

# Whole-rock Geochemical Data for the Allens Ranch, Boulter Peak, and Goshen Quadrangles, Utah

*by*

*Adam P. McKean<sup>1</sup>, Eric H. Christiansen<sup>2</sup>, Tara Allen<sup>2</sup>, and Bart J. Kowallis<sup>2</sup>*

<sup>1</sup>Utah Geological Survey, P.O. Box 146100, Salt Lake City, UT 84114-6100

<sup>2</sup>Department of Geological Sciences, Brigham Young University, Provo, UT 84602

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## **INTRODUCTION**

This open-file report makes available raw analytical data from laboratory procedures completed to determine the elemental composition of igneous rock samples collected during geologic mapping funded or supported by Brigham Young University (BYU), the U.S. Geological Survey (USGS) National Cooperative Geologic Mapping Program, and the Utah Geological Survey (UGS). Additional information about these samples and rock units is available in Christiansen and others (2007), McKean (2011), McKean and Solomon (2012), Allen (2012), Christiansen and others (2013), and McKean and others (in preparation). These data were prepared by ALS USA, Inc., Reno, Nevada, under contract to the UGS, and by Brigham Young University, Department of Geological Sciences. These data are highly technical in nature and proper interpretation requires considerable training in applicable geochemical techniques. The elemental compositions of each igneous rock sample can also be accessed electronically as an Excel document attached to the PDF file of this report, titled GeoChem\_AR-BP-GN\_OFR-839.xlsx.

## **DISCLAIMER**

This open-file release is intended as a data repository for technical analytical information gathered in support of geologic mapping of the Allens Ranch, Boulter Peak, and Goshen quadrangles. These data may not conform to UGS technical or editorial standards. Therefore, it may be premature for an individual or group to take actions based on the contents of this report. The Utah Department of Natural Resources, Utah Geological Survey, makes no warranty, expressed or implied, regarding its suitability for a particular use. The Utah Department of Natural Resources, Utah Geological Survey, shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to claims by users of this product.

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

## **ACKNOWLEDGMENTS**

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Table 1. Major- and trace-element analyses of volcanic rocks from the Allens Ranch, Boulder Peak, and Goshen quadrangles, Utah

