(I),
     >TH(I),EU(I),LA(I),CE(I),TB(I),YB(I),LU(I),SM(I),CS(I),NI(I)
   30 CONTINUE
  100 FORMAT(A2,3A4,11(F5.2,1X)/14X,11(F5.0,1X)/14X,11(F5.0,1X))
  110 FORMAT(1X,A2,3A4,11(F5.2,1X)/14X,11(F5.0,1X)/14X,11(F5.0,1X))
      STOP
      END
```

Table C-4. FORTRAN program to read and write File 2: Neutron Activation Analysis Data.

```
      REAL*8 HF(441),MN(441),NA(441),LA(441),LU(441)
      DIMENSION U(441),TH(441),CE(441),FE(441),SC(441),TI(441),V(441),AL
     >(441),DY(441),SM(441),YB(441)
      DIMENSION PLUDSG(441),ID1(441),ID2(441),ID3(441)
C     *****  SKIP 29 LINES TO GET PAST HEADER ON TAPE *****
      READ(1,99)
      DO 10 I=1,441
   99 FORMAT(/////////////////////////////)
      READ(1,100) PLUDSG(I),ID1(I),ID2(I),ID3(I),U(I),TH(I),HF(I),CE(I),
     >FE(I),MN(I),NA(I),SC(I),TI(I),V(I),AL(I),DY(I),LA(I),SM(I),YB(I),L
     >U(I)
   10 CONTINUE
      DO 30 I=1,441
      WRITE(1,110) PLUDSG(I),ID1(I),ID2(I),ID3(I),U(I),TH(I),HF(I),CE(I)
     >,FE(I),MN(I),NA(I),SC(I),TI(I),V(I),AL(I),DY(I),LA(I),SM(I),YB(I),
     >LU(I)
   30 CONTINUE
  100 FORMAT(A2,3A4,F6.1,1X,6(F6.0,1X),F5.1,1X,F7.0/14X,F4.0,1X,F7.0,1X,F
     >6.1,1X,2(F5.0,1X),2(F5.1,1X))
  110 FORMAT(1X,A2,3A4,F6.1,1X,6(F6.0,1X,F5.1,1X,F7.0/14X,F4.0,1X,F7.0,1
     >X,F6.1,1X,2(F5.0,1X),2(F5.1,1X))
      STOP
      END
```

Table C-5. SAS program to read and write File 1: Major and Minor Element Data.

```
DATA ONE;
* use firstobs option to get past header;
INFILE FT01F001 FIRSTOBS=54;
INPUT:
@1 PLUTDSG1 $ 1-2 @ 3 SAMPLEID $CHAR12. @ 15 SIC2 5.2 @21 AL2O3 5.2
@ 27 TIO2 5.2 @ 33 FE2O3 5.2 @ 39 MGO 5.2 @ 45 MNO 5.2 @ 51 CAO 5.2
@ 57 NA2O 5.2 @ 63 K2O 5.2 @ 69 P2O5 5.2 @ 75 LOI 5.2 /
@ 1 PLUTDSG2 $1-2 @ 3 SAMPLEID $CHAR12. @ 15 RB 5.0 @ 21 SR 5.0
@  27 Y 5.0 @ 33 ZR 5.0 @ 39 NB 5.0 @ 45 BA 5.0 @ 51 V 5.0 @ 57 CR 5.0
@ 63 CO 5.0 @ 69 TA 5.0 @ 75  MN 5.0 /
@ 1 PLUTDSG3 $1-2 @ 3 SAMPLEID $CHAR12. @ 15 U 5.0 @ 21 TH 5.0
@ 27 EU 5.0 @ 33 LA 5.0 @ 39 CE 5.0 @ 45 TB 5.0 @ 51 YB 5.0
@ 57 LU 5.0 @ 63 SM 5.0 @ 69 CS 5.0 @ 75 NI 5.0;
PROC PRINT;
```

Table C-6. SAS program to read and write File 2: Neutron Activation Analysis Data.

