

**TABLE S1: FISH CANYON LA-ICPMS U-Pb ZIRCON GEOCHRONOLOGY**

Zircon #	Composition			Ages													
	U	206Pb/	U/Th	206Pb/	2 $\sigma$	207Pb/	2 $\sigma$	206Pb/	2 $\sigma$	error	206Pb/	2 $\sigma$	207Pb/	2 $\sigma$	206Pb/	2 $\sigma$	%
	(ppm)	204Pb		207Pb	(%)	235U	(%)	238U	(%)	corr.	238U	(Ma)	235U	(Ma)	207Pb	(Ma)	Disc.
<b>Fish Canyon no CA Run 1</b>																	
Fish Canyon-1	575	3013	2.27	19.391	5.8	0.0307	7.6	0.00432	4.9	0.640	27.8	1.3	30.7	2.3	265.4	134.2	89.5
Fish Canyon-2	469	757	2.55	29.950	20.6	0.0212	22.9	0.00461	10.1	0.439	29.7	3.0	21.3	4.8	NA	NA	NA
Fish Canyon-3	347	879	1.18	25.229	29.4	0.0240	30.9	0.00439	9.7	0.313	28.2	2.7	24.1	7.4	NA	NA	NA
Fish Canyon-5	247	1070	2.40	25.905	11.3	0.0253	14.1	0.00476	8.4	0.598	30.6	2.6	25.4	3.5	NA	NA	NA
Fish Canyon-6	262	920	2.28	28.107	15.7	0.0237	18.8	0.00484	10.3	0.551	31.1	3.2	23.8	4.4	NA	NA	NA
Fish Canyon-8	433	1699	2.33	22.244	21.0	0.0307	23.4	0.00495	10.3	0.441	31.8	3.3	30.7	7.1	NA	NA	NA
<b>Fish Canyon no CA Run 1 (discordant)</b>																	
Fish Canyon-4	135	1251	1.16	24.164	14.4	0.0360	44.6	0.00632	42.2	0.947	40.6	17.1	35.9	15.7	NA	NA	NA
Fish Canyon-7	157	5689	2.34	11.017	28.4	0.0678	32.5	0.00542	15.8	0.487	34.8	5.5	66.6	20.9	1440.9	543.5	97.6
Fish Canyon-9	195	397	1.40	29.335	26.8	0.0237	31.6	0.00505	16.6	0.528	32.5	5.4	23.8	7.4	NA	NA	NA
Fish Canyon-10	452	1134	2.12	23.796	12.0	0.0240	17.3	0.00415	12.5	0.719	26.7	3.3	24.1	4.1	NA	NA	NA
Fish Canyon-11	158	189	2.52	36.304	56.2	0.0185	58.6	0.00488	16.8	0.287	31.4	5.3	18.6	10.8	NA	NA	NA
Fish Canyon-12	323	33433	2.65	19.317	10.5	0.0365	17.0	0.00511	13.4	0.786	32.9	4.4	36.4	6.1	274.2	241.2	88.0
Fish Canyon-13	305	413	1.15	53.117	28.7	0.0127	30.3	0.00489	9.8	0.324	31.5	3.1	12.8	3.9	NA	NA	NA
Fish Canyon-14	304	575	1.53	18.765	42.2	0.0374	43.4	0.00509	10.1	0.233	32.8	3.3	37.3	15.9	340.2	NA	90.4
Fish Canyon-15	139	191	1.22	21.003	42.1	0.0297	44.7	0.00452	15.1	0.338	29.1	4.4	29.7	13.1	79.0	NA	63.2
<b>Fish Canyon no CA Run 2</b>																	
FishC_1	362	26992	1.48	22.042	6.5	0.0273	7.6	0.00437	4	0.519	28.1	1.1	27.4	2.1	36.9	158.3	23.8
FishC_10	419	29024	2.3	21.458	6.4	0.0276	7.2	0.0043	3.3	0.463	27.7	0.9	27.7	2	27.9	152.4	0.7
FishC_11	334	5000	2.41	22.175	12.7	0.0269	12.9	0.00433	2.5	0.197	27.9	0.7	27	3.4	51.5	308.3	45.8
FishC_12	52	5000	2.43	21.207	17.1	0.03	18.4	0.00461	6.9	0.373	29.7	2	30	5.4	56	408.1	47.0
FishC_13	270	5000	2.58	22.094	13	0.0278	13.4	0.00446	3.4	0.25	28.7	1	27.8	3.7	42.7	316.2	32.8
FishC_14	1173	24959	0.46	21.088	5.2	0.0301	5.9	0.0046	2.8	0.466	29.6	0.8	30.1	1.8	69.3	124.9	57.3
FishC_15	355	5000	1.67	23.371	12.1	0.0274	12.4	0.00464	2.8	0.228	29.8	0.8	27.4	3.3	500	1	94.0
FishC_16	324	53203	1.9	21.802	8	0.0278	8.8	0.00441	3.5	0.403	28.3	1	27.9	2.4	10.4	194.2	-172.1
FishC_17	231	5000	0.94	16.566	19.7	0.0363	19.9	0.00437	2.8	0.141	28.1	0.8	36.2	7.1	615.7	427.1	95.4
FishC_18	597	5000	0.51	22.699	12	0.0283	12.3	0.00466	2.3	0.187	30	0.7	28.3	3.4	108.8	296.6	72.4
FishC_19	251	362179	1.51	21.113	7.5	0.0283	8.3	0.00434	3.5	0.421	27.9	1	28.3	2.3	66.5	179.6	58.0
FishC_2	171	5000	2.93	22.027	12	0.028	12.7	0.00447	4	0.318	28.8	1.2	28	3.5	35.2	291.6	18.2
FishC_20	425	5000	1.67	21.807	11.6	0.0277	12	0.00438	3.3	0.277	28.2	0.9	27.7	3.3	10.9	279.9	-158.7
FishC_21	193	5000	2.41	22.722	14.9	0.0264	15.2	0.00436	2.9	0.191	28	0.8	26.5	4	111.2	368.1	74.8
FishC_23	294	5000	2.52	22.19	12.8	0.0275	13.3	0.00443	3.5	0.264	28.5	1	27.6	3.6	53.2	312.5	46.4
FishC_24	120	47240	1.17	18.989	12.6	0.0318	13.4	0.00439	4.6	0.34	28.2	1.3	31.8	4.2	313.2	287.9	91.0
FishC_25	304	5000	2.4	22.313	12.9	0.0272	13.5	0.0044	3.7	0.276	28.3	1	27.2	3.6	66.6	316	57.5
FishC_26	228	45799	2.96	21.814	9.6	0.028	10	0.00444	2.8	0.281	28.5	0.8	28.1	2.8	11.8	231.6	-141.5
FishC_27	344	5000	1.85	23.196	13	0.0263	13.6	0.00443	3.7	0.275	28.5	1.1	26.4	3.5	162.3	324.6	82.4
FishC_28	517	5000	1.4	22.703	12.2	0.0271	12.5	0.00446	2.9	0.232	28.7	0.8	27.1	3.3	109.2	299.5	73.7
FishC_29	488	5000	1.46	21.892	11.8	0.0273	12.1	0.00433	2.8	0.227	27.8	0.8	27.3	3.3	20.3	286	-36.9

