

Data Analyses for Patterson KGS Core in Kearny County, Kansas, and Tectonic Activity Data of the Midcontinent

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SUMMARY

Geochemical data were collected on selected phases from the Arbuckle Group in the Patterson KGS #5-25 core (15-093-21979) from Kearny County, Kansas. Fluid inclusion microthermometry was conducted in quartz, calcite, and dolomite cements at the Kansas Geological Survey (KGS) using a Linkam THMSG 600 heating and cooling stage mounted on an Olympus BX53/60-MTRF-S microscope to determine fluid flow history and assess diagenetic processes. The data are shown in table 1.

We also examined carbon, oxygen, and $^{87}\text{Sr}/^{86}\text{Sr}$ isotopes of channel-, breccia- and vug-filling dolomite and calcite cements to determine the origin, composition, and temperature history of diagenetic minerals. The analysis for carbon and oxygen isotope samples was obtained by mass spectrometry at the Keck-NSF lab at the University of Kansas (KU). Strontium isotope was analyzed at the Isotope Geochemistry Laboratory (IGL) at KU. The data are shown in tables 2 and 3.

We conducted U-Pb dating on vug- and breccia-filling dolomite cements to determine the mineral formation age and provide information on the timing of geological events. This analysis was conducted by laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) at KU-IGL with a Thermo Scientific Element2 ICP-MS attached to a Photon Machines Analyte G2 193 nm ArF excimer LA system. The data are presented in table 4.

We used ArcGISTM to create lineaments from publicly available aeromagnetic data. Lineament start and end points were calculated in WGS84 format and are presented in table 5.

Table 1. Microthermometric data for dolomite, calcite, and quartz cements in Patterson KGS #5-25 core in Kearny County, Kansas.

Sample ID	Mineral	Chip	Assemblages	T _h (°C)	T _{mice} (°C)	Description
PA- 5788.5	Saddle dolomite	1	1	110.3	-2.2	Primary
			1	102	-9.2	Primary
			2	94	-7	Primary
PA- 5803.25	Calcite	1	1	-	-2	Primary
			2	87.2	-23.4	Primary
			2	66.8	-16.7	Primary

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			2	-	-20.4	Primary
			2	-	-18.1	Primary
			2	64	-18.1	Primary
			3	-	-9.7	Primary
			4	70.3	-15.8	Primary
			2	-	-18.4	Primary
			2	-	-14.5	Primary
			4	66.8	-18.1	Primary
			4	66.8	-9.7	Primary
			4	67.4	-15.9	Primary
			4	-	-8.9	Primary
PA- 5982.6 A	Saddle dolomite	1	1	137.5	-12.2	Primary
			1	137.5	-13.7	Primary
			2	81.3	-17.6	Primary
			2	52.7	-7.3	Primary
			3	88.7	-6	Primary
			3	88.7	-12.7	Primary
			3	95	-	Primary
			4	-	-20.9	Primary
			4	109.5	-8.9	Primary
			4	109.5	-	Primary
PA- 5992.2	Saddle dolomite	1	1	-	-18.2	Primary
			1	-	-19.1	Primary
			2	81.8	-19.3	Primary
			2	-	-16.2	Primary
			3	110.1	-14.4	Primary
			3	-	-6.3	Primary
			3	163.6	-	Primary
			4	-	-19.3	Primary
			5	114.5	-17.3	Primary
			5	102.7	-14.3	Primary
			5	-	-19.1	Primary
			6	-	-19.1	Primary
			6	128	-16.6	Primary
			7	-	-14.9	Primary
			7	-	-14.9	Primary
			7	-	-14.9	Primary
PA- 6003.4	Saddle dolomite	1	1	79	-	Secondary
			1	79	-	Secondary
			1	79	-	Secondary

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			2	71.6	-16.5	Secondary
			2	71.6	-16	Secondary
			2	71.6	-16	Secondary
			2	71.7	-16	Secondary
			2	71.6	-16	Secondary
			3	82.6	-16	Secondary
			3	82.6	-16	Secondary
			3	83	-	Secondary
			3	79.7	-16	Secondary
			3	79.7	-16	Secondary
			3	71.6	-16.5	Secondary
			4	76.8	-14.1	Primary
			4	65.2	-13.3	Primary
			4	65.2	-13.3	Primary
PA- 6085.9 B	Saddle dolomite	1	1	52.8	-	Primary
			1	67.8	-1.8	Primary
			1	-	-2.4	Primary
PA- 6097.25	Saddle dolomite	1	1	139.2	-20	Primary
			2	117	-15	Primary
			2	100.3	-	Primary
			2	117.6	-14.6	Primary
	Quartz	2	1	103	-	Primary
			2	248	-	Primary
			2	266.5	-	Primary
			3	-	-8.9	Primary
			3	-	-6.3	Primary
PA- 6122.8	Saddle dolomite	1	1	105.5	-4	Primary
			1	105.5	-	Primary
			1	105.3	-	Primary
			1	105	-	Primary
	Quartz	2	1	140	-	Primary
			2	152	-	Primary
			2	152	-	Primary
			2	-	-8.3	Primary
PA- 6129 A	Saddle dolomite	1	1	81	-13.8	Primary
			1	118.6	-16.9	Primary
			1	-	-20.7	Primary
			1	-	-20.7	Primary
			1	-	-20.9	Primary
PA- 6135.6	Saddle dolomite	1	1	108	-	Primary