Sample	Map Unit	Unit Name	Rock Type	Rock Name	X_UTM_NAD83	Y_UTM_NAD83	Y_Lat_NAD83	X_Long_NAD83	7.5' Quadrangle	Analysis Source	Reference
AR-608	Tb	Mosida Basalt	lava flow	trachybasalt	412874	4440448	40.10982	-112.02232	Allens Ranch	1	3
AR-708	Tb	Mosida Basalt	lava flow	trachybasalt	413664	4440058	40.10640	-112.01300	Allens Ranch	1	3
AR-AE-09	Tb	Mosida Basalt	lava flow	trachybasalt	414006	4435851	40.06853	-112.00843	Allens Ranch	1	3
AR-JRY-08-01	Tb	Mosida Basalt	lava flow	trachybasalt	412914	4440468	40.11002	-112.02186	Allens Ranch	1	3
AR-JRY-08-02	Tb	Mosida Basalt	lava flow	trachybasalt	414267	4440515	40.11057	-112.00598	Allens Ranch	1	3
AR-TLA-08	Tb	Mosida Basalt	lava flow	trachybasalt	414076	4435984	40.06974	-112.00763	Allens Ranch	1	3
AR-408	Tb	Mosida Basalt	lava flow	trachybasalt	414060	4442231	40.12601	-112.00864	Goshen Pass	1	3
AR-2008	Tpcb	pillow lava breccia member of the Pinyon Creek Conglomerate	pillow lava breccia	shoshonite	410993	4435446	40.06458	-112.04370	Allens Ranch	1	3
AR-2506	Tpcb	pillow lava breccia member of the Pinyon Creek Conglomerate	pillow lava breccia	shoshonite	411003	4435438	40.06450	-112.04358	Allens Ranch	1	3
AR-808	Tpcc	clast in the Pinyon Creek Conglomerate	clast	latite	413827	4439907	40.10505	-112.01107	Allens Ranch	1	3
AR-109	Tpcc	flow or clast in the Pinyon Creek Conglomerate	lava	dacite	411687	4435682	40.06677	-112.03559	Allens Ranch	1	3
AR-209	Tpcb	lava breccia member of the Pinyon Creek Conglomerate	lava/dike?	basalt	409654	4435047	40.06084	-112.05934	Allens Ranch	1	3
AR-105	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412297	4435203	40.06252	-112.02838	Allens Ranch	1	3
AR-1108	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	411620	4435130	40.06179	-112.03631	Allens Ranch	1	3
AR-205	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412297	4435203	40.06252	-112.02838	Allens Ranch	1	3
AR-305	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412297	4435203	40.06252	-112.02838	Allens Ranch	1	3
AR-308	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412969	4438214	40.08971	-112.02091	Allens Ranch	1	3
AR-AD-06	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	411658	4435167	40.06213	-112.03587	Allens Ranch	1	3
AR-CJS-09	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	411585	4435146	40.06194	-112.03672	Allens Ranch	1	3
AR-JR-06	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412330	4435256	40.06300	-112.02800	Allens Ranch	1	3
AR-NKA-06	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	411658	4435167	40.06213	-112.03587	Allens Ranch	1	3
AR-PDP-09	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412330	4435018	40.06086	-112.02797	Allens Ranch	1	3
AR-PUG-09	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412250	4435155	40.06208	-112.02893	Allens Ranch	1	3
AR-REH-06	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	411951	4435170	40.06218	-112.03243	Allens Ranch	1	3
AR-SES-09	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	409789	4435148	40.06176	-112.05778	Allens Ranch	1	3
AR-TAC-09	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	412046	4435010	40.06075	-112.03130	Allens Ranch	1	3
AR-TDW-06	Tc	Chimney Rock Pass tuff Member of Soldiers Pass Formation	ash-flow tuff	rhyolite	411585	4435154	40.06200	-112.03672	Allens Ranch	1	3
AR-RLH-08	Tlsl	lava of Laguna Springs Volcanic Group	lava flow	latite	407806	4428526	40.00190	-112.08009	Allens Ranch	1	3
AR-1608	Tlsl	lava of Laguna Springs Volcanic Group	lava flow	andesite	412566	4429017	40.00682	-112.02439	Allens Ranch	1	3
