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Data Repository

Table DR1. U-Pb data for analyzed zircon from volcanic rocks of the Midcontinent Rift

Table DR2. Paleomagnetic site mean directions of the upper Kallander Creek Volcanics

TABLE DR1

U-Pb data for analyzed zircon from volcanic rocks of the Midcontinent Rift.

Sample	Composition					Ratios					Ages (Ma)						
	Pb _c [‡]	Pb* [‡]	U	Th	206Pb [§]	208Pb [#]	206Pb ^{††}	err	207Pb ^{††}	err	207Pb ^{††}	err	206Pb	err	207Pb	err	corr
Fractions [†]	(pg)	Pb _c	(pg)	U	204Pb	206Pb	238U	(2σ%)	235U	(2σ%)	206Pb	(2σ%)	238U	(2σ)	206Pb	(2σ)	coef
AP71: Rhyolite Flow from Agate Point section, Osler Volcanic Group (48.60716°N 88.19866°W)																	
z1	0.20	122	108	1.18	6085.0	0.356	0.187057	0.06	1.97114	0.16	0.07646	0.13	1105.41	0.63	1106.3	2.6	0.59
z2	0.16	77	56	1.06	3951.0	0.321	0.186967	0.14	1.97364	0.26	0.07659	0.20	1104.9	1.5	1109.7	4.1	0.62
z3	0.18	53	41	1.09	2704.0	0.330	0.186927	0.19	1.97072	0.37	0.07650	0.30	1104.7	1.9	1107.2	6.0	0.57
z4	0.20	63	51	1.48	2939.1	0.447	0.187102	0.13	1.97222	0.29	0.07648	0.25	1105.7	1.3	1106.9	5.0	0.51
z5	0.18	57	42	1.43	2686.6	0.430	0.187257	0.22	1.97532	0.37	0.07654	0.28	1106.5	2.2	1108.3	5.7	0.64
z6	0.22	103	92	1.49	4804.1	0.449	0.186871	0.24	1.96914	0.30	0.07646	0.18	1104.4	2.4	1106.2	3.6	0.80
z7	0.16	174	124	1.11	8813.4	0.335	0.186882	0.07	1.96987	0.14	0.07648	0.10	1104.46	0.67	1106.8	2.0	0.70
z8	0.19	128	99	1.54	5930.5	0.466	0.186991	0.07	1.96975	0.16	0.07643	0.13	1105.05	0.71	1105.5	2.6	0.60
z9	0.49	68	139	1.40	3256.2	0.424	0.187165	0.10	1.97558	0.25	0.07659	0.22	1106.00	0.98	1109.6	4.4	0.50
NSVG-RRR: Red Rock Rhyolite Flow, North Shore Volcanic Group (47.90402°N 89.75767°W)																	
z1	0.25	96	116	0.64	5444.4	0.194	0.187063	0.07	1.97193	0.18	0.07649	0.16	1105.44	0.69	1107.0	3.2	0.43
z2	0.24	167	192	0.68	9406.8	0.204	0.187074	0.04	1.97288	0.11	0.07652	0.09	1105.50	0.46	1107.8	1.9	0.49
z3	0.31	74	114	0.65	4213.8	0.195	0.187120	0.09	1.97023	0.23	0.07640	0.20	1105.76	0.94	1104.7	4.1	0.45
z4	0.95	35	163	0.67	2001.7	0.202	0.187030	0.13	1.96935	0.43	0.07640	0.39	1105.3	1.4	1104.7	7.9	0.38
z5	0.29	191	271	0.64	10839.7	0.193	0.187199	0.08	1.97344	0.12	0.07649	0.08	1106.18	0.86	1107.1	1.7	0.72
z6	2.09	16	165	0.69	930.5	0.207	0.187560	0.11	1.98724	0.84	0.07688	0.82	1108.1	1.2	1117	16	0.27
NSVG-GMR1: Grand Marais Rhyolite, North Shore Volcanic Group (47.74943°N 90.35150 °W)																	
z1	1.09	80	415	0.80	4357.6	0.243	0.184770	0.08	1.93294	0.22	0.07591	0.19	1092.98	0.84	1091.7	3.8	0.50
z2	0.41	64	127	0.75	3550.6	0.226	0.184851	0.10	1.93325	0.28	0.07589	0.24	1093.4	1.0	1091.2	4.9	0.51
z4	0.67	29	95	0.75	1632.9	0.227	0.185065	0.13	1.94121	0.51	0.07611	0.48	1094.6	1.3	1097.1	9.6	0.36
z6	0.99	27	130	0.71	1524.6	0.216	0.184900	0.18	1.94350	0.56	0.07627	0.51	1093.7	1.8	1101	10	0.42
z9	1.30	16	100	0.77	892.9	0.232	0.184966	0.15	1.94455	0.91	0.07628	0.87	1094.0	1.5	1102	18	0.32
z10	0.90	70	301	0.79	3849.8	0.238	0.184858	0.08	1.93860	0.22	0.07609	0.20	1093.46	0.78	1096.6	4.1	0.41

