LA-ICP-MS Cassiterite U-Pb Dating Report

Methodology

In this study, cassiterite U-Pb dating was conducted at the LA-ICP-MS lab of Colorado School of Mines, USA. The instrument was a Resolution-SE 193 nm ArF excimer laser ablation system with an S-155 sample chamber, connected to an Agilent 8900 ICP-MS/MS. The analysis was done in the single quadrupole and no cell gas mode. The laser beam size was 80 microns with a on-sample fluence of 5 J/cm2, and a repetition rate of 5 Hz. The aerosol from the laser ablation was carried by helium gas at 370 ml/minute flow rate, then mixed with Ar gas (1.00 L/minute flow rate) in the funnel right above the sample chamber and then sent to the ICP-MS. One pre-analysis cleaning shot was fired, followed by 15 seconds of washing time for the waste to pass through the system. A gas black of 20 seconds was collected, followed by 50 seconds of cassitereite ablation signals. The primary reference material was cassiterite Yankee (Carr et al., 2020). The secondary reference material was cassiterite AY-4, treated as an unknown to monitor the dating accuracy of a session. In this session, a common Pb-anchored regression intercept age of 153 ± 1 (2σ ; n = 15) was obtained for AY-4, which overlaps with the published TIMS date of 154.3 ± 0.7 Ma (Yang et al., 2022). Date reduction was conducted using software lolite version 4 (Paton et al., 2010). Integration interval selections were aided with the VisualAge tool (Petrus and Kamber, 2012) in Iolite.



Figure 1 - Tera-Wasserburg concordia plot for the secondary reference cassiterite AY-4.

No.	Sample ID	# Data points	Age ⁽¹⁾ (Ma)	uncertainty (2σ; Ma)	Suggested ⁽²⁾ Uncertainty (2σ; Ma)	MSWD	
1	Argemela	20	311	2	3	1.1	
6	Pedra Alta	20	311	1	3	0.7	
4	Cerro Queimado	19	309	1	3	0.5	
3	Panasqueira (CST 8)	20	297	1	3	1.8	
7	Sandinho	20	296	1	3	1.1	
5	Mata da Rainha	20	292	1	3	0.7	
2	Capinha	20	286	1	3	1.2	

Table 1 – U-Pb cassiterite age summary table

 $^{\scriptscriptstyle (1)}\mbox{The final age is weighted average of 207-Pb corrected 206/238 age.}$

 $^{(2)}$ Recommended 1% uncertainty when the uncertainty from the weighted average of a sample is < 1%









References:

Carr, P.A., Zink, S., Bennett, V.C., Norman, M.D., Amelin, Y. and Blevin, P.L., 2020. A new method for U-Pb geochronology of cassiterite by ID-TIMS applied to the Mole Granite polymetallic system, eastern Australia. Chemical Geology, 539, p.119539.

Yang, M., Romer, R.L., Yang, Y.H., Wu, S.T., Wang, H., Tu, J.R., Zhou, H.Y., Xie, L.W., Huang, C., Xu, L. and Yang, J.H., 2022. U-Pb isotopic dating of cassiterite: Development of reference materials and in situ applications by LA-SF-ICP-MS. Chemical Geology, 593, p.120754.

Paton C., Woodhead J.D., Hellstrom J.C., Hergt J.M., Greig A. and Maas R. (2010) Improved laser ablation U-Pb zircon geochronology through robust downhole fractionation correction. Geochemistry, Geophysics, Geosystems, 11, Q0AA06 doi:10.1029/2009GC002618.

Petrus, J.A. and Kamber, B.S. (2012), VizualAge: A Novel Approach to Laser Ablation ICP-MS U-Pb Geochronology Data Reduction. Geostandards and Geoanalytical Research, 36: 247-270.

