TABLE DR1. $^{40}AR/^{39}AR$ ANALYTICAL DATA FOR RODEO GRABEN SANIDINES

ID	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x10^{-3}$)	$^{39}Ar_K$† ($x10^{-15}$ mol)	K/Ca#	%^{40}Ar*§	Age (Ma)	Å2&†† (Ma)
M-11, single crystal sanidine, J = 0.00080327 Å 0.09%, NM-65, Lab# = 7747								
13	21.38	0.0235	0.7909	2.21	21.7	98.9	30.39	0.16
14	21.54	0.0171	1.324	1.50	29.8	98.2	30.40	0.18
12	21.49	0.0204	0.9474	1.72	25.0	98.7	30.48	0.16
11	21.52	0.0167	0.9056	3.09	30.5	98.8	30.55	0.16
05	21.25	0.0174	-0.0444	4.27	29.2	100.1	30.56	0.16
07	21.50	0.0174	0.7779	3.33	29.3	98.9	30.56	0.14
10	21.37	0.0239	0.1631	3.65	21.4	99.8	30.64	0.15
01	21.43	0.0174	0.3460	3.08	29.3	99.5	30.65	0.13
02	21.44	0.0201	0.3175	1.53	25.3	99.6	30.68	0.17
03	21.37	0.0211	0.0432	3.15	24.2	99.9	30.69	0.14
08	21.66	0.0211	1.019	3.28	24.2	98.6	30.70	0.15
04	21.35	0.0179	-0.0643	2.91	28.5	100.1	30.70	0.14
15	21.48	0.0185	0.3353	1.40	27.5	99.5	30.73	0.18
09	21.42	0.0206	0.1065	3.19	24.7	99.9	30.74	0.14
06	21.45	0.0197	0.0187	1.80	25.9	100.0	30.81	0.17
weighted mean		n = 15			26.4 Å 5.9		30.62	0.09
M-13, single crystal sanidine, J = 0.00080368 Å 0.09%, NM-65, Lab# = 7748								
07	21.25	0.0200	0.0857	3.46	25.5	99.9	30.51	0.15
05	21.32	0.0218	0.3223	2.06	23.4	99.6	30.52	0.15
04	21.32	0.0167	0.2948	4.43	30.6	99.6	30.53	0.14
14	21.32	0.0192	0.2236	1.96	26.6	99.7	30.56	0.14
15	21.43	0.0171	0.5834	1.44	29.9	99.2	30.57	0.17
01	21.24	0.0167	-0.0806	3.57	30.5	100.1	30.58	0.15
09	21.36	0.0166	0.2893	3.21	30.7	99.6	30.58	0.15
10	21.33	0.0183	0.1456	4.55	27.8	99.8	30.60	0.17
08	21.34	0.0175	0.1658	1.76	29.2	99.8	30.61	0.17
02	21.38	0.0173	0.2616	2.38	29.6	99.6	30.63	0.14
13	21.40	0.0221	0.2363	1.90	23.1	99.7	30.67	0.14
12	21.36	0.0156	0.0731	1.82	32.7	99.9	30.68	0.15
11	22.42	0.0191	3.474	1.80	26.7	95.4	30.75	0.26
03	21.41	0.0162	-0.0380	2.43	31.6	100.1	30.79	0.14
06	21.43	0.0183	0.0438	2.00	28.0	99.9	30.79	0.15
weighted mean		n = 15			28.4 Å 5.8		30.62	0.09

M-13, single crystal sanidine, J = 0.000807318 Å 0.09%, NM-77, Lab# = 8347

3	21.46	0.0154	2.058	1.25	33.2	97.2	30.13	0.19
2	21.10	0.0184	0.4619	2.94	27.7	99.4	30.28	0.14
8	21.11	0.0161	0.2146	11.3	31.7	99.7	30.39	0.13
10	21.26	0.0173	0.6082	8.10	29.5	99.2	30.44	0.13
15	21.22	0.0170	0.3867	2.89	30.0	99.5	30.48	0.13
1	21.17	0.0170	0.0459	5.34	30.0	99.9	30.55	0.13
11	21.28	0.0169	0.2837	4.09	30.2	99.6	30.61	0.13
12	22.27	0.0171	3.537	3.49	29.8	95.3	30.66	0.15
weighted mean			n = 8		30.3 Å 3.2		30.46	0.13