TABLE DR1 CONTINUED

U-Pb data for analyzed zircon from volcanic rocks of the Midcontinent Rift.

Sample	Composition					Ratios					Ages (Ma)						
	Pb _c [‡]	Pb _c * [#]	U	Th	²⁰⁶ Pb [§]	²⁰⁸ Pb [#]	²⁰⁶ Pb ^{††}	err	²⁰⁷ Pb ^{††}	err	²⁰⁷ Pb ^{††}	err	²⁰⁶ Pb	err	²⁰⁷ Pb	err	corr.
Fractions [†]	(pg)	Pb _c	(pg)	U	²⁰⁴ Pb	²⁰⁶ Pb	²³⁸ U	(2σ%)	²³⁵ U	(2σ%)	²⁰⁶ Pb	(2σ%)	²³⁸ U	(2σ)	²⁰⁶ Pb	(2σ)	coef
NSVG-40I: 40th Avenue Icelandite, North Shore Volcanic Group (46.82037°N 92.04131°W)																	
z12	0.30	77	119	0.54	4502.1	0.164	0.185373	0.06	1.94651	0.21	0.07619	0.18	1096.26	0.64	1099.2	3.7	0.51
z13	0.23	80	94	0.50	4703.8	0.152	0.185542	0.09	1.95062	0.21	0.07628	0.17	1097.18	0.95	1101.6	3.5	0.57
z14	0.20	81	83	0.54	4687.5	0.163	0.185487	0.07	1.94916	0.20	0.07625	0.17	1096.88	0.70	1100.7	3.6	0.53
z15	0.41	39	79	0.56	2248.6	0.169	0.185473	0.08	1.94813	0.37	0.07621	0.35	1096.81	0.80	1099.8	7.0	0.39
z16	0.31	67	104	0.61	3839.5	0.183	0.185457	0.07	1.94867	0.23	0.07624	0.21	1096.72	0.67	1100.5	4.2	0.47
z17	0.33	30	50	0.54	1745.8	0.164	0.185298	0.10	1.94922	0.52	0.07633	0.49	1095.85	0.99	1102.8	9.9	0.33
z19	0.19	14	13	0.51	841.1	0.154	0.185800	0.27	1.96318	1.01	0.07667	0.94	1098.6	2.7	1112	19	0.38
z20	0.30	93	140	0.61	5328.9	0.184	0.185544	0.07	1.94884	0.19	0.07621	0.16	1097.19	0.73	1099.7	3.2	0.55
NSVG-PR1 & PR2: Palisade Rhyolite, North Shore Volcanic Group (PR1: 47.34445°N 91.18944°W; PR2: 47.32083°N 91.21000°W)																	
PR1-z1	0.21	51	44	1.45	2425.7	0.438	0.184992	0.11	1.94142	0.37	0.07615	0.33	1094.2	1.1	1098.1	6.7	0.45
PR1-z3	0.20	40	33	1.44	1935.1	0.433	0.185379	0.15	1.94916	0.46	0.07629	0.41	1096.3	1.5	1101.9	8.3	0.44
PR1-z4	0.31	87	113	1.44	4138.8	0.435	0.185079	0.07	1.94289	0.22	0.07617	0.19	1094.66	0.69	1098.6	3.9	0.50
PR2-z1	1.86	51	454	0.79	2810.9	0.239	0.185019	0.07	1.93765	0.30	0.07599	0.28	1094.34	0.70	1093.9	5.7	0.40
PR2-z2	0.41	287	559	0.79	15715.3	0.239	0.185044	0.08	1.93865	0.13	0.07602	0.08	1094.47	0.77	1094.7	1.6	0.78
PR2-z4	0.67	89	277	0.87	4772.8	0.263	0.184890	0.11	1.93962	0.26	0.07612	0.21	1093.6	1.1	1097.3	4.3	0.57
PR2-z6	0.96	76	344	0.82	4126.5	0.246	0.184861	0.09	1.93471	0.24	0.07594	0.20	1093.48	0.87	1092.6	4.2	0.52
PR2-z7	0.58	250	681	0.85	13466.2	0.257	0.184835	0.05	1.93913	0.11	0.07612	0.07	1093.33	0.49	1097.4	1.6	0.77
PR1-z1	0.21	51	44	1.45	2425.7	0.438	0.184992	0.11	1.94142	0.37	0.07615	0.33	1094.2	1.1	1098.1	6.7	0.45

TABLE DR1 CONTINUED

U-Pb data for analyzed zircon from volcanic rocks of the Midcontinent Rift.