FishC_3	258	5000	2.46	21.35	13	0.0286	13.2	0.00443	2.6	0.193	28.5	0.7	28.7	3.7	39.9	310.6	28.6
FishC_30	396	73929	1.64	21.906	6.4	0.0285	7.1	0.00452	2.9	0.412	29.1	0.8	28.5	2	22	156.1	-32.3
FishC_4	321	5000	2.27	20.639	12.1	0.0289	12.4	0.00432	2.6	0.213	27.8	0.7	28.9	3.5	120.3	285.2	76.9
FishC_5	184	5000	1.01	21.906	13.6	0.028	14.3	0.00444	4.4	0.31	28.6	1.3	28	3.9	21.9	328.3	-30.6
FishC_6	582	5000	1.7	22.424	11.6	0.027	12	0.0044	3.1	0.254	28.3	0.9	27.1	3.2	78.8	285	64.1
FishC_8	319	5000	2.32	22.716	12.4	0.0271	13	0.00446	4.1	0.317	28.7	1.2	27.1	3.5	110.6	304.8	74.1
FishC_9	309	5000	2.45	22.292	11.3	0.0275	11.8	0.00445	3.3	0.276	28.6	0.9	27.5	3.2	64.4	276.6	55.6

**Fish Canyon no CA Run 2 (discordant)**

FishC_22	61	5000	2.98	2.256	8.4	0.5751	9.7	0.00941	5	0.511	60.4	3	461.3	36	4062	124.6	98.5
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Composition										Ages							
Zircon	U	206Pb/	U/Th	206Pb/	2σ	207Pb/	2σ	206Pb/	2σ	error	206Pb/	2σ	207Pb/	2σ	206Pb/	2σ	%
#	(ppm)	204Pb		207Pb	(%)	235U	(%)	238U	(%)	corr.	238U	(Ma)	235U	(Ma)	207Pb	(Ma)	Disc.