M-12, single crystal sanidine, J = 0.000807089 Å 0.09%, NM-77, Lab# = 8348

6	22.29	0.0128	0.1018	9.19	40.0	99.9	32.12	0.14
1	22.44	0.0127	0.2711	7.58	40.2	99.6	32.27	0.13
13	22.49	0.0232	0.4092	4.94	22.0	99.5	32.29	0.15
7	22.43	0.0233	0.1528	7.01	21.9	99.8	32.30	0.13
3	22.75	0.0080	1.174	6.26	63.5	98.5	32.32	0.14
8	22.47	0.0121	0.1898	7.35	42.1	99.8	32.35	0.14
5	22.47	0.0196	0.1912	3.01	26.0	99.8	32.35	0.14
14	22.48	0.0139	0.1451	6.00	36.8	99.8	32.38	0.12
15	23.22	0.0184	2.624	10.4	27.7	96.7	32.39	0.15
11	22.53	0.0152	0.2243	4.87	33.6	99.7	32.42	0.15
4	23.26	0.0189	2.631	7.52	27.0	96.7	32.44	0.14
weighted mean			n = 11		34.6 Å 24.2		32.33	0.09

M-14, single crystal sanidine, J = 0.00080388 Å 0.09%, NM-65, Lab# = 7749

06	29.30	0.0106	0.1944	3.20	48.4	99.8	41.92	0.22
03	29.33	0.0096	0.1723	2.41	53.4	99.8	41.98	0.20
14	29.43	0.0100	0.4467	3.69	50.9	99.6	42.00	0.19
15	29.43	0.0098	0.3739	3.50	51.9	99.6	42.03	0.20
05	29.39	0.0113	0.1942	3.02	45.2	99.8	42.05	0.18
11	29.33	0.0083	-0.0354	5.75	61.8	100.0	42.06	0.22
07	29.45	0.0088	0.2414	4.31	58.3	99.8	42.11	0.19
04	29.36	0.0092	-0.0980	4.01	55.4	100.1	42.13	0.21
13	29.40	0.0091	0.0015	3.59	56.1	100.0	42.14	0.21
09	29.41	0.0111	-0.0194	4.25	46.0	100.0	42.17	0.19
08	29.55	0.0093	0.4318	6.85	55.0	99.6	42.18	0.21
01	29.47	0.0090	0.0391	3.80	56.7	100.0	42.23	0.19
02	29.58	0.0083	0.3292	6.27	61.5	99.7	42.26	0.20
12	29.50	0.0100	0.0320	3.03	51.0	100.0	42.26	0.18

10	29.62	0.0094	0.1596	3.54	54.3	99.8	42.39	0.22
weighted mean		n = 15			53.7 Å 10.0		42.13	0.11

Note: Each data line represents a laser-fusion analysis of a single sanidine crystal. Measured isotopic ratios are corrected for blank, radioactive decay, and mass discrimination, but not corrected for interfering reactions. Weighted mean line shows n = number of individual crystal analyses used in mean, mean K/Ca value Å 2&, and weighted mean age Å 2&, calculated by inverse variance weighting (Samson and Alexander, 1987). Mean age errors include errors in J and irradiation parameters. Decay constant and isotopic abundances after Steiger and Jäger (1977). Sample preparation and irradiation: Sanidine separated by crushing, LST heavy liquid, Franz, HF, then irradiated in machined Al discs in two separate irradiations (NM-65 and NM-77), each for 7 hours in the D-3 position, Nuclear Science Center, College Station, Texas. Neutron flux monitored by interlaboratory standard Fish Canyon Tuff sanidine FC-1 with an assigned age of 27.84 Ma (Deino and Potts, 1990), relative to Mmhb-1 at 520.4 Ma (Samson and Alexander, 1987). Instrumentation: Mass Analyzer Products 215-50 mass spectrometer on line with automated, all-metal extraction system at New Mexico Geochronology Research Laboratory, Socorro. Individual sanidine crystals were fused in vacuo by a 10W continuous CO_2 laser. Reactive gases removed for 1 to 2 minutes by SAES GP-50 getters operated at 20^{o}C and ~450^{o}C. Analytical parameters: electron multiplier sensitivity = $6x10^{-17}$ moles/pA; average system blanks = 300, 3, 0.6, 1.2, $1.2x10^{-18}$ moles at masses 40, 39, 38, 37, and 36, respectively. J-factors determined to a precision of Å 0.2% by CO_2 laser-fusion of 4 to 6 single crystals from each of 4 radial positions around irradiation vessel. Correction factors for interfering nuclear reactions, determined using K-glass and CaF_2: $(^{40}Ar/^{39}Ar)_K$ = 0.00020 Å 0.0003; $(^{36}Ar/^{37}Ar)_{Ca}$ = 0.00026 Å 0.00002; and $(^{39}Ar/^{37}Ar)_{Ca}$ = 0.00070 Å 0.00005.