AR-805	Tlsl	lava of Laguna Springs Volcanic Group	lava flow	latite	408246	4429146	40.00753	-112.07502	Allens Ranch	1	3
AR-1408	Ttp	tuff of Twelvemile Pass member of the Soldiers Pass Formation	welded tuff	trachydacite	409758	4435211	40.06232	-112.05815	Allens Ranch	1	3
AR-2606	Ttp	tuff of Twelvemile Pass member of the Soldiers Pass Formation	welded tuff	dacite	410491	4435324	40.06342	-112.04957	Allens Ranch	1	3
AR-2706	Ttp	tuff of Twelvemile Pass member of the Soldiers Pass Formation	welded tuff	dacite	410491	4435324	40.06342	-112.04957	Allens Ranch	1	3
AR-PG-09	Ttp	tuff of Twelvemile Pass member of the Soldiers Pass Formation	welded tuff	dacite	411469	4435090	40.06142	-112.03807	Allens Ranch	1	3
AR-SAM-06	Ttp	tuff of Twelvemile Pass member of the Soldiers Pass Formation	welded tuff	dacite	411469	4435044	40.06100	-112.03807	Allens Ranch	1	3
AR-KLG-08	Tlr	Latite Ridge Latite	welded tuff	trachydacite	410318	4429148	40.00777	-112.05074	Allens Ranch	1	3
AR-S7608	Tlr	Latite Ridge Latite	welded tuff	trachydacite	409620	4429488	40.01076	-112.05897	Allens Ranch	1	3
AR-1808	Tlr	Latite Ridge Latite	welded tuff	trachydacite	407225	4429671	40.01215	-112.08705	Allens Ranch	1	3
AR-S13408	Tlr	Latite Ridge Latite	welded tuff	trachydacite	410170	4428201	39.99922	-112.05235	Eureka	1	3
GN2011-401	Tlr	Latite Ridge Latite	welded tuff	trachydacite	421726	4413963	39.87210	-111.91528	Slate Jack Canyon	2	4
AR-1508	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410076	4435813	40.06778	-112.05450	Allens Ranch	1	3
AR-208	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	413319	4438406	40.09148	-112.01683	Allens Ranch	1	3
AR-405	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410294	4435810	40.06778	-112.05194	Allens Ranch	1	3
AR-505	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411123	4436397	40.07315	-112.04231	Allens Ranch	1	3
AR-605	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	412199	4435812	40.06800	-112.02961	Allens Ranch	1	3
AR-905	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	404137	4437921	40.08611	-112.12444	Allens Ranch	1	3
AR-APM-08	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411098	4436313	40.07240	-112.04259	Allens Ranch	1	3
AR-BL-06	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410741	4436081	40.07027	-112.04675	Allens Ranch	1	3
AR-BLB-06	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410160	4435572	40.06562	-112.05348	Allens Ranch	1	3
AR-DD-09	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411895	4435779	40.06766	-112.03317	Allens Ranch	1	3
AR-DPL-09	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411183	4436330	40.07256	-112.04160	Allens Ranch	1	3
AR-JL-09	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411810	4435797	40.06782	-112.03417	Allens Ranch	1	3
AR-JSC-08	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410177	4429376	40.00981	-112.05243	Allens Ranch	1	3
AR-ML-09	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411993	4435827	40.06811	-112.03203	Allens Ranch	1	3
AR-MP-06	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	411239	4436432	40.07348	-112.04096	Allens Ranch	1	3
AR-NJ-06	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410954	4436211	40.07146	-112.04427	Allens Ranch	1	3
AR-RWB-09	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	409588	4434760	40.05825	-112.06008	Allens Ranch	1	3
AR-S30409	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	404124	4436105	40.06975	-112.12433	Allens Ranch	1	3