**Fish Canyon CA Run 1**

Fish Canyon-2	265	2104	1.27	18.450	12.5	0.0378	17.3	0.00507	12.0	0.690	32.6	3.9	37.7	6.4	378.4	282.4	91.4
Fish Canyon-3	446	10945	1.47	21.471	7.6	0.0309	11.4	0.00481	8.5	0.743	31.0	2.6	30.9	3.5	26.4	NA	-17.1
Fish Canyon-4	1058	1171	1.59	23.211	11.8	0.0266	12.4	0.00448	3.9	0.313	28.8	1.1	26.7	3.3	NA	NA	
Fish Canyon-6	2292	31562	0.37	19.802	5.5	0.0321	6.1	0.00461	2.6	0.434	29.7	0.8	32.1	1.9	217.1	126.9	86.3
Fish Canyon-7	734	123526	2.41	20.147	8.2	0.0318	10.1	0.00464	5.9	0.585	29.9	1.8	31.7	3.2	176.9	191.4	83.1
Fish Canyon-9	593	2132	2.31	21.754	7.1	0.0280	8.0	0.00442	3.6	0.457	28.4	1.0	28.0	2.2	NA	NA	
Fish Canyon-10	726	5000	0.60	15.501	13.9	0.0438	16.0	0.00492	7.9	0.495	31.7	2.5	43.5	6.8	757.5	294.6	95.8
Fish Canyon-14	445	2607	2.62	22.845	8.2	0.0305	11.8	0.00506	8.5	0.721	32.6	2.8	30.5	3.5	NA	NA	

**Fish Canyon CA Run 1 (discordant)**

Fish Canyon-1	264	528	1.95	14.864	25.7	0.0431	27.5	0.00465	10.0	0.364	29.9	3.0	42.9	11.6	845.4	535.8	96.5
Fish Canyon-5	139	335	1.11	160.018	442.8	0.0040	443.1	0.00469	14.3	0.032	30.2	4.3	4.1	18.1	NA	NA	
Fish Canyon-8	423	1896	0.90	27.441	11.1	0.0270	17.7	0.00537	13.7	0.776	34.5	4.7	27.0	4.7	NA	NA	
Fish Canyon-11	235	1069	3.08	16.495	23.0	0.0533	33.1	0.00638	23.8	0.720	41.0	9.7	52.7	17.0	624.9	496.9	93.4
Fish Canyon-12	304	1824	2.71	26.782	8.5	0.0285	33.2	0.00553	32.0	0.966	35.6	11.4	28.5	9.3	NA	NA	
Fish Canyon-13	238	588	2.86	14.860	22.7	0.0427	25.1	0.00461	10.8	0.430	29.6	3.2	42.5	10.4	846.1	472.6	96.5
Fish Canyon-15	273	675	0.57	31.296	26.0	0.0219	35.1	0.00496	23.6	0.672	31.9	7.5	22.0	7.6	NA	NA	