$^{\dagger}{}^{39}Ar_K$ = number of moles of ^{39}Ar produced from neutron irradiation of K.

$^{\S}\%^{40}Ar^*$ = percentage of radiogenically derived ^{40}Ar (non-atmospheric).

$^{\#}K/Ca$ = molar ratio calculated from $^{39}Ar_K$ and $^{37}Ar_{Ca}$.

†† Age errors for individual analyses show analytical error only.

TABLE DR2. MODES DETERMINED BY POINT COUNTING (VOLUME %)

Sample	DGO-410	DGO-411	DGO-412	DGO-413	DGO-414	H90-35	NA-55	SL-29	NA-41
Pl ph	0.6	3.3	1.2	3.4	0.7	1.0	8.3	3.0	4.2
Pl mp	17.7	16.6	14.3	10.6	33.5	39.6	5.8	13.6	12.5
Pl mc	1.3	6.4	0.8	1.5	1.0	0	5.0	1.1	2.9
Ol ph	0.4	0.6	2.6	2.0	0.8	0.2	0.6	0.8	1.5
Ol mp	5.8	3.9	11.7	10.9	15.3	14.8	3.2	7.4	5.7
Ol mc	0.2	0.8	0	0	0	0	0	0	0
Cpx ph	0	0	0	0	0	0	0.1	0	0
Cpx mp	0	0	0.1	0	0.1	9.2	0.3	0	0.4
Cpx mc	0	0	0.4	0	0.4	0	2.5	0	0.2
Ox mp	0.1	0.8	1.1	1.6	3.4	7.9	0.7	2.9	2.1
Ox mc	0	1.5	0	0.1	0.1	0	0	0	0.2
Bt mp	0	0.2	0	0	0	0.3	0.7	0.1	0
Ap mc	0	0.1	0	0	0	0	0	0	0
Sm	0	0.1	0	0	0	13.8	0	0	0
Cc	0	0	0	1.3	0	0	0	0	0
Chl	0	0	0	0	0	0.9	0	0	0
Z	0	0	0	0	0	0	0	0.1	0
Qrp	<0.1	0	0	0	<0.1	0	0.1	0	0
Matrix	73.9	65.7	67.8	68.6	44.7	12.3	72.7	71.0	70.3

Note: More than 1,000 points counted. Abbreviations: ph - phenocryst (>0.3 mm); mp - microphenocryst (>0.03 mm, <0.3 mm: after Wilcox, 1954); mc - megacrysts or xenocryst. Pl - plagioclase; Ol - olivine; Cpx - Ca-rich pyroxene; Ox - oxide minerals including titanomagnetite and other spinels; Bt - biotite; Ap - apatite; Cc - secondary calcite; Chl - chlorite; Z - secondary zeolite; Qrp - quartz reaction products, interpreted as former quartz xenocrysts that reacted to form glass plus clinopyroxene - later the glass reacted to form feldspar and zeolites. Altered olivine was counted as olivine; see comments below. Course (>0.03 mm) patches of smectite, calcite, chlorite, or zeolites in the groundmass or vesicles were counted separately, but finer ones were not. Additional comments: DGO-410: minor alteration of olivine, some zeolites filling vesicles. DGO-411: minor alteration of olivine. DGO-412: moderate-strong alteration of olivine, most microphenocrysts completely altered, phenocrysts have 30-40 μm thick alteration rims. DGO-413: Olivine strongly altered along rims. Many vesicles filled with calcite. Calcite and smectite are present in the groundmass. DGO-414: moderate-strong alteration of olivine, most microphenocrysts completely altered, phenocrysts have 20-60 μm thick alteration rims. Groundmass includes chlorite, zeolites, and calcite. H90-35: moderate-strong alteration of olivine, most microphenocrysts completely altered, phenocrysts have 40-100 μm thick alteration rims. Groundmass has many large patches rich in smectite and lesser chlorite. These two phases were counted separately. NA-55: very minor alteration of olivine. SL-29: moderate alteration of olivine and smectite replacement of groundmass glass. NA-41: minor alteration of olivine rims and adjacent to fractures.