Table 2 – U-Pb cassiterite dating complete data

	Te	era-Wa	asserburg		Co	nvent	ional Conc	ordia				Age Estim	ate			207P	ction	
Spot ID	²³⁸ U/ ²⁰⁶ Pb	2σ %	²⁰⁷ Pb/ ²⁰⁶ Pb	2σ %	²⁰⁷ Pb/ ²³⁵ U	2σ %	²⁰⁶ Pb/ ²³⁸ U	2σ %	RHO lolite	²⁰⁷ Pb/ ²⁰⁶ Pb	2σ abs	²⁰⁶ Pb/ ²³⁸ U	2σ abs	²⁰⁷ Pb/ ²³⁵ U	2σ abs	²⁰⁷ Pb- corrected ²⁰⁸ Pb/ ²³⁸ U Age	2σ abs	Common ²⁰⁷ Pb/ ²⁰⁸ Pb Composition
Argemela																		
20240315_Argemela - 16 20240315_Argemela - 10	20.2723	5.0	0.0638	22.1	0.4418	20.1	0.04933	5.0	0.0	736.40	468.70	310.40	15.11	371.51	62.53	306.11	15.97	0.86
20240315_Argemela - 18	20.4474	1.7	0.0538	9.1	0.3690	6.5	0.04891	1.7	0.0	363.33	206.16	307.80	5.25	318.90	17.84	307.31	5.59	0.86
20240315_Argemela - 14	20.3989	2.0	0.0549	8.8	0.3790	6.5	0.04902	2.0	0.0	406.76	197.37	308.52	5.96	326.28	18.01	307.63	6.26	0.86
20240315_Argemela - 20	20.3712	1.9	0.0522	8.8	0.3629	6.7	0.04909	1.9	0.0	296.20	200.00	308.93	5.66	314.35	18.16	309.04	5.96	0.86
20240315_Argemela - 13	20.3112	2.2	0.0533	10.0	0.3704	8.3	0.04923	2.2	0.0	341.97	226.76	309.82	6.52	319.98	22.83	309.53	6.87	0.86
20240315_Argemela - 1 20240315_Argemela - 3	20.3073	1.6	0.0528	8.5	0.3655	6.2	0.04924	1.6	0.0	321.95	193.06	309.87	4.95	316.34	16.74	309.77	5.26	0.86
20240315_Argemela - 2	19.9433	1.8	0.0640	8.7	0.4558	6.4	0.05014	1.8	0.1	742.43	183.51	315.39	5.49	381.34	20.32	311.01	5.88	0.86
20240315_Argemela - 8	19.9485	2.0	0.0628	9.1	0.4424	6.9	0.05013	2.0	0.0	701.42	193.72	315.31	6.20	371.94	21.47	311.41	6.57	0.86
20240315_Argemela - 15 20240315_Argemela - 5	20.0878	2.0	0.0527	12.5	0.3700	10.5	0.04978	2.0	0.0	317.50	284.75	313.18	6.18	319.62	28.90	313.14	6.72	0.86
20240315_Argemela - 7	19.6038	2.3	0.0701	9.0	0.5117	7.2	0.05101	2.3	0.1	932.71	183.93	320.72	7.11	419.62	24.71	313.91	7.47	0.86
20240315_Argemela - 4 20240315_Argemela - 6	19.4619	2.3	0.0755	10.6	0.5503	4.8	0.05138	2.3	0.3	1081.91	239.19	323.00	7.09	445.19 328.35	24.44	314.05	5.66	0.86
20240315_Argemela - 11	19.5332	3.2	0.0600	13.5	0.4311	11.9	0.05119	3.2	0.0	604.93	292.15	321.85	10.06	363.97	36.55	319.02	10.56	0.86
20240315_Argemela - 9	19.4634	2.6	0.0607	9.7	0.4316	7.7	0.05138	2.6	0.0	629.94	209.97	322.98	8.11	364.30	23.46	319.87	8.44	0.86
20240315_Argemela - 19	19.1566	7.4	0.0634	30.6	0.4614	29.2	0.05220	7.4	0.2	721.13	650.40	328.02	23.73	385.21	93.50	323.85	24.90	0.86
Capi nha	00.0070	4.7	0.0560		0.0000		0.04474	4.7	0.4	400.07	400.40	004.04	4.00	240.20	47.07	200.04	4.00	0.95
20240315_CAPINHA - 9 20240315_CAPINHA - 1	22.3678	2.3	0.0569	10.4	0.3696	8.7	0.04471	2.3	0.1	488.97	244.94	281.94	6.23	279.34	21.27	280.21	6.54	0.85
20240315_CAPINHA - 3	21.8116	2.3	0.0694	11.2	0.4615	9.6	0.04585	2.3	0.0	911.81	231.26	288.98	6.54	385.30	30.79	282.81	7.04	0.85