			2	109.4	-17	Primary
			3	103	-11	Primary
			4	91.2	-14.8	Primary
PA- 6206.16	Saddle dolomite	1	1	121.4	-8.7	Primary
		2	1	65	-	Primary
			1	70	-	Primary
			1	76.6	-	Primary
PA- 6269.41	Saddle dolomite	1	1	249.6	-	Primary
			1	260	-12.1	Primary
			2	184.5	-	Primary
			3	118.4	-	Primary
			3	118.4	-16.6	Primary
			3	118.4	-16.6	Primary
PA- 6288.5	Quartz	1	1	101.6	-	Primary
			1	101.6	-	Primary
			1	100.4	-	Primary
			1	100.4	-	Primary
			1	101.6	-	Primary
			1	101.6	-	Primary
			2	148	-	

Table 2. Carbon and oxygen isotope data for Patterson KGS #5-25 core in Kearny County, Kansas.

Sample ID	Mineral & Open Space Type	$\delta^{13}\text{C}$ VPDB	$\delta^{18}\text{O}$ VPDB
PA- 5788.5	Breccia-filling saddle dolomite	-1.04	-7.34
PA- 5803.25	Channel-breccia-filling saddle dolomite	-0.81	-11.66
PA- 5982.6 A	Channel-breccia-filling saddle dolomite	-0.95	-8.16
PA- 5992.2	Channel-breccia-filling saddle dolomite	0.19	-6.72
PA- 6003.4	Vug-filling saddle dolomite	-0.53	-11.63
PA- 6085.9 B (1)	Vug-filling saddle dolomite	-0.21	-8.63
PA- 6085.9 B (2)	Vug-filling calcite	-1.02	-13.85
PA- 6097.25	Channel-filling saddle dolomite	-0.38	-8.69
PA- 6122.8	Channel-breccia-filling saddle dolomite	-0.30	-9.53
PA- 6129 A	Breccia-filling saddle dolomite	-0.33	-7.96
PA- 6135.6	Channel-breccia-filling saddle dolomite	-2.02	-9.13
PA- 6206.16	Vug-filling saddle dolomite	-1.82	-13.08

Table 3. $^{87}\text{Sr}/^{86}\text{Sr}$ isotope data for Patterson KGS #5-25 core in Kearny County, Kansas.

Sample ID	Mineral & Open Space Type	$^{87}\text{Sr}/^{86}\text{Sr}$
PA- 5788.5	Breccia-filling saddle dolomite	0.7096251
PA-5803.25	Channel-breccia-filling saddle dolomite	0.7175817
PA-5982.6	Channel-breccia-filling saddle dolomite	0.7109561
PA- 5992.2	Channel-breccia-filling saddle dolomite	0.7102666
PA- 6122.8	Channel-breccia-filling saddle dolomite	0.7114790
PA- 6206.16	Vug-filling saddle dolomite	0.7183057
PA-6269	Channel-filling saddle dolomite	0.712116

Table 4. Supplementary table of U-Pb data from the Patterson KGS #5-25 core, Kearny County, Kansas.**PA-17-6097.25**