Sample	Map Unit	Unit Name	Rock Type	Rock Name	X_UTM_NAD83	Y_UTM_NAD83	Y_Lat_NAD83	X_Long_NAD83	7.5' Quadrangle	Analysis Source	Reference
AR-SDF-06	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410606	4435871	40.06836	-112.04829	Allens Ranch	1	3
AR-TPW-06	Tp	tuff of Rattlesnake Pass member of the Packard Quartz Latite	ignimbrite	rhyolite	410821	4435389	40.06404	-112.04571	Allens Ranch	1	3
AR-2108	Tplt	Lava member of the Packard Quartz Latite	lava vitrophyre breccia	rhyolite	403863	4428510	40.00131	-112.12627	Boulter Peak	1	3
GN2011-384	Tpb	tuff breccia member of the Packard Quartz Latite	tuff breccia	rhyolite	421151	4416508	39.89498	-111.92231	Goshen	2	4
GN2011-388	Tpb	tuff breccia member of the Packard Quartz Latite	tuff breccia	rhyolite	421329	4416763	39.89729	-111.92026	Goshen	2	4
AR-107	Tp	tuff of Tintic Davis Canyon member of the Packard Quartz Latite	vitrophyre	rhyolite	406436	4429373	40.00937	-112.09625	Allens Ranch	1	3
AR-108	Tp	tuff of Tintic Davis Canyon member of the Packard Quartz Latite	vitrophyre	rhyolite	406436	4429373	40.00937	-112.09626	Allens Ranch	1	3
AR-1708	Tptd	tuff of Tintic Davis Canyon member of the Packard Quartz Latite	vitrophyre	rhyolite	406455	4429400	40.00962	-112.09603	Allens Ranch	1	3
AR-TCH-08	Tptd	tuff of Tintic Davis Canyon member of the Packard Quartz Latite	vitrophyre	rhyolite	406402	4429394	40.00956	-112.09665	Allens Ranch	1	3
BOULTPK-209	Tbr	minette of Black Rock Canyon	minette sill	shoshonite	395313	4432231	40.03381	-112.22701	Boulter Peak	1	5
BOULTPK-409	Tbp	Gardison Ridge dike	dike	basalt	403229	4433960	40.05033	-112.13450	Boulter Peak	1	5
AR-GKM-08	Tbp	Gardison Ridge dike	dike	basalt	403229	4433960	40.05033	-112.13450	Boulter Peak	1	5
AR-S24108	Tbp	Gardison Ridge dike	dike	basalt	403229	4433960	40.05033	-112.13450	Boulter Peak	1	5
BOULTPK-110	Tbp	Boulter Peak dikes	dike	trachybasalt	401197	4430183	40.01607	-112.15775	Boulter Peak	1	5
BOULTPK-310	Tbp	Boulter Peak dikes	dike	trachybasalt	397938	4435242	40.06125	-112.19672	Boulter Peak	1	5
BOULTPK-1009	Tbc	shoshonite of Broad Canyon	lava flow	shoshonite	401195	4433721	40.04794	-112.15831	Boulter Peak	1	5
BOULTPK-1109	Tbc	shoshonite of Broad Canyon	lava flow	shoshonite	402426	4433005	40.04164	-112.14378	Boulter Peak	1	5
BOULTPK-1509	Tbc	shoshonite of Broad Canyon	lava flow	shoshonite	401136	4433033	40.04174	-112.15889	Boulter Peak	1	5
BOULTPK-108	Tbc	shoshonite of Broad Canyon	lava flow	shoshonite	401204	4433607	40.04692	-112.15818	Boulter Peak	1	5
BOULTPK-208	Tbc	shoshonite of Broad Canyon	lava flow	shoshonite	401182	4433398	40.04503	-112.15841	Boulter Peak	1	5
BOULTPK-308	Tbc	shoshonite of Broad Canyon	lava flow	shoshonite	401090	4433588	40.04673	-112.15952	Boulter Peak	1	5
BOULTPK-408	Tr	tuff of Rattlesnake Pass member of the Packard Quartz Latite	tuff	rhyolite	401178	4432759	40.03927	-112.15836	Boulter Peak	1	5
BOULTPK-909	Tr	tuff of Rattlesnake Pass member of the Packard Quartz Latite	tuff	rhyolite	400989	4432822	40.03982	-112.16059	Boulter Peak	1	5
GN2011-392	Tvd	andesite dikes member of the volcanic rocks of Goshen Canyon	dike	andesite	422139	4416136	39.89172	-111.91071	Goshen	2	4
GN2011-393	Tvd	andesite dikes member of the volcanic rocks of Goshen Canyon	dike	andesite	421818	4415807	39.88872	-111.91442	Goshen	2	4
GN2011-385	Tvc	volcanic conglomerate member of the volcanic rocks of Goshen Canyon	clast	andesite	421291	4416468	39.89463	-111.92067	Goshen	2	4
GN2011-386	Tvc	volcanic conglomerate member of the volcanic rocks of Goshen Canyon	clast	dacite	421291	4416468	39.89463	-111.92067	Goshen	2	4
GN2011-394	Tvc	volcanic conglomerate member of the volcanic rocks of Goshen Canyon	clast	latite	421761	4415826	39.88889	-111.91509	Goshen	2	4
GN2011-398	Tvc	volcanic conglomerate member of the volcanic rocks of Goshen Canyon	clast	dacite	421471	4414405	39.87606	-111.91831	Goshen	2	4
GN2011-450	Tvc	volcanic conglomerate member of the volcanic rocks of Goshen Canyon	clast	shoshonite	420754	4416094	39.89121	-111.92690	Goshen	2	4
GN2011-346	Tvp	pyroxene latite member of the volcanic rocks of Goshen Canyon	lava flow	latite	424268	4416004	39.89072	-111.88579	Goshen	2	4
GN2011-391	Tvp	pyroxene latite member of the volcanic rocks of Goshen Canyon	lava flow	latite	422240	4416274	39.89297	-111.90954	Goshen	2	4
GN2011-399	Tvp	pyroxene latite member of the volcanic rocks of Goshen Canyon	lava flow	latite	421151	4414314	39.87521	-111.92204	Goshen	2	4
GN2011-390	Tvh	pyroxene latite member of the volcanic rocks of Goshen Canyon	lava flow	andesite	422223	4416431	39.89438	-111.90976	Goshen	2	4
GN2011-400	Tvp	pyroxene latite member of the volcanic rocks of Goshen Canyon	lava flow	latite	421316	4414228	39.87445	-111.92010	Slate Jack Canyon	2	4
GN2011-396	Tvh	hornblende latite member of the volcanic rocks of Goshen Canyon	lava flow	latite	421791	4414347	39.87557	-111.91456	Goshen	2	4
GN2011-397	Tvh	hornblende latite member of the volcanic rocks of Goshen Canyon	lava flow	latite	421646	4414283	39.87498	-111.91625	Goshen	2	4
GN2011-387	Tvs	shoshonite latite member of the volcanic rocks of Goshen Canyon	lava flow	shoshonite	421363	4416741	39.89710	-111.91986	Goshen	2	4