20240315_CAPINHA - 18 20240315_CAPINHA - 19	22.2534	2.0	0.0521	9.2	0.3371	8.2	0.04494	2.0	0.0	290.51	229.47	283.36	5.45	294.95	20.98	283.31	5.78	0.85
20240315_CAPINHA - 13	22.1996	1.6	0.0524	7.8	0.3416	5.3	0.04505	1.6	0.0	302.23	178.43	284.03	4.37	298.38	13.78	283.89	4.62	0.85
20240315_CAPINHA - 16	22.1849	1.5	0.0520	8.3	0.3397	5.8	0.04508	1.5	0.0	283.56	190.88	284.22	4.19	296.92	14.85	284.22	4.48	0.85
20240315_CAPINHA - 8 20240315_CAPINHA - 7	22.1395	2.1	0.0516	9.5	0.3372	7.2	0.04517	2.1	0.0	265.89	217.16	284.79	5.74	295.04	18.46	284.94	6.03 5.82	0.85
20240315_CAPINHA - 11	22.0118	1.8	0.0530	9.8	0.3483	7.9	0.04543	1.8	0.0	330.77	222.63	286.40	5.06	303.46	20.76	286.04	5.41	0.85
20240315_CAPINHA - 14	22.1103	1.5	0.0486	8.0	0.3186	5.3	0.04523	1.5	0.0	129.19	187.10	285.16	4.10	280.81	13.07	286.34	4.35	0.85
20240315_CAPINHA - 12	22.0295	1.8	0.0511	8.3	0.3351	5.8	0.04539	1.8	0.0	240.51	187.82	287.09	4.76	293.49	15.15	286.63	5.03	0.85
20240315_CAPINHA - 20	22.0510	2.2	0.0498	9.8	0.3221	8.0	0.04535	2.2	0.1	184.03	227.96	285.91	6.15	283.50	19.73	286.70	6.44	0.85
20240315_CAPINHA - 10 20240315_CAPINHA - 4	21.9924	2.1	0.0509	9.2	0.3377	7.1	0.04547	2.1	0.0	234.97	211.50	286.65	5.86	295.41	18.26	287.06	6.13	0.85
20240315_CAPINHA - 17	21.8276	2.1	0.0501	9.9	0.3325	8.0	0.04581	2.1	0.0	200.43	229.14	288.77	5.93	291.50	20.35	289.46	6.23	0.85
20240315_CAPINHA - 6	21.5928	2.3	0.0570	10.0	0.3814	8.2	0.04631	2.3	0.1	491.86	220.73	291.84	6.43	328.07	22.99	290.10	6.76	0.85
20240315_CAPINHA - 2 20240315_CAPINHA - 5	21.7348 21.6346	1.9	0.0493	9.5	0.3284	9.7	0.04601	1.9	0.0	48.63	272.19	289.97 291.29	5.36	288.34	24.34 18.53	290.98	5.66	0.85
Panasqueira	04 4000		0.0555	45.0	0.0070	40.0	0.04050		0.0	404.00	250.00	000.40	0.40	047.05	00.00	201.00	0.00	0.00
20240315_CST 8 - 12 20240315_CST 8 - 20	21.4920	3.2	0.0555	15.8	0.3676	4.0	0.04653	3.2	0.0	202.74	350.83	293.18	3.44	295.87	10.19	291.96	3.68	0.86
20240315_CST 8 - 5	21.4335	1.6	0.0532	8.1	0.3526	5.5	0.04666	1.6	0.0	339.15	183.11	293.96	4.58	306.70	14.45	293.58	4.86	0.86
20240315_CST 8 - 15 20240315_CST 8 - 19	21.4599	1.3	0.0504	6.9	0.3420	4.2	0.04660	1.3	0.0	211.37	160.92	293.60	3.60	298.72	10.79	294.27	3.84	0.86
20240315_CST 8 - 18	21.3239	1.3	0.0526	7.0	0.3590	4.0	0.04690	1.3	0.0	309.51	158.42	295.44	3.65	311.47	10.80	295.32	3.89	0.86
20240315_CST 8 - 4	21.2679	1.4	0.0546	7.1	0.3662	4.4	0.04702	1.4	0.1	394.62	159.69	296.20	4.02	316.81	11.91	295.35	4.27	0.86
20240315_CST 8 - 2 20240315_CST 8 - 9	21.3027	1.4	0.0518	7.6	0.3446	5.0	0.04694	1.4	0.0	300.08	1/3.66	295.72	4.13	300.65	12.99	295.88	4.39	0.86
20240315_CST 8 - 14	21.2920	1.4	0.0501	7.5	0.3384	4.8	0.04697	1.4	0.1	198.40	173.98	295.87	4.10	295.96	12.30	296.65	4.35	0.86