	²³⁸ U/ ²⁰⁶ Pb*	Prop 2SE	²⁰⁷ Pb/ ²⁰⁶ Pb**	Prop 2SE	Rhoχ ²	U ppm ±	Th ppm ±	Pb ppm ±			
1	0.4554	0.0659	0.7580	0.0971	0.4584	0.0025	0.0002	0.0109	0.0020	0.0201	0.0047
2	0.2327	0.0189	0.6640	0.0341	0.3588	0.0038	0.0002	0.0149	0.0023	0.0463	0.0037
3	0.7987	0.1198	0.7900	0.1300	0.4824	0.0020	0.0002	0.0139	0.0018	0.0139	0.0020
4	0.2145	0.0243	0.6800	0.0461	0.4547	0.0019	0.0002	0.0020	0.0007	0.0278	0.0031
5	0.2234	0.0313	0.6500	0.1900	-0.0404	0.0011	0.0002	0.0031	0.0009	0.0177	0.0022
6§	0.3243	0.1385	0.8000	0.2000	0.9867	0.0010	0.0002	0.0028	0.0008	0.0129	0.0019
7	0.2816	0.0827	0.8000	0.2000	0.6177	0.0010	0.0002	0.0027	0.0007	0.0140	0.0030
8	0.2839	0.0401	0.8000	0.1300	0.1417	0.0013	0.0002	0.0024	0.0008	0.0151	0.0030
9§	0.3102	0.0682	0.9000	0.2100	0.0636	0.0010	0.0002	0.0011	0.0005	0.0147	0.0021
10§	0.1982	0.1801	0.5220	0.0152	-0.4188	0.0008	0.0002	0.0021	0.0007	0.0146	0.0032
11	0.2272	0.0274	0.7000	0.0891	0.0368	0.0019	0.0002	0.0020	0.0006	0.0256	0.0042
12	0.4116	0.0487	0.7040	0.0611	0.0080	0.0031	0.0003	0.0098	0.0015	0.0199	0.0022
13	0.7987	0.1085	0.7700	0.1200	0.2695	0.0027	0.0003	0.0089	0.0014	0.0119	0.0024
14	0.6995	0.0646	0.7230	0.0571	0.5315	0.0064	0.0005	0.0150	0.0021	0.0310	0.0046
15	0.4298	0.0375	0.7320	0.0811	0.0232	0.0045	0.0005	0.0323	0.0028	0.0310	0.0038
16	4.7273	0.3560	0.2310	0.0140	-0.3023	0.1201	0.0040	0.0480	0.0044	0.0344	0.0038
17	5.0247	0.3924	0.4610	0.0231	0.2102	0.0592	0.0023	0.0230	0.0021	0.0283	0.0030
18	0.6486	0.0995	0.6840	0.0671	0.5030	0.0052	0.0007	0.0246	0.0027	0.0281	0.0029
19	0.2327	0.0667	0.8100	0.1301	0.6397	0.0018	0.0003	0.0038	0.0008	0.0282	0.0047
20	1.5579	0.1988	0.7000	0.1100	0.4638	0.0031	0.0002	0.0156	0.0019	0.0072	0.0015
21	0.7484	0.1010	0.7800	0.1900	0.2576	0.0016	0.0002	0.0090	0.0014	0.0106	0.0018
22	0.3665	0.0533	0.6710	0.0631	-0.0194	0.0032	0.0005	0.0270	0.0035	0.0238	0.0027
23	5.9262	0.4883	0.1610	0.0130	-0.0643	0.1617	0.0087	0.0826	0.0047	0.0221	0.0026
24	9.7474	0.8397	0.2820	0.0310	0.1857	0.0599	0.0017	0.1280	0.0085	0.0106	0.0026
25	5.4886	0.7792	0.5090	0.0441	0.2998	0.0759	0.0076	0.1120	0.0100	0.0378	0.0082
26§	0.5461	0.1996	0.6430	0.0222	-0.3634	0.2610	0.0230	0.3660	0.0290	1.330	0.480
27	3.3977	0.4521	0.5340	0.0211	0.0949	0.2070	0.0230	0.2620	0.0120	0.1530	0.0160
28	2.8617	0.5387	0.5830	0.0212	-0.5485	1.0020	0.0890	0.7170	0.0320	0.8600	0.160
29	1.2895	0.2115	0.6160	0.0153	-0.5307	1.5500	0.3600	0.8820	0.0680	2.840	0.720
30	0.2216	0.0348	0.7000	0.1100	0.7502	0.0021	0.0005	0.0037	0.0010	0.0249	0.0040
31	0.4101	0.0498	0.7480	0.0871	0.4811	0.0017	0.0002	0.0069	0.0014	0.0220	0.0100
32	0.2877	0.0619	0.6260	0.0820	0.7896	0.0020	0.0005	0.0050	0.0011	0.0176	0.0025
33	0.1946	0.0609	0.6480	0.0491	-0.0404	0.0014	0.0002	0.0037	0.0009	0.0324	0.0048
34	0.8919	0.0992	0.8060	0.0891	0.2881	0.0024	0.0002	0.0105	0.0016	0.0118	0.0015
35	0.2554	0.0433	0.7300	0.1300	0.1386	0.0015	0.0002	0.0270	0.0024	0.0251	0.0028

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36	0.3604	0.0448	0.6230	0.0721	0.2093	0.0021	0.0002	0.0432	0.0040	0.0252	0.0025
37	0.1289	0.0182	0.6610	0.0272	0.0614	0.0045	0.0005	0.0159	0.0025	0.1120	0.0130
38	3.4194	0.2748	0.5030	0.0271	-0.0182	0.0666	0.0013	0.1317	0.0073	0.0497	0.0088
39	7.0090	0.5721	0.3390	0.0310	-0.1390	0.0622	0.0015	0.1267	0.0086	0.0199	0.0021
40	1.9495	0.2727	0.5900	0.0251	-0.4558	0.2100	0.0320	0.2340	0.0180	0.2990	0.0860
41	1.2445	0.2957	0.5590	0.0241	-0.3259	0.1072	0.0085	0.1940	0.0140	0.2430	0.0640
42	8.6521	0.8773	0.3080	0.0270	-0.2077	0.1224	0.0061	0.3760	0.0150	0.0292	0.0039
43	1.0811	0.2995	0.6010	0.0172	-0.0665	0.4110	0.0520	1.130	0.280	1.010	0.250

PA-20-5992.2

	²³⁸ U/ ²⁰⁶ Pb*	Prop 2SE	²⁰⁷ Pb/ ²⁰⁶ Pb**	Prop 2SE	Rho χ^2	U ppm	±	Th ppm	±	Pb ppm	±
1	6.8735	0.4736	0.3950	0.0280	0.2035	0.096	0.003	0.008	0.002	0.028	0.005
2	0.1663	0.0158	0.6796	0.0061	0.2266	0.135	0.003	0.122	0.006	2.880	0.280
3	0.0387	0.0035	0.6646	0.0075	-0.1421	0.074	0.004	0.172	0.008	6.020	0.420
4	0.0167	0.0023	0.6734	0.0070	0.0916	0.457	0.026	0.063	0.008	80.70	7.90
5	0.0157	0.0011	0.6620	0.0110	0.2459	0.232	0.007	0.662	0.025	49.40	3.40