Sample	Composition					Ratios					Ages (Ma)						
	Pb _c [‡]	Pb ^{**}	U	Th	²⁰⁶ Pb [§]	²⁰⁸ Pb [#]	²⁰⁶ Pb ^{††}	err	²⁰⁷ Pb ^{††}	err	²⁰⁷ Pb ^{††}	err	²⁰⁶ Pb	err	²⁰⁷ Pb	err	corr.
Fractions [†]	(pg)	Pb _c	(pg)	U	²⁰⁴ Pb	²⁰⁶ Pb	²³⁸ U	(2σ%)	²³⁵ U	(2σ%)	²⁰⁶ Pb	(2σ%)	²³⁸ U	(2σ)	²⁰⁶ Pb	(2σ)	coef

NSVG-TH1: icelandite with Two Harbors basalts, North Shore Volcanic Group (47.0703°N 91.6039°W)

z1	0.85	87	377	0.51	5118.6	0.154	0.185277	0.07	1.94628	0.20	0.07622	0.17	1095.74	0.71	1100.0	3.5	0.57
z2	0.30	132	198	0.55	7658.3	0.165	0.185570	0.07	1.94860	0.17	0.07619	0.14	1097.33	0.71	1099.2	2.8	0.63
z3	0.21	198	214	0.52	11571.2	0.157	0.185432	0.08	1.94797	0.15	0.07622	0.11	1096.58	0.85	1100.1	2.3	0.68
z4	0.36	141	256	0.56	8122.9	0.170	0.185374	0.06	1.94683	0.15	0.07620	0.11	1096.27	0.59	1099.5	2.4	0.63
z5	0.27	126	174	0.51	7357.3	0.153	0.185405	0.06	1.94791	0.16	0.07623	0.13	1096.44	0.57	1100.3	2.7	0.61

PLV-CC1: Pegmatoid segregation within Copper City Flow, Portage Lake Volcanics (47.27579°N 88.38029°W)

z1	0.16	185	137	0.82	9958.8	0.248	0.183990	0.06	1.92755	0.13	0.07602	0.09	1088.73	0.59	1094.6	1.9	0.71
z2	0.13	146	95	0.68	8113.9	0.206	0.184881	0.08	1.94006	0.15	0.07614	0.11	1093.59	0.76	1097.9	2.2	0.67
z3	0.20	104	101	0.74	5751.9	0.222	0.184799	0.08	1.93563	0.18	0.07600	0.14	1093.14	0.85	1094.2	2.8	0.62
z4	0.14	552	385	0.76	30154.4	0.228	0.184401	0.05	1.93287	0.10	0.07606	0.05	1090.97	0.50	1095.7	1.2	0.85
z5	0.13	78	51	0.62	4406.9	0.186	0.184816	0.14	1.93670	0.25	0.07604	0.19	1093.2	1.4	1095.1	3.8	0.65

PLV-GS1: Pegmatoid segregation within Greenstone Flow, Portage Lake Volcanics (47.38815°N 88.30050°W)

z1	0.16	63	51	0.68	3570.8	0.206	0.184708	0.09	1.93510	0.26	0.07602	0.22	1092.64	0.94	1094.6	4.5	0.49
z2	0.17	83	57	1.46	3935.7	0.442	0.184521	0.09	1.93427	0.24	0.07606	0.21	1091.62	0.95	1095.8	4.3	0.50
z3	0.18	109	82	1.29	5382.7	0.388	0.184526	0.07	1.92962	0.20	0.07588	0.17	1091.65	0.75	1090.9	3.4	0.58
z4	0.14	704	435	1.27	34644.2	0.384	0.184463	0.05	1.93195	0.10	0.07599	0.05	1091.31	0.49	1094.0	1.2	0.85
z5	0.32	297	423	1.20	14868.1	0.362	0.184536	0.05	1.93136	0.11	0.07594	0.07	1091.71	0.52	1092.6	1.6	0.76
z6	0.22	79	75	1.30	3873.0	0.393	0.184465	0.07	1.93453	0.24	0.07609	0.21	1091.32	0.67	1096.7	4.2	0.48

TABLE DR1 CONTINUED

U-Pb data for analyzed zircon from volcanic rocks of the Midcontinent Rift.