20240315_CST 8 - 13 20240315_CST 8 - 17	21.1432	2.0	0.0542	9.2	0.3665	6.7	0.04730	2.0	0.0	380.68	206.37	297.90	5.83	317.06	18.34	297.19	6.14	0.86
20240315_CST 8 - 16	21.1704	1.3	0.0517	7.1	0.3539	4.4	0.04724	1.3	0.1	271.91	162.91	297.53	3.84	307.68	11.66	297.74	4.08	0.86
20240315_CST 8 - 8	21.0363	1.6	0.0513	8.5	0.3470	6.1	0.04754	1.6	0.0	252.38	194.83	299.38	4.80	302.47	15.97	299.77	5.10	0.86
20240315_CST 8 - 11 20240315_CST 8 - 10	20.9728	1.7	0.0529	8.4	0.3652	5.8	0.04768	1.7	0.1	261.50	191.54	300.27	5.10	316.08	17.30	300.07	5.38	0.86
20240315_CST 8 - 6	20.9238	1.7	0.0527	7.6	0.3591	5.0	0.04779	1.7	0.0	314.38	172.46	300.95	4.87	311.54	13.42	300.84	5.12	0.86
20240315_CST 8 - 1	20.8909	1.2	0.0539	7.4	0.3683	4.9	0.04787	1.2	0.0	365.37	167.41	301.42	3.63	318.38	13.49	300.86	3.93	0.86
20240315_CST 8 - 3	20.8602	1.3	0.0503	7.0	0.3493	4.8	0.04794	1.3	0.1	243.26	166.01	301.85	3.84	304.92	12.64	302.63	4.99	0.86
Cerro Queimado 20240315 Cerro Queimado - 19	23.0740	2.9	0.1152	10.9	0.7035	81	0.04334	2.9	0.0	1882.41	196 19	273 49	7.65	540.90	34.05	252 13	8.58	0.85
20240315_Cerro Queimado - 15	20.5742	1.6	0.0537	8.4	0.3783	6.3	0.04860	1.6	0.2	360.14	188.50	305.95	4.93	325.75	17.55	305.47	5.23	0.86
20240315_Cerro Queimado - 18	20.4899	1.5	0.0551	7.9	0.3840	5.1	0.04880	1.5	0.0	414.69	176.47	307.18	4.59	330.01	14.50	306.21	4.89	0.86
20240315_Cerro Queimado - 13 20240315_Cerro Queimado - 5	20.4851 18.9928	1.7	0.0552	6.9	0.3921	5.9 4.0	0.04882	1.7	0.0	419.88	124.34	307.25	4.99	535.90 621.94	18.60	306.24	5.79	0.86
20240315_Cerro Queimado - 16	20.1772	1.4	0.0639	7.3	0.4591	4.7	0.04956	1.4	0.0	738.79	155.42	311.82	4.26	383.65	14.88	307.50	4.62	0.86
20240315_Cerro Queimado - 17 20240315_Cerro Queimado - 20	20.3645	1.5	0.0556	7.6	0.3941	5.2	0.04911	1.5	0.2	434.83	169.02	309.03	4.59	337.37	14.82	307.88	4.87	0.86
20240315_Cerro Queimado - 12	20.2501	1.8	0.0569	8.2	0.4040	5.8	0.04938	1.8	0.1	487.37	180.23	310.73	5.60	344.52	16.94	309.09	5.89	0.86
20240315_Cerro Queimado - 7	19.7228	1.5	0.0776	7.0	0.5678	4.3	0.05070	1.5	0.2	1135.73	138.90	318.84	4.64	456.60	15.86	309.15	5.11	0.86
20240315_Cerro Queimado - 2 20240315 Cerro Queimado - 10	18.1504	1.6	0.1396	7.1	0.5905	4.3	0.05510	1.8	0.1	1206.01	126.90	345.73	4.50	471.21	16.34	309.26	5.05	0.86
20240315_Cerro Queimado - 4	20.1211	1.7	0.0611	7.7	0.4303	5.0	0.04970	1.7	0.1	644.26	164.46	312.67	5.21	363.42	15.30	309.41	5.50	0.86
20240315_Cerro Queimado - 11 20240315_Cerro Queimado - 1	20.2338	1.8	0.0563	8.3 6.8	0.4004	5.9	0.04942	1.8	0.1	465.48	183.16	310.97	5.50	341.94	21.14	309.55	5.79	0.86
20240315_Cerro Queimado - 9	19.8044	2.0	0.0712	11.1	0.5251	11.5	0.05049	2.0	0.9	964.34	226.76	317.55	6.27	428.58	40.33	310.36	6.95	0.86