PA-21-5982.6A

	²³⁸ U/ ²⁰⁶ Pb*	Prop 2SE	²⁰⁷ Pb/ ²⁰⁶ Pb**	Prop 2SE	Rho χ^2	U ppm	±	Th ppm	±	Pb ppm	±
1	0.2347	0.0188	0.7100	0.1400	0.4930	0.0009	0.0001	0.0203	0.0020	0.0297	0.0026
2	0.3176	0.0487	0.7600	0.1101	0.3643	0.0017	0.0001	0.0762	0.0047	0.0175	0.0021
3	0.0877	0.0150	0.7050	0.0901	-0.3122	0.0010	0.0001	0.0177	0.0020	0.0304	0.0048
4	0.1542	0.0130	0.7360	0.0711	-0.4307	0.0013	0.0001	0.0249	0.0025	0.0379	0.0033
5	0.2449	0.0180	0.5896	0.0103	0.1585	0.0476	0.0020	0.2060	0.0084	0.5230	0.0250
6	0.3836	0.0268	0.5940	0.0133	0.5129	0.1146	0.0030	0.1603	0.0085	0.7880	0.0290
7	1.2148	0.1121	0.6060	0.0143	0.0069	0.1215	0.0018	0.1341	0.0089	0.2820	0.0240
8	9.1711	0.7907	0.2710	0.0240	-0.5808	0.2160	0.0180	0.0523	0.0072	0.0283	0.0037
9	0.2854	0.0377	0.7730	0.0691	0.0715	0.0018	0.0002	0.0761	0.0037	0.0235	0.0031
10	0.4101	0.0948	0.8400	0.1101	0.5884	0.0014	0.0002	0.0370	0.0036	0.0106	0.0020
11	0.1911	0.0926	0.7200	0.0431	-0.7384	0.0010	0.0001	0.0309	0.0023	0.0131	0.0020
12	0.1029	0.0223	0.7080	0.0641	-0.3968	0.0011	0.0001	0.0169	0.0017	0.0469	0.0041
13	0.0645	0.0056	0.6500	0.0222	-0.0531	0.0025	0.0003	0.0329	0.0033	0.1200	0.0110
14	0.1784	0.0572	0.7400	0.1900	0.7753	0.0006	0.0002	0.0155	0.0016	0.0163	0.0023

PA-23-5788.5

	²³⁸ U/ ²⁰⁶ Pb*	Prop 2SE	²⁰⁷ Pb/ ²⁰⁶ Pb**	Prop 2SE	Rho χ^2	U ppm	±	Th ppm	±	Pb ppm	±
1	0.4955	0.0993	0.7900	0.1201	0.4930	0.0100	0.0035	0.0612	0.0048	0.0620	0.0210
2	0.2636	0.0649	0.7810	0.0471	0.5397	0.0028	0.0006	0.0259	0.0024	0.0402	0.0047
3	0.1529	0.0272	0.8190	0.0193	0.1075	0.0124	0.0032	0.0760	0.0240	0.2600	0.0500
4	0.1416	0.0143	0.8190	0.0263	0.9704	0.1120	0.0330	0.6700	0.2200	2.360	0.650
5	0.1497	0.0117	0.6670	0.0252	0.2086	0.0065	0.0003	0.0729	0.0034	0.1275	0.0067
6	0.2489	0.1106	0.5600	0.2400	0.7557	0.0010	0.0001	0.1619	0.0044	0.0126	0.0018
7	0.5335	0.0331	0.6624	0.0070	0.2648	0.3000	0.0150	0.3088	0.0068	1.750	0.100
8	4.9780	1.2055	0.4200	0.0510	0.0046	0.0744	0.0080	0.0810	0.0140	0.0370	0.0130
9	9.7386	0.9053	0.2150	0.0380	-0.3484	0.0793	0.0025	0.0205	0.0027	0.0087	0.0023
10	0.0527	0.0063	0.6792	0.0075	-0.0581	0.0408	0.0020	0.2012	0.0083	2.290	0.150
11	7.5906	0.7916	0.4310	0.0640	-0.1745	0.0739	0.0011	0.0272	0.0035	0.0178	0.0041
12	8.8745	0.7910	0.3020	0.0460	-0.0829	0.0628	0.0052	0.0789	0.0054	0.0096	0.0014
13	9.9838	0.6865	0.1900	0.0190	-0.0246	0.1828	0.0067	0.2490	0.0160	0.0190	0.0030
14	7.5531	0.5796	0.2740	0.0250	-0.4965	0.1378	0.0033	0.2760	0.0140	0.0283	0.0041
15	0.5633	0.0708	0.6320	0.0940	0.0729	0.0019	0.0002	0.1669	0.0064	0.0166	0.0022