**Notes:**

Major oxides reported in weight percent and trace elements reported in parts per million (ppm)

Location data based on NAD83

Rock name using total alkali-silica diagram of LeBas and others (1986), for values normalized to 100% on a volatile free basis (data not shown here)

LOI is loss on ignition

\* CaO adjusted because of the presence of secondary calcite (Sample, Original CaO value; AR-205, 5.57; AR-1508, 3.45)

**Analysis Source:**

<sup>1</sup> Analyses by Brigham Young University, Department of Geological Sciences; major oxides and trace elements by X-ray fluorescence spectrometry (XRF)

<sup>2</sup> Analyses by ALS USA, Inc., Reno, NV; major oxides by XRF and trace elements by inductively coupled plasma-mass spectrometry (ICP-MS)

**Reference:**

<sup>3</sup>McKean, 2011

<sup>4</sup>McKean and Solomon, 2012

<sup>5</sup>Allen, 2012

Sample	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MnO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	LOI	Total (w/ LOI)	Sc	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Nb
AR-608	47.72	2.56	16.62	12.16	0.21	4.86	8.32	2.97	2.11	0.59	0.97	99.08	16	232	27		18	29	91	22	39	947	26	224	38
AR-708	48.00	2.57	16.63	12.20	0.21	5.06	8.05	2.94	2.15	0.58	0.79	99.17	19	254	29		17	32	97	24	40	938	26	241	38
AR-AE-09	48.53	2.68	16.18	12.06	0.14	3.87	8.52	2.96	2.27	0.58	0.73	98.52	29	244	17		9	24	102	19	39	962	27	267	46
AR-JRY-08-01	47.85	2.51	16.72	11.97	0.17	4.67	8.42	3.71	2.04	0.53	0.74	99.31	19	259	35		22	31	104	23	39	993	25	234	38
AR-JRY-08-02	47.81	2.57	16.54	12.08	0.20	5.00	8.19	2.96	2.14	0.58	0.74	98.80	17	230	25		18	31	96	24	41	948	26	237	38
AR-TLA-08	48.81	2.65	16.06	11.98	0.19	3.61	8.63	3.69	2.32	0.61	0.86	99.40	19	243	14		9	27	95	24	43	958	27	245	39
AR-408	48.05	2.53	16.77	12.00	0.18	4.63	8.72	2.98	2.15	0.58	1.51	100.09	18	246	32		21	32	96	24	40	973	26	241	37
AR-2008	50.63	1.35	14.34	10.37	0.21	5.02	9.66	3.03	1.93	0.69	1.73	98.96	27	263	619		164	51	84	19	48	1123	29	222	47
AR-2506	50.41	1.31	14.39	10.16	0.19	5.25	9.76	3.12	1.94	0.74	2.44	99.73	29	255	537		187	54	95	19	45	1146	29	243	51
AR-808	57.54	0.94	15.31	6.62	0.09	4.03	6.47	3.51	2.73	0.34	1.03	98.60	15	135	135		44	29	84	21	67	1031	16	210	13
AR-109	66.81	0.44	14.84	3.61	0.06	1.35	3.74	2.88	3.59	0.09	1.33	98.73	14	31	31		4	11	47	14	136	514	17	171	13
AR-209	46.55	1.89	14.97	10.36	0.15	7.41	12.01	2.20	1.61	0.84	2.18	99.96	0	275	101		40	91	88	20	29	1527	25	272	54
AR-105	70.98	0.21	13.37	1.49	0.05	0.75	2.11	2.33	5.82	0.05	4.15	101.31	0	20	5		1	1	30	14	230	207	20	151	16
AR-1108	71.45	0.21	13.14	1.45	0.06	1.44	1.21	2.85	6.03	0.05	2.49	99.37	0	18	6		1	4	21	13	218	215	19	162	14
AR-205	65.41	0.17	12.54	1.32	0.06	1.04	*1.3	2.16	5.02	0.05	7.31	100.66	1	15	9		0	2	34	15	196	289	19	121	14
AR-305	70.17	0.20	12.94	1.31	0.06	1.10	2.11	2.43	5.61	0.06	4.02	100.01	0	20	4		0	4	33	14	198	218	20	140	15
AR-308	68.73	0.28	13.78	1.90	0.10	1.47	2.04	2.53	4.44	0.07	4.08	99.41	0	21	10		4	6	33	16	176	246	20	174	16
AR-AD-06	71.08	0.22	13.44	1.46	0.04	0.57	1.23	2.42	6.08	0.05	3.09	99.66	0	14	4		4	0	27	15	223	224	21	148	16
AR-CJS-09	71.59	0.20	13.15	1.42	0.04	0.48	1.19	2.56	6.11	0.05	2.85	99.66	1	0	4		0	2	25	9	226	197	17	141	16
AR-JR-06	69.05	0.23	13.69	1.44	0.07	0.94	1.89	2.41	5.57	0.04	4.17	99.50	0	16	5		2	0	31	16	203	221	20	152	16
AR-NKA-06	71.71	0.23	13.52	1.43	0.06	0.56	1.26	2.64	6.12	0.05	3.06	100.64	0	17	3		3	0	28	15	217	218	20	150	15
AR-PDP-09	69.91	0.20	13.01	1.39	0.05	0.64	1.30	3.43	5.68	0.06	4.07	99.74	3	0	5		0	0	26	10	198	208	16	132	14
AR-PUG-09	70.92	0.20	13.36	1.32	0.05	0.85	1.35	2.29	5.62	0.04	3.26	99.27	3	0	7		0	1	28	12	203	187	17	133	16