20240315_Cerro Queimado - 6	19.7489	1.4	0.0722	7.2	0.5190	4.2	0.05064	1.4	0.1	991.66	146.17	318.42	4.47	424.51	14.69	310.84	4.91	0.86
20240315_Cerro Queimado - 3 20240315 Cerro Queimado - 8	19.6730	1.0	0.1083	6.7	0.8286	3.7	0.05083	1.6	0.4	1770.91	122.20	319.62	4.34	612.84	17.11	311.39	5.60	0.86
20240315_Cerro Queimado - 14	19.9849	2.3	0.0598	9.4	0.4327	7.2	0.05004	2.3	0.0	597.98	203.40	314.75	7.08	365.12	22.15	311.99	7.40	0.86
Mata da Rainha 20240315 MATA DA RAINHA - 3	21.7124	1.3	0.0538	7.3	0.3580	4.5	0.04606	1.3	0.0	362,53	164.59	290.27	3.61	310.71	12.03	289.67	3.88	0.85
20240315_MATA DA RAINHA - 10	21.6530	1.4	0.0548	7.2	0.3666	4.4	0.04618	1.4	0.0	402.46	160.65	291.04	3.96	317.15	12.12	290.10	4.21	0.85
20240315_MATA DA RAINHA - 4	21.6827	1.2	0.0536	7.4	0.3548	4.6	0.04612	1.2	0.0	354.52	167.87	290.65	3.51	308.34	12.13	290.12	3.79	0.85
20240315_MATA DA RAINHA - 19 20240315_MATA DA RAINHA - 6	21.56802	1.2	0.0560	6.5	0.3669	3.3	0.04636	1.2	0.0	453.96	149.06	292.16	3.31	317.36	≥9.96 8.76	290.76	3.54	0.85
20240315_MATA DA RAINHA - 5	21.4955	1.1	0.0580	6.2	0.3939	2.8	0.04652	1.1	0.1	531.48	136.85	293.13	3.29	337.21	7.94	291.02	3.54	0.86
20240315_MATA DA RAINHA - 11 20240315_MATA DA RAINHA - 13	21.5270	1.2	0.0562	6.9	0.3782	3.9	0.04645	1.2	0.0	462.18	152.33	292.71	3.45	325.70	10.98	291.24	3.72	0.86
20240315_MATA DA RAINHA - 9	21.6675	1.4	0.0500	7.3	0.3337	4.6	0.04615	1.4	0.0	193.66	168.93	290.85	3.91	292.35	11.62	291.62	4.14	0.85
20240315_MATA DA RAINHA - 8	20.8898	1.1	0.0783	6.1	0.5442	2.5	0.04787	1.1	0.1	1155.20	121.82	301.43	3.39	441.18	8.90	291.83	3.89	0.86
20240315_MATA DA RAINHA - 16 20240315 MATA DA RAINHA - 7	21.6310	1.2	0.0500	6.4	0.3355	3.6	0.04623	1.2	0.2	194.31 228.82	152.83	291.33	3.42	293.73	9.26	292.10	3.64	0.85
20240315_MATA DA RAINHA - 2	21.5429	1.3	0.0516	7.0	0.3466	4.2	0.04642	1.3	0.1	267.07	160.47	292.50	3.80	302.14	10.89	292.71	4.03	0.86
20240315_MATA DA RAINHA - 14	21.3556	1.1	0.0574	6.2	0.3875	2.5	0.04683	1.1	0.0	505.84	137.43	295.01	3.17	332.52	7.19	293.14	3.42	0.86
20240315_MATA DA RAINHA - 12	21.5157	3.4	0.0513	15.1	0.3407	4.3	0.04648	3.4	0.0	356.69	339.91	292.86	9.73	312.16	37.88	293.16	10.21	0.86
20240315_MATA DA RAINHA - 1	21.4529	1.3	0.0522	7.0	0.3523	4.1	0.04661	1.3	0.0	292.56	159.81	293.70	3.74	306.42	10.73	293.71	3.98	0.86
20240315_MATA DA KAINHA - 15 20240315_MATA DA RAINHA - 20	21.4476 21.3923	1.2	0.0520	6.8 12.2	0.3487	3.8	0.04663	1.2	0.0	283.38 215.19	282.52	293.77	3.45 7.45	303.77	9.87 25.83	293.86 295.15	3.69 7.85	0.86
20240315_MATA DA RAINHA - 18	20.9293	2.8	0.0513	12.7	0.3488	11.1	0.04778	2.8	0.0	255.90	292.35	300.88	8.15	303.79	29.13	301.25	8.57	0.86