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16	0.3822	0.1784	0.8400	0.1900	0.4121	0.0013	0.0002	0.1622	0.0086	0.0348	0.0073
17	0.6371	0.1179	0.6730	0.0801	0.2186	0.0019	0.0003	0.1098	0.0058	0.0186	0.0028
18	7.6448	0.7068	0.2720	0.0320	0.0810	0.1109	0.0068	0.1700	0.0100	0.0235	0.0035
19	4.5543	0.5329	0.6560	0.0661	0.5436	0.0713	0.0031	0.1070	0.0120	0.0459	0.0068
20	1.5998	0.1488	0.7130	0.0272	-0.2080	0.0644	0.0022	0.1014	0.0083	0.1300	0.0130
21	1.8264	0.1714	0.6130	0.0291	0.2481	0.0574	0.0029	0.1100	0.0100	0.0980	0.0100
22	3.5915	0.4345	0.5360	0.0441	-0.1497	0.0621	0.0033	0.0703	0.0072	0.0462	0.0077
23	7.3609	0.5680	0.3560	0.0270	0.0438	0.2248	0.0063	0.1200	0.0110	0.0512	0.0064
24	4.9321	0.5344	0.4670	0.0351	-0.3904	0.2157	0.0055	0.2010	0.0130	0.0920	0.0170
25	10.800	0.7976	0.1830	0.0270	0.0990	0.0963	0.0034	0.0125	0.0016	0.0051	0.0010
26	0.2489	0.0546	0.7600	0.1600	0.4144	0.0159	0.0033	0.1054	0.0062	0.1760	0.0240
27	0.2230	0.0568	0.7700	0.1001	0.0030	0.0016	0.0002	0.1651	0.0063	0.0279	0.0029
28	0.1805	0.0116	0.6890	0.0114	0.2626	0.0824	0.0036	0.1900	0.0120	1.430	0.073
29	0.6371	0.0437	0.6800	0.0212	0.5571	0.0475	0.0041	0.1510	0.0150	0.2340	0.0260
30	0.1092	0.0218	0.6710	0.0411	-0.0217	0.0020	0.0004	0.1483	0.0060	0.0791	0.0066
31	0.5881	0.0796	0.6960	0.0581	0.3277	0.0032	0.0002	0.1076	0.0068	0.0183	0.0028
32	0.3964	0.0494	0.6625	0.0083	-0.2055	0.1640	0.0140	0.2270	0.0180	1.205	0.057
33	9.7033	0.7021	0.2410	0.0250	0.2909	0.1286	0.0034	0.0318	0.0062	0.0129	0.0026
34	0.2854	0.0625	0.7600	0.1001	0.4576	0.0015	0.0002	0.0661	0.0039	0.0230	0.0026
35	0.0931	0.0137	0.7530	0.0481	0.8607	0.0039	0.0034	0.1549	0.0073	0.0916	0.0071
36	8.4009	0.6941	0.4000	0.0780	0.0885	0.0976	0.0043	0.0900	0.0110	0.0137	0.0031
37	5.3674	0.4156	0.4730	0.0411	0.3866	0.0934	0.0041	0.0730	0.0100	0.0472	0.0084
38	0.1507	0.0265	0.7080	0.0361	0.0241	0.0024	0.0002	0.1567	0.0067	0.0585	0.0044
39	0.3822	0.0616	0.6470	0.0910	0.5062	0.0042	0.0008	0.2220	0.0180	0.0322	0.0052
40	0.1932	0.0201	0.7110	0.0391	0.2331	0.0034	0.0003	0.1410	0.0060	0.0512	0.0030
41	0.1898	0.0195	0.6810	0.0351	0.3281	0.0037	0.0003	0.0973	0.0057	0.0582	0.0050
42	0.0412	0.0046	0.8160	0.0233	0.1483	0.0028	0.0003	0.1584	0.0059	0.2630	0.0230
43	0.1901	0.0164	0.6810	0.0292	0.3003	0.0062	0.0008	0.1220	0.0069	0.1050	0.0160
44	11.839	0.779	0.1400	0.0160	0.2225	0.2419	0.0061	0.2590	0.0110	0.0166	0.0031

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	²³⁸ U/ ²⁰⁶ Pb*	Prop 2SE	²⁰⁷ Pb/ ²⁰⁶ Pb**	Prop 2SE	Rho χ^2	U ppm	±	Th ppm	±	Pb ppm	±
1	0.3836	0.0581	0.6560	0.0301	0.4024	0.0161	0.0019	0.0443	0.0023	0.1170	0.0200
2	1.0291	0.2524	0.6020	0.0321	-0.2208	0.0960	0.0180	0.1580	0.0440	0.2270	0.0410
3	0.4715	0.0421	0.6800	0.0531	0.8314	0.0093	0.0012	0.0791	0.0077	0.0597	0.0083
4	0.4351	0.0368	0.7070	0.0451	-0.0300	0.0048	0.0006	0.0851	0.0042	0.0310	0.0030
5	0.7623	0.0539	0.6530	0.0291	0.2465	0.0129	0.0005	0.0648	0.0038	0.0509	0.0040
6	1.0597	0.1264	0.7170	0.0631	0.6138	0.0032	0.0003	0.0635	0.0034	0.0098	0.0015
7	0.4214	0.0647	0.6640	0.0691	0.6454	0.0022	0.0003	0.0695	0.0034	0.0170	0.0021
8	0.9109	0.0738	0.6690	0.0581	0.3955	0.0043	0.0002	0.0746	0.0040	0.0135	0.0017
9	0.6774	0.1121	0.7300	0.1200	0.1868	0.0037	0.0007	0.0712	0.0053	0.0165	0.0033
10	0.7088	0.0701	0.6940	0.0521	0.7140	0.0056	0.0005	0.0744	0.0050	0.0240	0.0027
11	7.0879	0.7424	0.3860	0.0320	-0.5498	0.4480	0.0200	0.2320	0.0220	0.1490	0.0320
12	11.277										
	9	0.8182	0.2710	0.0150	0.3349	0.4230	0.0460	0.1340	0.0220	0.0397	0.0065
13	0.2869	0.0534	0.7110	0.0691	0.4480	0.0042	0.0008	0.0954	0.0044	0.0356	0.0057
14	0.4593	0.0488	0.6730	0.0511	0.3893	0.0034	0.0003	0.0860	0.0039	0.0228	0.0023
15	0.5298	0.0680	0.7090	0.0681	0.3232	0.0033	0.0005	0.1095	0.0065	0.0217	0.0037
16	0.5461	0.1065	0.6800	0.0711	-0.1644	0.0019	0.0003	0.1122	0.0048	0.0143	0.0019
17	0.5881	0.0591	0.6910	0.0451	0.3224	0.0059	0.0004	0.0735	0.0039	0.0306	0.0029
18	0.6607	0.1663	0.8100	0.1301	0.1820	0.0028	0.0004	0.0740	0.0044	0.0147	0.0024
19	0.4535	0.0511	0.7030	0.0701	0.4614	0.0027	0.0003	0.1217	0.0069	0.0168	0.0021
20	0.7634	0.0637	0.6080	0.0421	0.2152	0.0043	0.0002	0.0505	0.0031	0.0167	0.0016
21	1.2176	0.1282	0.7100	0.0591	0.4048	0.0038	0.0005	0.0841	0.0049	0.0124	0.0015
22	0.3716	0.0670	0.7100	0.0831	0.0752	0.0034	0.0008	0.0743	0.0078	0.0292	0.0052
23	2.5362	0.2337	0.5790	0.0381	-0.0446	0.0549	0.0071	0.0952	0.0059	0.0625	0.0068
24	0.3544	0.0330	0.7380	0.0541	0.1836	0.0048	0.0005	0.079	0.0043	0.0421	0.0035