AR-REH-06	71.86	0.22	13.34	1.44	0.03	0.44	1.15	2.63	6.13	0.05	3.39	100.67	0	16	3		2	0	29	15	228	221	22	146	16
AR-SES-09	69.64	0.22	13.67	1.40	0.04	0.56	1.62	2.41	5.78	0.05	3.35	98.74	4	1	3		0	3	27	11	219	214	16	145	16
AR-TAC-09	70.99	0.20	12.96	1.44	0.06	0.57	1.63	2.86	5.96	0.05	3.59	100.30	3	0	4		0	6	22	8	204	217	13	134	15
AR-TDW-06	70.70	0.21	13.32	1.33	0.05	0.79	1.38	2.45	5.67	0.05	3.75	99.69	0	13	3		1	0	29	15	224	198	20	143	15
AR-RLH-08	60.24	0.91	14.59	6.94	0.13	2.84	5.58	3.18	3.42	0.31	2.00	100.14	16	133	58		14	26	65	18	112	605	26	206	14
AR-1608	59.00	0.98	14.65	7.51	0.14	3.36	5.96	3.15	2.99	0.31	0.66	98.70	15	132	45		13	25	69	18	77	611	25	180	12
AR-805	58.72	0.96	16.38	6.51	0.12	2.39	5.60	3.68	2.99	0.46	1.29	99.10	13	88	10		6	13	73	20	101	630	33	220	14
AR-1408	62.99	0.82	17.04	4.25	0.07	1.32	4.48	3.29	3.87	0.19	1.24	99.55	14	66	8		5	12	62	21	123	742	33	302	15
AR-2606	66.40	0.65	15.43	3.65	0.09	0.99	3.43	3.06	4.38	0.21	1.59	99.88	14	41	7		6	2	45	19	151	624	36	328	16
AR-2706	65.10	0.77	16.21	3.85	0.06	1.06	3.76	3.17	4.21	0.21	1.06	99.44	13	46	9		2	4	49	19	142	651	34	337	16
AR-PG-09	66.16	0.70	15.64	3.71	0.06	1.04	3.37	2.96	4.43	0.15	0.88	99.10	12	38	9		0	12	53	15	152	566	31	344	16
AR-SAM-06	66.95	0.72	15.48	3.88	0.07	0.86	3.51	2.99	4.25	0.22	1.34	100.27	13	48	9		3	4	44	18	137	597	29	312	14
AR-KLG-08	59.34	0.95	16.92	5.28	0.14	1.39	3.80	3.97	5.61	0.29	1.03	98.70	11	96	10		7	23	87	23	219	785	37	377	25
AR-S7608	58.88	1.03	17.06	5.89	0.12	1.35	3.53	3.63	5.55	0.34	1.18	98.56	11	112	11		5	26	84	24	220	841	35	375	25
AR-1808	66.70	0.71	14.34	4.17	0.17	0.67	2.20	4.15	5.97	0.19	0.82	100.07	9	52	9		5	17	44	18	190	419	35	423	19
AR-S13408	61.79	0.99	17.59	3.47	0.07	0.99	2.54	3.79	5.75	0.36	1.57	98.90	12	103	8		7	14	85	22	228	768	36	345	26
GN2011-401	60.29	0.93	17.30	5.23	0.08	1.06	3.07	3.58	5.51	0.33	1.99	99.59		84	10	8				25	244	681	36	429	24
AR-1508	71.81	0.22	12.74	1.77	0.04	0.45	*1.5	3.41	4.82	0.07	2.15	100.93		21	5		2	6	14	12	193	247	16	124	15
AR-208	70.47	0.27	14.16	1.70	0.09	1.22	1.30	2.88	4.56	0.06	4.07	100.77		31	11		4	4	42	17	192	287	16	161	17
AR-405	74.81	0.23	12.05	1.73	0.02	0.54	1.73	2.82	4.39	0.13	0.68	99.13	0	25	5		3	2	11	11	139	226	15	122	13
AR-505	69.04	0.24	13.48	1.79	0.06	0.83	2.54	3.37	4.51	0.09	3.88	99.83		24	6		0	1	30	15	230	315	20	115	18
AR-605	70.16	0.25	14.03	1.88	0.07	0.97	2.45	3.15	4.48	0.08	2.42	99.94		26	5		0	1	29	15	260	258	21	121	18
AR-905	72.05	0.24	12.95	1.83	0.07	0.72	2.09	3.22	4.84	0.11	1.01	99.13	0	19	5		2	2	17	13	166	252	17	116	14
AR-APM-08	71.10	0.25	14.30	1.96	0.07	1.00	2.04	3.45	4.34	0.06	2.02	100.60		18	6		1	2	23	16	223	268	19	126	17
AR-BL-06	67.51	0.24	13.75	1.82	0.03	0.85	2.54	3.99	4.39	0.09	4.31	99.52		18	3		2	0	27	16	277	316	19	116	16
AR-BLB-06	77.08	0.21	11.52	1.50	0.05	0.37	1.46	2.81	4.00	0.07	1.30	100.37		17	3		0	0	18	12	135	190	16	106	14
AR-DD-09	70.85	0.26	13.80	1.95	0.04	0.75	1.74	3.08	4.47	0.06	1.72	98.72	3	0	6		0	0	19	6	237	245	16	111	18
AR-DPL-09	70.63	0.25	14.10	1.86	0.05	0.92	1.85	3.12	4.39	0.06	1.86	99.09	5	0	5		0	0	24	9	228	245	15	116	18
AR-JL-09	70.52	0.25	13.69	1.95	0.04	0.71	2.62	3.13	4.66	0.08	2.10	99.75	7	0	8		0	4	17	4	235	248	14	114	18
AR-JSC-08	73.04	0.22	12.78	1.64	0.09	0.84	1.67	3.03	3.92	0.07	1.54	98.85		21	3		2	2	19	11	115	249	18	120	14
AR-ML-09	70.38	0.25	13.94	1.92	0.06	0.82	1.97	3.08	4.62	0.07	1.92	99.02	5	0	5		0	5	21	9	258	242	14	116	18
AR-MP-06	69.54	0.26	14.12	1.87	0.06	0.84	1.84	3.22	4.44	0.10	2.37	98.65		20	4		2		27	16	239	255	20	124	18
AR-NJ-06	74.40	0.23	12.66	1.70	0.04	0.44	1.79	3.32	4.65	0.08	1.06	100.35		20	3		2	0	21	13	183	205	18	113	16
AR-RWB-09	74.62	0.2																							