	Te	ra-Wa	asserburg		Conventional Concordia					Age Estim		207Pb correction						
Spot ID	²³⁸ U/ ²⁰⁶ Pb	2σ %	²⁰⁷ Pb/ ²⁰⁸ Pb	2σ %	²⁰⁷ Pb/ ²³⁵ U	2σ %	²⁰⁶ Pb/ ²³⁸ U	2σ %	RHO lolite	²⁰⁷ Pb/ ²⁰⁶ Pb	2σ abs	²⁰⁸ Pb/ ²³⁸ U	2σ abs	²⁰⁷ Pb/ ²³⁵ U	2σ abs	²⁰⁷ Pb- corrected ²⁰⁶ Pb/ ²³⁸ U Age	2σ abs	Common ²⁰⁷ Pb/ ²⁰⁸ Pb Composition
Pedra Alta																		
20240315_Pedra Alta - 7	20.1051	3.1	0.0753	12.4	0.5125	10.7	0.04974	3.1	0.1	1075.83	249.50	312.92	9.53	420.11	36.95	304.23	10.06	0.86
20240315_Pedra Alta - 5	20.0352	1.5	0.0695	7.7	0.4914	5.0	0.04991	1.5	0.0	912.76	158.38	313.98	4.61	405.84	16.71	307.51	5.04	0.86
20240315_Pedra Alta - 4	20.2766	2.0	0.0583	9.3	0.4081	7.6	0.04932	2.0	0.1	540.50	204.09	310.33	6.09	347.54	22.23	308.16	6.44	0.86
20240315_Pedra Alta - 3	19.9964	1.6	0.0672	7.6	0.4751	4.8	0.05001	1.6	0.0	843.57	157.24	314.58	5.00	394.68	15./1	308.98	5.35	0.86
20240315_Pedra Alta - 19 20240315_Pedra Alta - 1	10.4422	1.5	0.2062	7.2	1./019	4.6	0.06082	1.5	0.1	2875.00	141.44	380.60	10.26	1031.55	40.40	310.01	14.14	0.80
20240315_Pedra Alta - 6	19.6459	1.8	0.0030	8.6	0.5607	6.3	0.05090	1.5	0.0	1142.18	171.39	320.05	5.55	451.98	23.09	310.25	6.12	0.86
20240315 Pedra Alta - 16	19.2240	2.1	0.0940	9.1	0.6905	6.9	0.05202	2.1	0.1	1507.58	172.49	326.90	6.75	533.09	28.44	310.48	7.54	0.86
20240315_Pedra Alta - 8	19.1539	3.0	0.0964	12.2	0.7343	11.5	0.05221	3.0	0.0	1556.32	228.65	328.07	9.68	559.09	49.30	310.62	10.56	0.86
20240315_Pedra Alta - 11	19.2683	2.0	0.0909	8.1	0.6719	5.9	0.05190	2.0	0.1	1445.13	153.94	326.17	6.35	521.87	23.99	311.00	6.97	0.86
20240315_Pedra Alta - 14	19.9710	1.5	0.0621	7.6	0.4422	5.0	0.05007	1.5	0.0	678.44	161.47	314.97	4.69	371.83	15.49	311.32	5.02	0.86
20240315_Pedra Alta - 12	19.9670	2.0	0.0620	9.0	0.4411	6.7	0.05008	2.0	0.0	675.48	192.73	315.03	6.07	371.03	20.90	311.42	6.44	0.86
20240315_Pedra Alta - 13	18.5876	1.6	0.1167	7.0	0.9051	4.8	0.05380	1.6	0.5	1906.86	126.02	337.80	5.19	654.44	23.09	311.55	6.54	0.86
20240315_Pedra Alta - 15 20240315_Pedra Alta - 18	20.0349	1.0	0.0583	8.2	0.4171	5.Z	0.04991	1.0	0.2	941.04	168.65	313.99	4.78	420.29	10.00	311.82	5.08	0.86
20240315_Pedra Alta - 10	19.7888	1.7	0.0658	8.6	0.4717	6.1	0.05053	1.9	0.0	800.71	179.47	317.80	6.01	392.35	19.91	312.24	6.38	0.86
20240315 Pedra Alta - 2	19.8909	1.6	0.0615	8.2	0.4412	6.0	0.05027	1.6	0.1	657.41	175.94	316.20	4.90	371.11	18.63	312.79	5.27	0.86
20240315 Pedra Alta - 9	19.2770	2.1	0.0806	8.2	0.6025	6.5	0.05188	2.1	0.2	1211.49	162.31	326.03	6.56	478.84	24.67	314.99	7.02	0.86
20240315_Pedra Alta - 20	19.1419	1.6	0.0853	7.7	0.6311	5.0	0.05224	1.6	0.0	1322.02	148.98	328.27	4.98	496.79	19.49	315.29	5.67	0.86
20240315_Pedra Alta - 17	19.0104	1.8	0.0874	8.4	0.6618	6.6	0.05260	1.8	0.2	1370.15	161.75	330.48	5.80	515.74	26.83	316.57	6.51	0.86
Sandinho	04 5005		0.050-		0.017-		0.01007				007.01	000 / -		000 0-	40.45	004.00	0.00	
20240315_Sandinho - 9	21.5686	2.0	0.0528	9.1	0.3477	6.9	0.04636	2.0	0.0	319.97	207.61	292.16	5.74	302.98	18.15	291.93	6.03	0.86
20240315_Sandinho - 18	21.4325	1.4	0.0560	7.2	0.3692	4.4	0.04666	1.4	0.1	451.08	168.69	293.97	4.02	319.05	12.03	292.61	4.29	0.86