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25	1.8233	0.2234	0.6480	0.0581	0.3912	0.0243	0.0042	0.0814	0.0066	0.0369	0.0063
26	3.7953	0.3048	0.5770	0.0381	0.4044	0.0626	0.0061	0.0595	0.0056	0.0442	0.0043
27	0.6296	0.0602	0.6590	0.0461	0.1223	0.0066	0.0005	0.0596	0.0037	0.0314	0.0032
28	<i>0.6566</i>	<i>0.0904</i>	<i>0.7630</i>	<i>0.0881</i>	<i>0.5615</i>	<i>0.0022</i>	<i>0.0002</i>	<i>0.0732</i>	<i>0.0038</i>	<i>0.0123</i>	<i>0.0017</i>
29	3.9348	0.4093	0.6250	0.0421	-0.3745	0.7650	0.0170	0.1220	0.0130	0.5190	0.0830
30	10.232										
	0	0.7123	0.3390	0.0221	0.0937	0.8600	0.0230	0.0990	0.0120	0.1150	0.0130
31	<i>6.9050</i>	<i>0.5944</i>	<i>0.3990</i>	<i>0.0161</i>	<i>-0.4833</i>	<i>0.6850</i>	<i>0.0170</i>	<i>0.2370</i>	<i>0.0130</i>	<i>0.1660</i>	<i>0.0180</i>
32	5.9792	0.5796	0.4730	0.0161	-0.4895	1.1290	0.0920	0.6090	0.0360	0.3910	0.0430
33	<i>2.7944</i>	<i>0.4376</i>	<i>0.6080</i>	<i>0.0232</i>	<i>-0.6758</i>	<i>1.3300</i>	<i>0.1400</i>	<i>1.172</i>	<i>0.074</i>	<i>1.110</i>	<i>0.160</i>
34	<i>4.2640</i>	<i>0.5036</i>	<i>0.5110</i>	<i>0.0211</i>	<i>-0.6265</i>	<i>0.8740</i>	<i>0.0310</i>	<i>0.7830</i>	<i>0.0420</i>	<i>0.4860</i>	<i>0.0720</i>
35	5.0247	0.5738	0.4890	0.0261	-0.1326	0.7950	0.0510	0.6290	0.0450	0.3270	0.0460
36	10.544										
	5	0.7456	0.3260	0.0211	0.0023	0.4781	0.0055	0.0332	0.0057	0.0700	0.0120
37	8.8672	0.7002	0.3800	0.0181	-0.0101	0.3790	0.0210	0.0970	0.0190	0.0727	0.0099
38	5.0247	0.5738	0.5000	0.0590	0.1591	0.1070	0.0220	0.0960	0.0110	0.0403	0.0075
39	<i>0.6222</i>	<i>0.1197</i>	<i>0.6650</i>	<i>0.0391</i>	<i>-0.0318</i>	<i>0.0230</i>	<i>0.0053</i>	<i>0.0575</i>	<i>0.0054</i>	<i>0.0830</i>	<i>0.0110</i>
40	5.6153	0.3935	0.5490	0.0351	0.1127	0.5700	0.0360	0.2340	0.028	0.2480	0.0230
41	11.471										
	3	0.8040	0.2960	0.0200	-0.4308	0.5680	0.0330	0.1740	0.02	0.0570	0.0054
42	6.5661	0.6837	0.4750	0.0311	-0.4902	0.8370	0.0590	0.7240	0.033	0.2630	0.0320
43	5.5168	0.4125	0.4890	0.0301	-0.0603	0.3820	0.0220	0.0910	0.019	0.1580	0.0140
44	<i>1.3052</i>	<i>0.1714</i>	<i>0.7420</i>	<i>0.0282</i>	<i>-0.4527</i>	<i>1.0750</i>	<i>0.0830</i>	<i>0.5920</i>	<i>0.061</i>	<i>2.370</i>	<i>0.280</i>
45	<i>0.9070</i>	<i>0.1600</i>	<i>0.6460</i>	<i>0.0123</i>	<i>-0.0661</i>	<i>0.8900</i>	<i>0.0630</i>	<i>0.7140</i>	<i>0.092</i>	<i>3.070</i>	<i>0.640</i>
46	1.9112	0.2374	0.6380	0.0143	0.0475	0.7890	0.0580	0.4040	0.027	1.210	0.150
47	2.3522	0.3018	0.6100	0.0202	-0.1306	0.4590	0.0170	0.2630	0.027	0.5200	0.0640
48	<i>3.3446</i>	<i>0.4293</i>	<i>0.5330</i>	<i>0.0182</i>	<i>-0.3824</i>	<i>0.5160</i>	<i>0.0340</i>	<i>0.2190</i>	<i>0.035</i>	<i>0.3780</i>	<i>0.0560</i>
49	3.5676	0.5401	0.5380	0.0311	-0.6502	0.6760	0.0590	0.3720	0.024	0.4900	0.1100
50	1.0291	0.1381	0.6380	0.0123	-0.3517	0.8820	0.0930	0.5430	0.055	2.260	0.2200
51	<i>5.8806</i>	<i>0.5911</i>	<i>0.4560</i>	<i>0.0181</i>	<i>-0.4815</i>	<i>1.1970</i>	<i>0.0450</i>	<i>1.041</i>	<i>0.043</i>	<i>0.4350</i>	<i>0.0470</i>
52	3.6653	0.4396	0.5580	0.0182	-0.4776	1.3200	0.1800	1.133	0.059	0.8900	0.1100
53	2.1932	0.2367	0.6100	0.0172	-0.5478	1.4800	0.1300	1.128	0.091	1.830	0.230
54	3.3342	0.3887	0.5740	0.0172	-0.5422	1.1280	0.0770	0.7690	0.0470	0.8900	0.0890
55	7.0412	0.6143	0.4530	0.0211	-0.3655	0.9500	0.0720	0.5280	0.0420	0.2730	0.0260
56	3.3342	0.3422	0.5640	0.0212	-0.2167	1.3310	0.0720	0.2120	0.0190	0.9830	0.0730
57	9.7033	0.6892	0.3700	0.0131	0.1023	0.4683	0.0086	0.0784	0.0055	0.0780	0.0069
58	10.854										
	7	0.7172	0.3200	0.0171	-0.0803	0.3791	0.0087	0.0579	0.0054	0.0433	0.0038
59§	<i>0.1597</i>	<i>0.0507</i>	<i>0.6400</i>	<i>0.0281</i>	<i>-0.7127</i>	<i>0.8790</i>	<i>0.0580</i>	<i>0.6660</i>	<i>0.0310</i>	<i>16.08</i>	<i>5.10</i>
60	4.3331	0.5186	0.5640	0.0371	-0.5969	0.6060	0.0440	0.3750	0.0170	0.3560	0.0540
61	6.0127	0.6148	0.4800	0.0221	-0.5712	0.4830	0.0420	0.2260	0.0270	0.1790	0.0280
62	<i>0.2643</i>	<i>0.0279</i>	<i>0.6350</i>	<i>0.0381</i>	<i>0.4610</i>	<i>0.0035</i>	<i>0.0005</i>	<i>0.0824</i>	<i>0.0034</i>	<i>0.0451</i>	<i>0.0046</i>