TABLE DR3. REPRESENTATIVE ELECTRON MICROPROBE ANALYSES OF PLAGIOCLASE FROM RODEO-NAZAS SAMPLES

Number	SiO_2	Al_2O_3	$Fe_2O_3^t$	MgO	CaO	SrO	Na_2O	K_2O	Total	mol% An
1	51.97	30.32	0.52	0.10	12.65	0.11	3.98	0.39	100.05	62.3
2	56.01	28.14	0.23	0.05	9.45	0.25	5.72	0.77	100.63	45.6
3	53.00	29.39	0.66	0.04	11.76	0.18	4.62	0.25	99.91	57.6
4	54.47	28.95	0.22	0.04	10.28	0.22	5.25	0.70	100.14	49.9
5	59.31	24.97	0.23	0.02	6.47	0.29	6.60	1.85	99.74	31.4
6	60.45	24.73	0.14	0.02	5.78	0.20	6.85	2.13	100.30	27.9
7	51.64	30.49	0.62	0.09	13.12	0.15	3.80	0.40	100.32	64.1
8	55.56	27.76	0.41	0.11	10.13	0.13	5.37	0.69	100.15	49.0
9	53.16	29.73	0.52	0.08	12.05	0.16	4.41	0.50	100.61	58.4
10	58.68	25.78	0.30	0.03	7.38	0.09	6.56	1.31	100.15	35.4
11	49.94	32.04	0.60	0.09	14.64	0.17	3.10	0.29	100.87	71.1
12	55.10	28.60	0.42	0.06	10.28	0.18	5.19	0.75	100.58	50.0

Note: Five samples were selected for detailed analysis of mineral compositions by electron microprobe: DGO-410, DGO-411, NA-41, NA-55, and SL-29. Minerals were analyzed at the Smithsonian Institution using a JEOL JXA-8900R instrument with 15 kV accelerating voltage, 20 nA beam current, focused beam, off-peak background corrections, and a combination of natural and synthetic standards similar in composition to the unknowns; all oxide values in wt.%.

Number 1, phenocryst core from DGO-410.
Number 2, megacryst core from DGO-410.
Number 3, phenocryst core from DGO-411.
Number 4, megacryst core from DGO-411; intergrown with spinel megacryst number 2.
Number 5, megacryst core from DGO-411; host to spinel inclusion number 5.
Number 6, megacryst core from DGO-411.
Number 7, megacryst rim from NA-55.
Number 8, megacryst core from NA-55.
Number 9, phenocryst core from SL-29.
Number 10, megacryst core from SL-29.
Number 11, megacryst rim from NA-41, at 60 micron mark in Fig. 4A.
Number 12, megacryst core from NA-41, at 140 micron mark in Fig. 4A.