20240315_Sandinho - 10	21.4686	1.4	0.0530	7.0	0.3529	4.1	0.04658	1.4	0.1	327.02	158.52	293.49	3.89	306.89	10.95	292.32	4.13	0.86
20240315 Sandinho - 2	21,4407	1.4	0.0524	7.0	0.3494	4.4	0.04664	1.4	0.1	302.33	159.03	293.86	3.89	304.28	11.62	293.79	4.13	0.86
20240315_Sandinho - 3	21.3297	1.7	0.0558	8.3	0.3747	5.8	0.04688	1.7	0.0	443.76	185.60	295.36	4.79	323.14	16.19	294.07	5.09	0.86
20240315_Sandinho - 11	21.4177	1.3	0.0522	7.0	0.3521	4.5	0.04669	1.3	0.2	295.61	159.15	294.17	3.72	306.32	12.01	294.16	3.97	0.86
20240315_Sandinho - 8	21.3492	1.8	0.0544	9.4	0.3637	7.6	0.04684	1.8	0.0	389.23	210.82	295.09	5.29	314.99	20.46	294.29	5.62	0.86
20240315_Sandinho - 5	21.3792	1.3	0.0525	6.9	0.3535	4.1	0.04677	1.3	0.0	306.80	158.28	294.69	3.90	307.35	10.77	294.59	4.13	0.86
20240315_Sandinho - 13	21.2752	2.6	0.0558	13.0	0.3603	10.4	0.04700	2.6	0.0	444.72	288.21	296.10	7.57	312.41	28.10	294.80	8.03	0.86
20240315_Sandinho - 1	21.3574	1.5	0.0510	7.2	0.3421	4.3	0.04682	1.5	0.0	239.61	166.93	294.98	4.39	298.74	11.21	295.43	4.62	0.86
20240315_Sandinho - 16	21.2613	2.1	0.0544	9.9	0.3638	1.9	0.04703	2.1	0.0	385.62	223.18	296.28	6.07	315.02	21.46	295.52	6.41	0.86
20240315_Sandinho - 15 20240315_Sandinho - 6	21.2132	1.4	0.0529	6.9	0.3522	4.2	0.04714	1.4	0.1	278.40	157.62	296.94	4.00	306.34	10.86	296.09	4.23	0.86
20240315_Sandinho - 7	21 2516	1.3	0.0505	7.1	0.3320	4.1	0.04706	1.3	0.2	219.53	163.37	296.42	3.90	300.54	11 54	290.90	4.00	0.86
20240315 Sandinho - 12	21,1507	1.3	0.0524	7.0	0.3545	4.2	0.04728	1.3	0.0	303.33	160.61	297.80	3.84	308.09	11.25	297.75	4.09	0.86
20240315 Sandinho - 14	21.1042	1.5	0.0529	7.4	0.3558	4.7	0.04738	1.5	0.1	325.71	167.33	298.44	4.51	309.11	12.65	298.21	4.75	0.86
20240315_Sandinho - 17	21.0729	1.4	0.0531	7.4	0.3588	4.8	0.04745	1.4	0.0	333.48	167.34	298.87	4.04	311.32	12.88	298.58	4.31	0.86
20240315_Sandinho - 19	21.0399	1.4	0.0538	7.0	0.3624	4.3	0.04753	1.4	0.1	362.55	158.47	299.33	3.99	314.04	11.53	298.79	4.24	0.86
20240315_Sandinho - 20	21.0797	1.3	0.0506	7.1	0.3439	4.5	0.04744	1.3	0.1	222.25	163.48	298.78	3.69	300.15	11.82	299.41	3.94	0.86
Venkee																		
20240215 Vankaa - 2	25 9056	37	0.0571	25.0	0.2058	24.8	0.03975	37	0.3	404.08	771 97	245.00	8.83	270.02	82.68	242.28	10.70	0.95
20240315_Tankee - 4	25.5694	3.0	0.0454	14.5	0.2570	13.4	0.03911	3.0	0.3	-32.36	352.87	243.03	7.17	232.23	27.91	243.20	7.54	0.85
20240315 Yankee - 6	25,4686	4.4	0.0444	46.3	0.2652	47.9	0.03926	4.4	0.4	-85.81	1133.81	248.27	10.79	238.87	101.88	250.33	12.64	0.85
20240315_Yankee - 8	25.6935	4.5	0.0439	45.6	0.2650	42.6	0.03892	4.5	0.4	-115.42	1124.47	246.14	10.80	238.67	90.64	248.32	12.54	0.85
20240315_Yankee - 9	25.6716	3.4	0.0548	16.6	0.3158	15.8	0.03895	3.4	0.2	402.70	371.38	246.34	8.16	278.68	38.41	245.24	8.63	0.85
20240315_Yankee - 12	26.0322	4.2	0.0425	65.4	0.2954	49.3	0.03841	4.2	0.3	-199.22	1639.06	242.99	10.04	262.81	114.05	245.57	13.18	0.85
20240315_Yankee - 13	25.5990	1.7	0.0514	10.9	0.2895	9.0	0.03906	1.7	0.1	257.36	249.72	247.03	4.12	258.17	20.51	246.96	4.47	0.85