Footnotes:

Italics font: gross outliers from main Discordia array and/or uncertainty >15%. Data are to be omitted from calculations.

§: omitted from calculations and not plotted due to uncertainty >30%

*: ratio corrected for elemental fractionation, based on reference material DBTL, in addition to corrections for **.

**: ratio corrected for laser induced fractionation and drift, based on reference material NIST 612.

‡: error correlation

Table 5: Start and end points of all lineaments in this study, created manually in ArcGIS™.

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X end	X start	Y start	Y end
-95.797628	-96.466292	34.082636	33.744369
-95.756409	-95.783888	33.679603	33.504111
-95.477036	-95.619012	33.511749	33.412409
-95.861747	-95.857167	33.416231	33.3053
-95.70145	-95.70145	33.3053	33.102197
-97.515088	-97.515088	34.150886	33.896565
-96.658648	-97.034199	34.347744	34.162256
-96.507511	-96.498352	34.302356	34.090222
-96.438813	-97.327312	34.143306	33.645296
-97.725763	-98.417327	34.755127	34.359087
-97.657064	-97.689124	34.309922	34.245587
-97.41891	-97.588366	34.234228	34.147096
-97.446389	-97.483029	33.987753	33.907969
-97.286093	-97.368531	33.915571	33.900367
-97.038779	-97.221975	33.862345	33.78625
-96.869323	-96.97924	33.782443	33.729134
-96.828104	-96.869323	33.664357	33.523204
-96.846424	-97.231134	33.328263	33.488834
-96.837264	-97.134957	33.297644	33.400939
-96.741086	-96.722766	33.335916	33.201891
-96.425073	-96.681547	33.217219	33.152058
-96.347215	-96.434233	33.55756	33.182728
-97.42349	-97.634165	34.412001	34.430891
-97.112057	-97.345632	34.408222	34.374208
-97.047939	-97.061678	34.491309	34.377988
-96.589949	-96.901382	34.434668	34.32127
-95.765569	-96.324316	34.222868	33.968763
-95.215982	-95.678551	33.80528	33.858541
-94.991567	-95.27094	33.691036	33.839523
-100.244704	-100.927108	33.339742	34.03331
-100.121047	-100.372941	33.527022	33.771023
-99.585199	-99.800454	33.751985	34.063668
-100.267603	-100.688953	34.510181	34.946807
-101.604932	-101.797287	33.236374	33.740561
-101.426316	-101.563713	33.538475	33.888962
-99.658477	-99.98365	35.063101	35.081842
-99.374524	-99.516501	34.991844	34.804029
-99.003553	-99.218808	34.804029	34.506407