**Fish Canyon CA Run 2**

FishC 1	377	5000	0.89	22.441	12.7	0.028	13.4	0.00455	4.3	0.318	29.3	1.2	28	3.7	80.7	310.6	63.7
FishC 10	376	5000	0.94	20.063	14.9	0.0309	15.4	0.00449	4	0.261	28.9	1.2	30.9	4.7	186.6	347.5	84.5
FishC 11	387	5000	1.86	21.089	14	0.0302	14.6	0.00463	4.5	0.304	29.8	1.3	30.2	4.4	69.3	332.2	57.0
FishC 12	928	5000	1.52	22.79	12.6	0.0273	13.3	0.00452	4.2	0.314	29	1.2	27.4	3.6	118.6	311.7	75.5
FishC 13	868	82039	1.51	21.477	6.3	0.029	6.9	0.00452	2.8	0.411	29.1	0.8	29	2	25.7	150.7	-13.2
FishC 14	1137	58895	1.01	21.819	4.3	0.0286	5.5	0.00452	3.3	0.612	29.1	1	28.6	1.5	12.3	104.5	-136.6
FishC 15	445	5000	0.91	22.245	13.8	0.0277	14.1	0.00447	3.2	0.226	28.8	0.9	27.7	3.9	59.2	336.2	51.4
FishC 16	542	432079	1.33	20.9	7.6	0.0296	8.3	0.00448	3.2	0.386	28.8	0.9	29.6	2.4	90.6	181.1	68.2
FishC 17	884	24103	1.09	21.234	6.3	0.0288	7.3	0.00443	3.7	0.504	28.5	1	28.8	2.1	52.9	150.7	46.1
FishC 18	392	5000	1.99	23.725	12.6	0.0269	13.2	0.00464	3.9	0.296	29.8	1.2	27	3.5	500	1	94.0
FishC 19	746	5000	2.03	21.203	12.2	0.0287	13.5	0.00442	5.8	0.43	28.4	1.7	28.7	3.8	56.5	291.7	49.7
FishC 2	391	5000	0.88	22.414	12.9	0.0272	13.6	0.00442	4.3	0.317	28.5	1.2	27.2	3.7	77.7	315.6	63.3
FishC 20	401	27374	1.39	20.776	8.1	0.0301	9.1	0.00454	4.1	0.453	29.2	1.2	30.1	2.7	104.8	191.4	72.1

FishC 21	441	5000	1.06	22.506	13.8	0.0278	14.1	0.00454	3	0.215	29.2	0.9	27.9	3.9	87.7	338.5	66.7
FishC 22	675	5000	2.28	22.51	12.5	0.0278	12.8	0.00454	2.8	0.219	29.2	0.8	27.8	3.5	88.2	305.5	66.9
FishC 23	820	5000	2.62	22.474	11.8	0.0276	12.1	0.0045	2.7	0.222	29	0.8	27.6	3.3	84.3	289.8	65.6
FishC 24	73	5000	1.08	21.224	19.8	0.0304	21.1	0.00469	7.4	0.351	30.1	2.2	30.4	6.3	54	473.1	44.3
FishC 25	545	21677	2.28	20.848	6.1	0.0291	7.4	0.00441	4.2	0.566	28.4	1.2	29.2	2.1	96.5	143.5	70.6
FishC 26	620	5000	2.02	23.454	12.2	0.0267	12.7	0.00454	3.3	0.26	29.2	1	26.7	3.3	500	1	94.2
FishC 27	681	39128	1.51	21.121	7.5	0.0291	8.4	0.00446	3.6	0.436	28.7	1	29.1	2.4	65.7	179.3	56.3
FishC 28	742	589756	2.54	20.418	6.5	0.0298	7.1	0.00441	3	0.418	28.4	0.8	29.8	2.1	145.7	151.8	80.5
FishC 29	671	5000	1.38	22.342	11.9	0.0274	12.2	0.00445	2.8	0.227	28.6	0.8	27.5	3.3	69.8	289.9	59.0
FishC 3	320	5000	1.26	21.384	13.4	0.0286	14.4	0.00444	5.2	0.359	28.6	1.5	28.7	4.1	36.1	322	20.8
FishC 30	655	5000	1.99	22.358	12	0.0273	12.5	0.00443	3.2	0.257	28.5	0.9	27.4	3.4	71.6	294.5	60.2
FishC 4	85	5000	1.57	18.202	21.1	0.033	22.6	0.00436	8	0.353	28	2.2	33	7.3	408.7	473.5	93.1
FishC 5	330	5000	1.44	21.913	12.9	0.0279	13.4	0.00444	3.5	0.263	28.6	1	28	3.7	22.7	312.3	-26.0
FishC 6	568	5000	0.87	21.807	13.2	0.0284	13.5	0.0045	2.8	0.206	29	0.8	28.5	3.8	11	318.9	-163.6
FishC 7	262	5000	1.79	22.322	13.6	0.0282	14.2	0.00457	3.9	0.278	29.4	1.2	28.2	3.9	67.6	332.2	56.5
FishC 8	1796	117931	1.05	20.708	5.4	0.0299	6.2	0.0045	3	0.483	28.9	0.9	29.9	1.8	112.4	127.6	74.3
FishC 9	920	5000	1.86	19.356	13.8	0.0317	14.4	0.00445	4.3	0.296	28.6	1.2	31.7	4.5	269.5	315.9	89.4