20240315_Yankee - 15	25.4513	3.3	0.0436	27.3	0.2438	25.3	0.03929	3.3	0.0	-131.00	674.78	248.44	8.12	221.53	50.44	250.74	9.02	0.85
20240315_Yankee - 17	25.7439	1.6	0.0487	11.6	0.2646	10.0	0.03884	1.6	0.2	135.46	273.35	245.66	3.78	238.35	21.20	246.38	4.18	0.85
20240315_TBRK86 - 19 20240315_Vankec - 20	25.5815	2.1	0.0496	11.3	0.2766	9.9	0.03909	2.1	0.1	1/5.64	263.08	247.19	0.15	247.92	21.74	247.67	5.46	0.85
20240315 Yankee - 21	25.5909	2.0	0.0404	18.2	0.2020	18.3	0.03908	2.0	0.1	350.52	412 44	240.04	5.64	250.75	41.23	240.29	6.39	0.85
20240315 Yankee - 22	25.8958	3.9	0.0451	29.6	0.2441	26.4	0.03862	3.9	0.1	-48.01	719.54	244.25	9.42	221.81	52.54	246.04	10.36	0.85
20240315 Yankee - 23	25.6468	3.0	0.0501	13.5	0.2712	11.9	0.03899	3.0	0.0	200.56	314.10	246.58	7.22	243.61	25.78	246.88	7.56	0.85
20240315_Yankee - 24	25.6446	2.8	0.0454	14.6	0.2583	12.6	0.03899	2.8	0.0	-35.43	355.41	246.60	6.85	233.26	26.16	248.35	7.24	0.85
20240315_Yankee - 25	25.5659	4.1	0.0515	22.4	0.2820	20.9	0.03911	4.1	0.1	264.62	514.94	247.34	9.98	252.28	46.65	247.23	10.64	0.85
20240315_Yankee - 26	25.6868	3.0	0.0563	14.5	0.3016	12.6	0.03893	3.0	0.0	465.52	321.61	246.20	7.33	267.65	29.61	244.62	7.74	0.85
AT-4	41 1205	4.4	0.0524		0.1840	2.4	0.02424	1.4	0.0	333.99	142.07	164.00	1.60	171.40	4 00	164.07	1 70	0.05
20240315_AT-4 - 1 20240315_AV-4 - 2	41.1305	2.1	0.0531	9.8	0.1840	7.6	0.02431	2.1	0.2	307.27	223.95	155.03	3.29	171.40	4.00	154.07	3.44	0.85
20240315 AY-4 - 3	42 1110	1.2	0.0525	7.1	0.1753	4.2	0.02434	1.2	0.0	234.30	163.42	151.29	1.82	164.02	6.42	150.96	1.94	0.85
20240315 AY-4 - 4	41.5880	1.4	0.0612	9.0	0.2152	7.6	0.02405	1.4	0.4	646.95	194.23	153.17	2.20	197.87	13.67	150.86	2.43	0.85
20240315_AY-4 - 5	42.0610	1.5	0.0484	10.1	0.1673	8.1	0.02378	1.5	0.0	118.09	238.70	151.47	2.24	157.08	11.77	151.60	2.42	0.85
20240315_AY-4 - 6	40.5090	2.4	0.0690	13.6	0.2488	13.5	0.02469	2.4	0.4	899.26	281.55	157.20	3.80	225.61	27.33	153.32	4.18	0.85
20240315_AY-4 - 7	39.3169	4.9	0.0842	16.0	0.3066	14.1	0.02543	4.9	0.0	1297.15	311.91	161.91	7.91	271.58	33.61	154.87	8.10	0.85
20240315_AY-4 - 8	40.7412	2.2	0.0523	11.0	0.1772	8.1	0.02455	2.2	0.3	299.91	250.67	156.32	3.35	165.63	12.42	155.70	3.53	0.85
20240315_AY-4 - 9	33.2536	4.3	0.1741	13.2	0.7645	15.3	0.03007	4.3	0.7	2597.62	220.00	191.00	8.10	576.61	67.49	161.52	9.34	0.85
20240315_AY-4 - 10	37.2839	2.7	0.1140	15.1	0.4487	16.5	0.02682	2.7	0.9	1864.92	272.22	170.62	4.58	376.39	51.94	156.91	5.78	0.85
20240315_AY-4 - 11	40.2118	5.2	0.0644	13.3	0.2275	13.1	0.02487	5.2	0.4	753.19	281.82	158.35	8.06	208.13	24.59	155.37	8.13	0.85
20240315_AT-4 - 12 20240315_AY_4 - 13	41.0713	2.2	0.0513	0.0	0.1775	3.3	0.02435	1.1	0.0	254.05	200 70	155.08	3.34	170.91	7.84	104.66	3.46	0.85
20240315 AY-4 - 14	39 6152	1.4	0.0313	7.8	0.1825	6.0	0.02445	1.4	0.0	1214 51	153.03	160.74	2.17	262.39	13.90	154.41	2.53	0.85
20240315 AY-4 - 15	41.1190	1.4	0.0608	9.5	0.2145	7.9	0.02432	1.4	0.3	632.01	205.09	154.90	2.16	197.33	14.09	152.65	2.42	0.85
		1.14	0.0000	0.0	3.2.140		Z		0.0	002.01	200.00	.04.00		.01.00		102.00	2.72	5.05