Sample	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MnO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	LOI	Total (w/ LOI)	Sc	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Nb
AR-SDF-06	73.90	0.22	12.94	1.74	0.05	0.63	1.75	2.87	4.43	0.05	1.82	100.40		20	5		0	0	23	13	105	215	14	115	15
AR-TPW-06	76.92	0.19	11.33	1.58	0.05	0.35	1.55	2.74	3.96	0.07	1.54	100.27		18	3		0	0	18	11	136	191	16	106	15
AR-2108	70.30	0.30	14.05	2.12	0.08	0.38	1.48	2.73	4.88	0.05	3.35	99.71	18	6	0		0	8	37	20	126	386	21	226	14
GN2011-384	68.11	0.33	14.54	2.35	0.05	0.59	2.02	2.05	5.29	0.10	3.75	99.50		24	<10	4				18	142	484	19	229	14
GN2011-388	67.93	0.34	14.47	2.53	0.05	0.72	2.15	2.33	5.23	0.10	3.19	99.36		25	<10	3				18	128	475	21	238	14
AR-107	68.57	0.37	14.48	2.57	0.10	0.73	2.33	3.43	4.59	0.11	2.44	99.72	0	12	1		4	2	28	14	119	463	20	212	13
AR-108	68.18	0.37	14.37	2.52	0.09	0.75	2.20	3.18	4.73	0.11	2.56	99.04	3	16	4		2	6	30	14	115	442	23	216	13
AR-1708	68.48	0.36	14.47	2.50	0.11	0.71	2.31	3.31	4.65	0.10	2.68	99.67	3	10	3		1	5	35	13	115	448	21	212	13
AR-TCH-08	68.06	0.38	14.49	2.14	0.08	0.79	2.23	3.20	4.56	0.12	2.86	98.91	9	13	2		2	4	36	15	119	448	23	216	13
BOULTPK-209	48.60	2.02	11.82	9.43	0.09	7.40	8.96	2.62	4.35	1.09	3.56	99.94	21	208	213		116	70	98	18	83	1225	28	358	29
BOULTPK-409	45.39	1.46	13.26	10.14	0.16	8.75	13.68	2.51	0.95	1.02	2.87	100.18	32	258	342		80	97	84	17	56	1547	24	233	54
AR-GKM-08	46.05	1.40	13.43	10.31	0.18	9.03	12.48	2.47	1.66	0.89	1.73	99.63	27	255	349		72	81	77	17	82	1485	26	201	53
AR-S24108	45.81	1.40	13.26	10.18	0.20	9.23	12.41	2.50	1.28	0.81	1.89	98.97	32	261	341		76	98	81	17	29	1589	24	237	53
BOULTPK-110	47.79	1.63	15.02	10.52	0.17	7.09	11.27	2.97	1.77	0.98	1.09	100.31	28	267	107		38	86	83	18	30	1585	26	262	56
BOULTPK-310	47.44	1.68	15.45	10.20	0.16	6.12	9.40	2.55	2.78	1.04	3.46	100.27	23	236	37		28	88	84	19	66	1948	27	283	57
BOULTPK-1009	55.61	1.08	14.06	7.32	0.12	5.20	8.51	3.88	2.64	0.86	0.82	100.09	21	147	226		38	39	76	18	52	1566	23	290	51
BOULTPK-1109	55.18	1.08	13.98	7.22	0.12	4.53	8.88	3.75	2.83	0.87	1.44	99.86	22	143	229		40	39	68	19	65	1581	23	290	51
BOULTPK-1509	54.35	1.16	14.56	7.81	0.12	4.27	8.42	3.68	2.75	0.93	0.69	98.74	21	162	188		36	36	78	20	54	1630	26	308	55
BOULTPK-108	54.49	1.07	13.89	7.34	0.13	5.63	8.88	3.65	2.70	0.80	0.72	99.31	23	150	206		31	34	68	17	59	1507	21	264	54
BOULTPK-208	54.64	1.07	13.98	7.15	0.15	5.59	8.62	3.67	2.72	0.79	0.41	98.79	17	152	159		29	26	63	19	55	1434	20	228	51
BOULTPK-308	54.03	1.05	13.75	7.17	0.13	5.66	9.09	3.67	2.67	0.81	1.06	99.09	23	144	201		29	37	65	16	60	1504	21	262	53
BOULTPK-408	69.20	0.39	14.46	2.02	0.04	1.26	2.73	3.19	3.61	0.10	3.97	100.96		18	4		2	6	30	14	149	348	23	166	15
BOULTPK-909	70.10	0.31	13.97	1.93	0.07	1.11	1.88	2.75	3.72	0.07	3.94	99.85	4	24	3		9	7	38	16	144	319	19	137	14
GN2011-392	59.28	0.87	17.25	6.57	0.09	1.57	5.49	3.56	2.69	0.44	1.49	99.30		81	<10	9				26	65	893	38	298	14
GN2011-393	57.79	0.80	16.48	6.02	0.13	1.96	6.08	3.29	2.93	0.42	3.77	99.67		79	<10	10				26	74	733	39	306	15
GN2011-385	57.30	1.00	17.03	7.45	0.14	2.96	6.04	2.55	3.46	0.35	1.44	99.72		150	10	20				24	104	586	37	256	12
GN2011-386	62.26	0.47	16.90	3.61	0.06	1.26	3.52	3.13	3.75	0.20	4.20	99.36		27	<10	5				23	145	665	27	385	16
GN2011-394	56.02	1.07	17.75	7.59	0.16	2.49	6.68	3.27	3.16	0.42	1.26	99.87		141	<10	20				25	89	690	33	298	13
GN2011-398	62.64	0.45	17.02	3.89	0.07	0.56	3.69	2.91	3.88	0.23	4.04	99.38		12	<10	3				23	132	650	31	331	17
GN2011-450	54.90	1.00	17.54	7.93	0.20	2.64	7.10	2.71	3.22	0.44	2.16	99.84		146	<10	21				25	112	728	35	280	13
GN2011-346	56.18	1.05	17.58	8.50	0.13	2.38	6.37	3.26	2.88	0.42	1.02	99.77		149	<10	18				25	75	716	34	332	13
GN2011-391	55.84	1.04	17.63	8.29	0.13	2.28	6.41	3.20	2.87	0.43	1.29	99.41		127	<10	17				24	71	724	33	338	14
GN2011-399	58.93	0.88	17.27	5.58	0.12	1.48	5.86	3.22	3.40	0.41	1.67	98.82		71	<10	11				26	114	737	51	376	19
GN2011-390	60.25	0.72	17.55	5.53	0.13	1.63	5.21	3.38	3.19	0.35	1.49	99.43		38	10	6				25	94	783	34	305	16
GN2011-400	59.90	0.89	17.39	6.36	0.09	1.47	5.12	3.28	3.46	0.42	1.34	99.72		70	<10	10				25	114	712	43	362	19
GN2011-396	58.11	0.81	17.93	6.88	0.14	1.13	4.72	3.37	3.16	0.42	2.02	98.69		54	<10	13				25	77	692	34	320	15
GN2011-397	60.02	0.83	17.88	6.45	0.05	0.71	4.56	3.49	3.33	0.41	2.05	99.78		74	<10	10				24	95	714	35	304	15
GN2011-387	55.20	1.12	16.60	9.02	0.18	3.50	6.66	2.92	2.99	0.36	1.04	99.59		199	20	26				24	87	575	37	246	12