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-98.499765	-98.861576	34.506407	34.412001
-97.8311	-98.435646	34.268299	34.090222
-99.195908	-99.892052	35.302667	35.108073
-99.085991	-99.085991	35.179229	35.078094
-98.861576	-99.026452	35.048104	34.913014
-98.650901	-98.856996	35.033105	34.916769
-98.495185	-98.68754	35.055603	34.894233
-98.431066	-98.472285	34.849143	34.773939
-99.099731	-99.11805	34.935544	34.852902
-98.916535	-99.035612	34.88672	34.807789
-98.788298	-98.870736	34.781462	34.721254
-98.545564	-98.71044	34.73631	34.653468
-98.540984	-98.751659	34.574314	34.570543
-98.953174	-99.090571	34.713725	34.634629
-94.86333	-95.092325	34.010534	34.207719
-94.400761	-94.712194	34.313705	34.498859
-93.677138	-94.153447	34.54414	34.589396
-93.461883	-94.153447	34.249372	34.502633
-94.382441	-94.570217	33.94977	34.120559
-100.592775	-100.263023	35.384854	35.530345
-101.046185	-100.775971	35.589957	35.630915
-101.577452	-101.25686	35.63836	35.753662
-101.843086	-101.737749	35.861375	35.946698
-101.563713	-101.797287	35.485607	35.388588
-101.160682	-101.398837	35.418452	35.429649
-100.895048	-101.018705	35.38112	35.287715
-100.688953	-100.753072	35.265281	35.369917
-100.551556	-100.601935	35.362448	35.257802
-100.331722	-100.469118	35.239101	35.23536
-100.226384	-100.263023	35.287715	35.377386
-100.029449	-100.024869	35.212912	35.093085
-101.119463	-101.467535	35.369917	35.261542
-100.940847	-101.027865	35.197944	35.119312
-100.83093	-100.927108	35.029355	34.89799
-100.972907	-100.945427	34.867934	35.00685
-101.444635	-101.582032	35.00685	34.901746
-101.101144	-101.334718	34.894234	35.066849
-101.991472	-101.900718	35.493935	35.537586
-102.205982	-102.05335	35.529193	35.586245
-102.445244	-102.3153	35.631521	35.740416

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-102.67213	-102.546311	35.770545	35.837457
-102.985645	-102.77526	35.835785	35.824079
-102.569	-102.665942	36.176169	36.012835
-102.453494	-102.511247	36.029517	36.076209
-102.319425	-102.321488	36.031185	35.95108
-102.187419	-102.274048	35.937721	35.860864
-102.003848	-102.129666	35.855849	35.855849
-101.873904	-101.944032	35.879249	35.97779
-102.152355	-102.131729	35.790625	35.69185
-102.094602	-102.284361	35.778912	35.621462
-101.849153	-101.927531	35.624815	35.584567
-101.671769	-101.776962	35.603017	35.517442
-101.290188	-101.564514	35.696876	35.539264
-102.611356	-103.160241	35.751369	35.62458
-99.705789	-100.516528	36.032853	35.669592
-102.127934	-102.566035	36.187446	36.187446
-103.829982	-104.127085	36.463324	36.183381
-103.311311	-103.709127	36.061354	35.877957
-103.190455	-103.376774	36.236201	36.057283
-102.591213	-103.11492	36.04914	36.536187
-104.388939	-104.585329	36.357957	36.325507
-104.212691	-104.313404	36.264628	35.955443
-103.860196	-104.177442	35.882037	35.415553
-103.699055	-103.885374	35.743195	35.640951
-103.492594	-103.598342	35.677774	35.722757
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-102.253825	-103.185419	35.534478	35.304671
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-97.337462	-96.833897	39.66486	39.001512
-97.652189	-97.526298	38.823967	38.510655

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-96.642817	-96.777283	40.154051	40.417814
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-100.343112	-100.775863	37.36892	37.325135
-101.106327	-101.271559	38.115543	37.836442
-101.39745	-101.562683	38.319541	38.152676
-100.256562	-101.004041	38.338058	38.016428
-101.79086	-101.901015	37.94821	37.668473
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-100.697181	-100.760127	36.633736	36.387099
-100.649972	-100.563422	36.050667	36.304712
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-105.425967	-104.938139	36.266658	37.105826
-101.452528	-101.334505	36.54529	36.942499
-101.326637	-100.948964	36.412431	37.080722
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-100.870281	-100.358849	38.418244	38.609096
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-96.459175	-95.770707	35.426789	35.786625
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-97.762344	-97.504169	35.536911	35.995781
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-99.655629	-99.397454	35.776651	36.481657
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-95.856766	-95.586297	34.580905	34.954574
-96.090353	-96.053471	34.974725	35.316517
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-105.323524	-104.797866	37.812604	38.472473
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-101.83599	-101.623706	36.149224	36.287866
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-105.468395	-105.447195	38.179591	38.435358
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-93.395781	-94.138145	36.243547	36.039461
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-91.437202	-91.563562	35.591173	35.3081
-94.738355	-95.686054	35.732336	35.655369
-93.853835	-94.201325	35.526926	35.475491
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-94.203852	-93.930915	38.004022	38.139309
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-92.636989	-92.920035	37.692714	37.620687
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-89.653946	-90.238996	35.229478	35.697774
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