Sample	Composition					Ratios					Ages (Ma)						
	Pb _c [‡]	Pb* [‡]	U	Th	²⁰⁶ Pb [§]	²⁰⁸ Pb [#]	²⁰⁶ Pb ^{††}	err	²⁰⁷ Pb ^{††}	err	²⁰⁷ Pb ^{††}	err	²⁰⁶ Pb	err	²⁰⁷ Pb	err	cor
Fractions [†]	(pg)	Pb _c	(pg)	U	²⁰⁴ Pb	²⁰⁶ Pb	²³⁸ U	(2σ%)	²³⁵ U	(2σ%)	²⁰⁶ Pb	(2σ%)	²³⁸ U	(2σ)	²⁰⁶ Pb	(2σ)	coe
CF1: Sheep Farm rhyolite, Kallander Creek Volcanics (46.37547°N 90.63715°W)																	
z1	0.33	310	479	0.80	16886.5	0.243	0.185755	0.09	1.95223	0.15	0.07626	0.10	1098.34	0.91	1101.0	2.1	0.72
z2	0.81	101	386	0.82	5480.7	0.248	0.185724	0.11	1.95323	0.21	0.07631	0.16	1098.2	1.1	1102.3	3.3	0.66
z4	0.40	215	403	0.83	11665.0	0.251	0.185620	0.09	1.95267	0.15	0.07633	0.09	1097.60	0.91	1102.9	1.9	0.79
z5	0.51	202	482	0.83	10955.5	0.251	0.185812	0.08	1.95204	0.15	0.07623	0.10	1098.65	0.77	1100.1	2.2	0.68

Notes: Corr. coef. = correlation coefficient. Age calculations are based on the decay constants of Jaffey et al. (1971).

[†] All analyses are single zircon grains and pre-treated by the thermal annealing and acid leaching (CA-TIMS) technique. Data used in age calculations are in bold.[‡] Pb_c is total common Pb in analysis. Pb* is radiogenic Pb concentration.[§] Measured ratio corrected for spike and fractionation only.[#] Radiogenic Pb ratio.^{††} Corrected for fractionation, spike, blank, and initial Th disequilibrium in magma (using an estimated magma Th/U ratio of 2.8 ± 1 [2σ]). Mass fractionation corrections of 0.25%/amu and 0.18%/amu ± 0.04 /amu (atomic mass unit) was applied to single-detector Daly analyses on Sector54 and X62 instruments, respectively, unless Pb double-spike was used. All common Pb is assumed to be blank. Total procedural blank was less than 0.1pg for U. $^{238}\text{U}/^{235}\text{U} = 137.818 \pm 0.045$ (2σ) is utilized following Hiess et al., (2012). Blank isotopic composition: $^{206}\text{Pb}/^{204}\text{Pb} = 18.15 \pm 0.47$, $^{207}\text{Pb}/^{204}\text{Pb} = 15.30 \pm 0.29$ and $^{208}\text{Pb}/^{204}\text{Pb} = 37.11 \pm 0.87$.

Table DR2. Paleomagnetic site mean directions of the upper Kallander Creek Volcanics.