```
DATA ONE;
* use firstcbs option to get by header;
INFILE FT01F001 FIRSTOBS=30;
INPUT @1 PLUTDSG1 $ 1-2 @ 3 SAMPLEID $CHAR12. @ 15 U 6.1 @ 22 TH 6.0
@ 29 HF 6.0 @ 36 CE 6.0 @ 43 FE 6.0 @ 50 MN 6.0 @ 57 NA 6.0
@ 64 SC 5.1 @ 70 TI 7.0 /
@ 15 V 4.0 @ 20 AL 7.0 @ 28 DY 6.1 @ 35 LA 5.0 @ 41 SM 5.0 @ 47 YB 5.1
@ 53 LU 5.1;
PROC PRINT:
```

Table C-7. List of Plutons by SRL Two-letter Code.

CODE	PLUTON
AA	Jabal Arkeno, Libya
AB	Eridya, Egypt
AC	Fawakhir, Egypt
AD	Gebel el Gindy, Egypt
AE	Ben Ghnema Bath., Tibesti Massif
AF	Homrit Ghannem, Egypt
AG	Kadabora, Egypt
AH	Mons Claudianus, Egypt
AJ	Ruses, Egypt
AK	Sheikh Salem, Egypt
AL	Um Rus, Egypt
AM	Wadi Abu Shihat, Egypt
AN	Blue Hills Porphyry, Mass.
AO	Quincy, Mass.
AP	Catawba, S.C.
AQ	Mt. Airy, N.C.
AR	Blue Hills Aporhyolite, Mass.
AS	Salisbury, N.C.
AT	Hatcher, Va.
AU	Southmont, N.C.
AV	Yadkin, N.C.
AW	Edgemoor, S.C.
AX	Lowrys, S.C.
AY	Siloam, Ga.
AZ	Sparta, Ga.
BA	Cloud Creek, S.C.
BB	Castalia, N.C.
BC	Lilesville, N.C.
BD	Pageland, S.C.
BE	Clover, S.C.
BF	York, S.C.
BG	Churchland, N.C.
BH	Gold Hill, N.C.
BI	Lexington, S.C.
BJ	Coronaca, S.C.
BK	Edgefield, S.C. (Cuffytown Creek)
BL	Columbia, S.C.
BM	Winnsboro, S.C.
BN	Concord Syenite, N.C.
BO	Concord Gabbro, N.C.
BP	York Co. Gabbro, S.C. (North York)
BQ	Farrington E&W, N.C.
BR	Appling, Ga.
BS	Mecklenburg Gabbro, N.C.
BT	Liberty Hill, S.C.
BU	Lancaster Co. Gabbro, S.C.
BV	Mt. Carmel Syenite, S.C.
BX	Great Falls, S.C.
BZ	Farmington Gabbro, N.C.

Table C-7. Continued.

CODE	PLUTON
CA	Rowan Co., N.C.
CB	Landis, N.C.
CC	Manzanita, N.M.
CD	Dalmein, Africa
CE	Kaap Valley, Africa
CF	Kwetta, Africa
CG	Ladron, N.M.
CH	Capriote, N.M.
CI	Lochiel, Africa
CJ	Laramie, Wyo.
CK	Mliba, Africa
CL	Monte Largo, N.M.
CM	Priest, N.M.
CN	Mbabane, Africa
CO	Mhlosheni, Africa
CP	Mpageni, Africa
CR	Ngwempisi, Africa
CS	Ojita, N.M.
CT	Oscura Gray, N.M.
CU	Mockingbird Gap, N.M.
CV	Oscura Red, N.M.
CX	Pongola, Africa
CY	Salisbury, Rhodesia
CZ	Chilimanzi, Rhodesia
DA	Mashaba, Rhodesia
DB	Capitol Peak, N.M.
DC	Stolzburg, Africa
DD	Sicunusa, Africa
DF	Salisburykop, Africa
DG	Sinceni, Africa
DH	South Sandia, N.M.
DI	North Sandia, N.M.
DJ	Theespruit, Africa
DK	Nelshoogte, Africa
DL	Embudo, N.M.
DM	Petersburg, Va.
DN	Cape Ann, Mass.
DO	Striped Rock, Va.