TABLE DR4. REPRESENTATIVE ELECTRON MICROPROBE ANALYSES OF OLIVINE FROM RODEO-NAZAS SAMPLES

No.	SiO_2	FeO	MnO	MgO	NiO	CaO	Total	Mg#
1	37.00	29.09	0.76	33.29	0.09	0.35	100.57	67.1
2	38.06	24.05	0.48	37.78	0.12	0.28	100.75	73.7
3	36.84	31.12	0.74	31.09	0.09	0.38	100.27	64.0
4	35.54	37.38	0.96	25.86	0.03	0.27	100.03	55.2
5	36.38	32.05	0.91	29.95	0.10	0.36	99.76	62.5
6	36.44	31.69	0.70	31.35	0.03	0.36	100.57	63.8
7	37.13	30.12	0.83	32.39	0.08	0.29	100.84	65.7
8	37.46	28.30	0.70	34.05	0.06	0.33	100.91	68.2
9	36.23	33.28	0.79	29.38	0.04	0.36	100.09	61.1
10	36.56	30.78	0.83	30.78	0.08	0.38	99.40	64.1
11	36.42	31.73	0.78	30.15	0.02	0.38	99.48	62.9
12	37.22	28.62	0.62	33.15	0.10	0.37	100.07	67.4
13	36.76	30.64	0.63	31.71	0.04	0.40	100.18	64.9
14	37.46	26.88	0.57	34.99	0.14	0.29	100.32	69.9
15	38.39	19.94	0.36	40.27	0.22	0.23	99.40	78.3
16	37.87	24.97	0.58	36.38	0.13	0.29	100.22	72.2
17	38.47	19.58	0.38	40.76	0.21	0.24	100.56	78.8

Note: see Table DR3 for analytical conditions; all oxide values in wt.%.

Number 1, phenocryst rim from DGO-410, rim of core number 2.

Number 2, phenocryst core from DGO-410, core of rim number 1.

Number 3, megacryst rim from DGO-411, at 0 micron mark of Fig. 4B, rim of core number 4.

Number 4, megacryst core from DGO-411, at 540 micron mark of Fig. 4B, core of rim number 3.

Number 5, microphenocryst rim from DGO-411.

Number 6, microphenocryst rim from NA-55.

Number 7, phenocryst rim from NA-55, rim to core number 8.

Number 8, phenocryst core from NA-55, core to rim number 7.

Number 9, microphenocryst rim from SL-29, rim to core number 10.

Number 10, microphenocryst core from SL-29, core to rim number 9.

Number 11, groundmass crystal from SL-29.

Number 12, microphenocryst core from NA-41, adjacent to spinel inclusion number 13.

Number 13, groundmass crystal from NA-41.

Number 14, phenocryst rim from NA-41, rim to core number 15.

Number 15, phenocryst core from NA-41, core to rim number 14.

Number 16, phenocryst core from NA-41.

Number 17, phenocryst core from NA-41, adjacent to spinel inclusion number 14.

TABLE DR5. REPRESENTATIVE ELECTRON MICROPROBE ANALYSES OF CLINOPYROXENE FROM RODEO-NAZAS SAMPLES

No.	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	MnO	MgO	NiO	CaO	Na_2O	Total	Fe^t	Mg	Ca
1	53.16	0.81	1.15	0.03	7.93	0.18	15.52	0.05	21.11	0.39	100.32	12.7	44.2	43.2
2	50.11	1.77	3.40	0.06	9.09	0.23	13.80	0.00	20.73	0.36	99.55	15.1	40.8	44.1
3	52.21	1.42	2.88	0.03	8.15	0.23	13.81	0.06	21.58	0.78	101.15	13.5	40.7	45.8
4	49.57	2.08	3.88	0.07	9.60	0.20	13.89	0.06	20.15	0.50	100.00	16.0	41.1	42.9
5	51.44	0.73	2.86	0.01	8.70	0.31	12.98	0.05	20.57	0.83	98.48	14.9	39.8	45.3
6	48.98	1.12	8.66	0.02	8.14	0.18	15.01	0.03	18.21	0.68	101.04	14.0	45.9	40.1
7	48.63	1.11	8.71	0.03	8.42	0.18	14.64	0.07	17.89	0.66	100.35	14.7	45.4	39.9
8	52.44	0.88	2.02	0.01	9.19	0.23	14.37	0.06	20.34	0.57	100.11	15.1	42.1	42.8
9	51.27	1.29	2.52	0.01	8.98	0.15	13.90	0.04	20.78	0.44	99.36	14.9	41.0	44.1
10	51.37	1.44	2.69	0.00	8.92	0.20	13.73	0.04	21.17	0.47	100.04	14.7	40.4	44.8
11	50.23	1.40	5.01	0.21	6.85	0.22	14.24	0.09	21.44	0.44	100.12	11.5	42.5	46.0
12	51.52	1.35	2.59	0.03	8.51	0.24	14.00	0.00	21.19	0.51	99.94	14.0	41.2	44.8
13	47.85	1.63	9.03	0.05	9.25	0.19	13.28	0.06	17.34	0.88	99.56	16.8	42.9	40.3

Note: see Table DR3 for analytical conditions; all oxide values in wt.%; Fe^t, Mg, and Ca in atom%.