site	lat	lon	n	dec	inc	dec (alt)	inc (alt)	k	r	α_{95}	strat
CF1	46.375233	-90.636919	3	306.3	36.4	280.7	35.0	66	3.0	15.2	563
CF2	46.375136	-90.636845	5	284.3	29.9	259.1	28.5	92	5.0	8.0	490
CF3	46.375239	-90.636594	2	302.1	23.6	276.6	22.2	1206	2.0	7.2	482
CF4	46.375160	-90.636176	3	312.7	36.7	287.0	35.4	15	2.9	33.1	476
CF5	46.375023	-90.636296	7	305.9	18.6	280.4	17.3	20	6.7	13.8	442
CF6	46.374543	-90.636024	7	306.3	26.6	280.8	25.2	1118	7.0	1.8	422
CF7	46.374465	-90.635931	6	312.6	31.0	286.9	29.7	147	6.0	5.5	386
CF8	46.374104	-90.635743	8	291.6	32.9	266.2	31.5	390	8.0	2.8	373
CF10	46.373933	-90.635701	2	292.2	34.9	266.9	33.5	185	2.0	18.5	351
CF11	46.373864	-90.635634	3	300.4	33.5	275.0	32.2	603	3.0	5.0	348
CF12	46.373605	-90.635231	8	290.8	35.8	265.4	34.4	476	8.0	2.5	342
CF13	46.373614	-90.635440	7	299.1	29.9	273.7	28.6	86	6.9	6.6	336
CF14	46.373697	-90.635365	7	326.0	13.6	300.5	12.6	139	7.0	5.1	329
CF15	46.373599	-90.635219	6	318.8	29.9	293.0	28.7	58	5.9	8.9	324
CF16	46.373452	-90.635004	6	122.7	-50.7	96.9	-49.3	432	6.0	3.2	309
CF17	46.373486	-90.634871	4	340.0	15.9	314.4	15.0	211	4.0	6.3	299
CF18	46.373196	-90.634767	4	304.0	43.9	278.3	42.6	334	4.0	5.0	274
CF19	46.373112	-90.634687	8	302.4	39.0	276.7	37.6	662	8.0	2.2	270
CF20	46.372938	-90.634636	8	301.8	24.8	276.4	23.5	466	8.0	2.6	258
CF21	46.372847	-90.634565	7	309.0	34.2	283.4	32.9	29	6.8	11.4	238
CF23	46.372654	-90.634300	7	305.0	34.7	279.4	33.3	307	7.0	3.5	219
CF24	46.372471	-90.634129	5	305.2	40.8	279.5	39.4	732	5.0	2.8	215
CF25	46.372328	-90.634012	3	311.6	39.3	285.8	38.0	6050	3.0	1.6	192
CF26	46.372193	-90.633729	7	306.3	25.1	280.8	23.7	110	6.9	5.8	178
CF27	46.371882	-90.632170	7	278.7	44.8	253.6	43.4	635	7.0	2.4	105
CF29	46.371561	-90.631973	8	308.8	29.8	283.2	28.5	167	8.0	4.3	60
CF30	46.371490	-90.631981	7	313.1	30.7	287.5	29.5	130	7.0	5.3	56
CF31	46.371428	-90.631922	7	302.3	10.7	276.9	9.3	94	6.9	6.3	52
CF33	46.371403	-90.631651	4	298.8	17.2	273.5	15.8	55	3.9	12.5	40
CF35	46.371293	-90.631520	2	290.6	-2.6	265.3	-4.0	705	2.0	9.4	27

Notes: lat, lon—latitude ($^{\circ}$ N), longitude ($^{\circ}$ E) of sample site; n—number of samples analyzed and included in the site mean; dec—tilt-corrected mean declination for the site; inc—tilt-correction mean inclination for the site; k—Fisher precision parameter; R—resultant vector length; α_{95} —95% confidence limit in degrees; strat—stratigraphic height (in meters) from base of Copper Falls section (see Figure 8 in main text). All paleomagnetic measurements were made using an alternating field (AF) demagnetization protocol. Directional fits were only made to samples for which 10% of remanence was removed during AF demagnetization. Of the 35 paleomagnetic sites that were sampled, 30 sites contained a sufficient number of samples that met this criteria in order to calculate a mean direction. The five sites that did not yield directions in accordance with our criteria and are excluded from the table include CF9 (46.3740057°N, -90.63577423°E), CF22 (46.3727213°N, -90.63432097°E), CF28 (46.37169573°N, -90.6319893°E), CF32 (46.37150869°N, -90.63164673°E) and CF34 (46.37128238°N, -90.63164555°E). In addition to a standard tilt-correction, we also calculate paleomagnetic directions according to two-step tilt correction method to account for possible structural rotations about more than one axis. Rather than correcting directions by the present-day orientation of the Kallander Creek lava flows (as given by “dec” and “inc” above), for this correction we first rotate the directions of these flows according to the orientation of the Oronto Group sediments above the Brownstone Falls angular unconformity. This initial rotation reconstructs the tilt of the lava flows prior to the deposition of Oronto Group sediments, which we use to tilt-correct the paleomagnetic directions in a second rotation. These alternative tilt-corrected directions are shown above as dec (alt) and inc (alt). The difference between the two versions of the tilt-correction highlights the uncertainty that results from this tilt history and these sites therefore not being used to calculate a paleomagnetic pole of paleogeography reconstruction. For further details and background on the structural history of the Kallander Creek volcanics, see the discussion in the *Powder Mill Group: Background and Paleomagnetism* section of the main text.