Sample	Ba	Pb	Th	U	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Mo	Sn	Cs	Hf	Ta	W
AR-SDF-06	651	25	19		34	68			4															
AR-TPW-06	628	24	17	2	30	60			5															
AR-2108	2510	26	15	0	113	212		69	12															
GN2011-384	2590		21	5	101	161	16.1	49.3	6.6	1.52	4.45	0.61	3.52	0.66	1.94	0.28	1.85	0.28	<2	2	3.7	6	1.2	3
GN2011-388	2520		21	4	99	168	16.2	51.3	7.2	1.61	4.90	0.65	3.76	0.72	2.04	0.29	1.84	0.28	<2	1	3.5	6	1.1	2
AR-107	2664	24	20	5	89	170		65	13															
AR-108	2920	22	18	5	83	146		46	10															
AR-1708	2587	22	18	4	90	160		50	11															
AR-TCH-08	3349	22	16	4	82	155		52	11															
BOULTPK-209	2806	21	13	1	147	216		123	11															
BOULTPK-409	2958	25	15		169	172		103	10															
AR-GKM-08	2853	14	16	3	139	256		118	16															
AR-S24108	2784	15	12	3	130	261		115	22															
BOULTPK-110	3034	18	15		139	187		106	10															
BOULTPK-310	3362	22	20		163	186		111	11															
BOULTPK-1009	3459	30	22	2	136	145		93	9															
BOULTPK-1109	3485	26	21	2	137	141		91	9															
BOULTPK-1509	3773	29	21	1	143	132		94	10															
BOULTPK-108	3253	26	21	5	154	306		99	17															
BOULTPK-208	3286	25	19	5	123	235		98	16															
BOULTPK-308	3395	24	21	5	157	315		98	17															
BOULTPK-408	913	23	20	5	43	82		38	8															
BOULTPK-909	841	23	16	5	30	53		26	4															
GN2011-392	1190		10	2	65	121	15.1	57.3	10.4	2.73	8.77	1.17	6.99	1.37	3.90	0.53	3.38	0.49	<2	2	0.6	8	0.7	2
GN2011-393	1210		9	2	63	124	14.2	53.2	9.6	2.55	8.09	1.11	7.03	1.40	4.02	0.57	3.76	0.56	<2	2	1.1	8	0.7	2
GN2011-385	1275		11	3	51	100	11.5	43.6	8.4	2.21	7.64	1.10	6.83	1.36	3.90	0.55	3.56	0.52	<2	2	2.4	7	0.7	2
GN2011-386	1605		15	3	61	116	12.8	46.2	7.6	2.01	5.91	0.81	4.77	0.93	2.69	0.40	2.61	0.39	<2	2	2.6	10	0.9	2
GN2011-394	1545		8	2	47	91	10.7	40.9	8.1	2.33	7.09	1.01	6.07	1.21	3.34	0.47	3.09	0.46	<2	1	2.4	8	0.7	2
GN2011-398	1500		13	3	62	120	13.3	47.9	8.1	2.17	6.57	0.90	5.29	1.08	3.19	0.45	2.99	0.45	2	2	3.0	8	0.9	2
GN2011-450	1405		9	2	49	99	11.5	44.1	8.5	2.44	7.49	1.05	6.39	1.26	3.58	0.50	3.25	0.49	<2	2	2.9	7	0.6	2
GN2011-346	1385		8	2	46	92	10.8	41.8	8.3	2.45	7.09	0.98	6.02	1.16	3.25	0.46	2.98	0.43	<2	1	1.9	8	0.7	2
GN2011-391	1380		8	2	46	92	10.7	41.3	7.9	2.43	7.19	1.01	6.06	1.21	3.39	0.47	3.06	0.44	<2	1	1.9	8	0.7	2
GN2011-399	1310		14	3	69	137	15.7	58.4	10.7	2.66	9.26	1.33	8.30	1.72	4.95	0.70	4.57	0.69	<2	2	4.1	10	1.0	2
GN2011-390	1220		12	2	65	128	14.7	53.7	9.5	2.46	7.72	1.05	6.16	1.23	3.58	0.50	3.32	0.50	2	2	2.2	8	0.8	2
GN2011-400	1245		14	3	66	132	15.2	56.9	10.3	2.64	9.07	1.31	7.83	1.56	4.51	0.62	4.04	0.59	2	2	3.0	10	1.0	2
GN2011-396	1565		9	2	53	103	11.9	45.3	8.6	2.42	7.24	1.01	6.18	1.22	3.50	0.48	3.23	0.48	<2	1	0.6	8	0.8	2
GN2011-397	1565		9	2	56	104	12.4	45.9	8.5	2.47	7.21	1.01	5.94	1.22	3.40	0.48	3.20	0.48	<2	1	2.4	8	0.8	2
GN2011-387	1210		9	2	46	93	10.8	41.2	8.4	2.22	7.52	1.08	6.63	1.32	3.77	0.55	3.45	0.51	<2	2	2.0	7	0.6	2