Number 1, microphenocryst rim from DGO-410.

Number 2, groundmass crystal from DGO-410.

Number 3, groundmass crystal from DGO-411.

Number 4, groundmass crystal from NA-55.

Number 5, microphenocryst rim from NA-55.

Number 6, megacryst core from NA-55.

Number 7, megacryst core from NA-55.

Number 8, rim of exsolved xenocryst from SL-29.

Number 9, core of exsolved xenocryst from SL-29.

Number 10, groundmass crystal from SL-29.

Number 11, phenocryst core from NA-41.

Number 12, groundmass crystal from NA-41.

Number 13, megacryst core from NA-41, at 400 micron mark of Fig. 4C.

TABLE DR6. REPRESENTATIVE ELECTRON MICROPROBE ANALYSES
OF SPINEL AND FERRIAN ILMENITE FROM RODEO-NAZAS SAMPLES

Number	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO^t	MnO	MgO	NiO	Total	Fe_2O_3	FeO	Total
1	0.15	22.92	2.04	0.37	67.97	0.87	2.41	0.07	96.81	22.52	47.71	99.07
2	0.13	19.77	7.34	0.06	64.90	0.65	4.52	0.12	97.50	24.44	42.91	99.95
3	0.23	15.20	8.58	3.31	63.42	0.63	4.06	0.08	95.52	26.98	39.14	98.22
4	0.18	1.64	51.16	2.17	30.28	0.28	13.02	0.07	98.78	10.23	21.07	99.81
5	0.11	20.79	3.52	0.00	67.66	0.60	3.39	0.05	96.13	25.56	44.66	98.69
6	0.07	47.84	0.18	0.04	43.98	0.77	4.26	0.08	97.22	10.45	34.58	98.55
7	0.16	18.97	1.60	0.15	71.43	0.64	2.74	0.06	95.74	30.90	43.62	99.06
8	0.21	16.87	2.08	0.19	72.64	0.78	2.39	0.09	95.25	33.99	42.06	98.80
9	0.08	50.53	0.22	0.07	42.43	0.79	4.43	0.15	98.70	6.48	36.60	99.35
10	0.10	23.60	2.13	0.45	67.01	0.65	3.11	0.11	97.17	21.61	47.57	99.34
11	0.16	24.85	1.59	0.23	65.53	0.91	3.06	0.09	96.42	19.33	48.14	98.36
12	0.20	1.21	51.44	2.63	28.38	0.22	14.05	0.18	98.31	10.49	18.95	99.36
13	0.27	18.21	3.98	8.26	60.93	0.66	3.79	0.12	96.22	21.50	41.58	98.38
14	0.20	0.77	39.42	18.65	26.18	0.33	12.15	0.18	97.87	7.68	19.27	98.64

Note: see Table DR3 for analytical conditions; all oxide values in wt.%; Fe_2O_3 and FeO calculated from stochiometry after Stormer (1983).

Number 1, groundmass titanomagnetite from DGO-411.

Number 2, spinel megacryst core from DGO-411, intergrown with plagioclase megacryst number 4.

Number 3, spinel megacryst rim from DGO-411.

Number 4, spinel megacryst core from DGO-411.

Number 5, spinel inclusion in plagioclase megacryst number 5 from DGO-411.

Number 6, groundmass ferrian ilmenite from NA-55.

Number 7, groundmass spinel from NA-55.

Number 8, groundmass spinel from NA-55.

Number 9, groundmass ferrian ilmenite from SL-29.

Number 10, groundmass spinel from SL-29.

Number 11, groundmass spinel from SL-29.

Number 12, spinel megacryst core from NA-41.

Number 13, spinel inclusion in olivine number 12 from NA-41.

Number 14, spinel inclusion in olivine number 17 from NA-41.