

Appendix Nine:
Chronology for the study area

Pumice tephra sample SMH: Isotope measurements (volts)																
Run_ID	Material	40Ar ± 1s	39Ar ± 1s	38Ar ± 1s	37Ar ± 1s	36Ar ± 1s	39Ar ± 1s	40Ar*/39Ar	± 1s	% 40Ar*	Age (ka)	± 1s				
90432-01	Sandstone	0.061727	0.000433	0.008082	0.000132	2.75E-05	0.0000117	0.00002	5.71E-06	4.33E-06	9.13E-16	7.45	0.18	98	540.0	13.4
90432-02	Sandstone	0.057395	0.004433	0.006834	4.97E-05	0.000127	2.27E-05	-2.80E-06	2.08E-05	4.56E-06	7.72E-16	7.42	0.23	89	537.7	16.6
90432-03	Sandstone	0.040555	0.000403	0.004865	4.22E-05	0.000152	2.19E-05	0.0000339	2.33E-05	1.43E-06	5.50E-16	7.73	0.34	93	560.4	24.6
90432-04	Sandstone	0.043028	0.00367	0.006517	5.06E-05	8.66E-05	2.19E-05	0.0000336	2.64E-05	3.34E-06	7.36E-16	7.57	0.26	101	548.6	18.5
90432-05	Sandstone	0.052474	0.000394	0.006326	4.49E-05	5.53E-05	2.11E-05	-5.14E-05	2.14E-05	1.15E-05	7.15E-16	7.52	0.24	91	545.4	17.1
90432-06	Sandstone	0.074648	0.00044	0.008151	4.49E-05	0.00108	2.62E-05	0.000023	2.55E-05	3.34E-06	9.21E-16	7.99	0.20	87	579.3	14.5
90432-07	Sandstone	0.040674	0.000376	0.004833	3.92E-05	3.98E-05	2.41E-05	-6.92E-05	2.48E-05	7.85E-06	5.46E-16	7.54	0.31	90	546.6	22.4
90432-08	Sandstone	0.075662	0.000481	0.005231	4.05E-05	0.00114	2.68E-05	-1.77E-05	0.000117	5.66E-06	5.91E-16	7.69	0.36	53	557.3	26.1
90432-09	Sandstone	0.065553	0.000409	0.007254	4.68E-05	9.17E-05	2.36E-05	-3.47E-05	2.34E-05	2.58E-05	8.20E-16	7.83	0.22	87	567.7	15.8
90432-10	Sandstone	0.040633	0.000318	0.004654	0.000043	7.68E-05	2.36E-05	-1.16E-05	2.58E-05	2.82E-05	5.26E-16	6.84	0.33	79	496.0	23.9
90432-11	Sandstone	0.070927	0.000437	0.008039	5.75E-05	0.00109	1.98E-05	-0.000042	2.58E-05	4.47E-06	9.08E-16	7.86	0.20	89	569.7	14.6
90432-12	Sandstone	0.058812	0.000418	0.006493	5.07E-05	0.00121	2.58E-05	0.0000305	2.76E-05	3.74E-06	7.34E-16	7.44	0.24	82	539.6	17.7
90432-13	Sandstone	0.073146	0.000437	0.007336	0.000044	0.00014	0.000025	-3.35E-05	2.48E-05	5.38E-05	8.29E-16	7.65	0.22	77	554.3	15.9
90432-14	Sandstone	0.035875	0.000372	0.004743	4.08E-05	9.74E-05	0.000024	0.0000484	2.19E-05	2.27E-06	4.17E-06	7.67	0.31	101	556.3	22.3
90432-15	Sandstone	0.057793	0.000443	0.006388	3.98E-05	0.00105	0.000024	4.80E-06	2.26E-05	0.000028	4.46E-06	7.74	0.24	86	561.2	17.6
90432-16	Sandstone	0.053922	0.000461	0.005761	4.46E-05	3.96E-05	2.48E-05	0.0000247	2.28E-05	3.63E-05	6.51E-16	7.57	0.28	81	549.0	20.2
90432-17	Sandstone	0.030929	0.000363	0.003519	0.000037	0.000083	2.37E-05	-1.60E-06	2.19E-05	1.24E-05	3.98E-16	7.71	0.42	88	559.1	30.2
90432-18	Sandstone	0.051752	0.000381	0.006476	4.56E-05	7.93E-05	2.02E-05	-0.000039	2.19E-05	1.17E-05	7.32E-16	7.28	0.23	91	527.6	16.3
90432-19	Sandstone	0.071546	0.000399	0.007032	4.71E-05	0.00116	2.39E-05	-6.93E-05	2.34E-05	5.63E-05	7.95E-16	7.51	0.23	74	544.3	17.0
90432-20	Sandstone	0.048004	0.001309	0.005856	0.00005	7.49E-05	2.39E-05	-4.65E-05	2.27E-05	7.67E-06	6.62E-16	7.58	0.35	93	549.6	25.3

Dacitic tephra sample BC: Isotope measurements (volts)																	
Run_ID	Material	40Ar ± 1s	39Ar ± 1s	38Ar ± 1s	37Ar ± 1s	36Ar ± 1s	39Ar ± 1s	40Ar*/39Ar	± 1s	% 40Ar*	Age (ka)	± 1s					
90431-01	Sandstone	0.034026	0.00044	0.005888	4.46E-05	4.94E-05	0.000027	0.0000855	0.000024	9.81E-06	4.88E-06	5.63	0.28	97	408.3	20.4	
90431-02	Sandstone	0.036719	0.000331	0.004361	3.58E-05	2.38E-05	2.22E-05	0.0000312	0.000024	0.0000422	4.82E-06	5.69	0.37	68	412.9	26.7	
90431-03	Sandstone	0.034203	0.000264	0.004937	4.22E-05	0.000111	2.28E-05	-4.60E-06	2.48E-05	0.0000222	4.82E-06	5.55	0.32	80	402.4	23.5	
90431-04	Sandstone	0.038371	0.000431	0.006507	5.25E-05	5.92E-05	2.34E-05	-7.20E-06	2.27E-05	1.76E-05	7.35E-16	5.78	0.23	98	418.7	16.9	
90431-05	Sandstone	0.036805	0.000381	0.006113	5.14E-05	6.87E-05	2.27E-05	-0.00005	2.69E-05	7.69E-06	6.91E-16	5.43	0.26	91	393.5	18.7	
90431-06	Sandstone	0.029433	0.000327	0.004607	4.37E-05	5.05E-05	0.000024	-6.42E-05	2.62E-05	4.10E-06	5.21E-16	5.76	0.33	91	417.6	24.1	
90431-07	Sandstone	0.062434	0.000484	0.009068	0.00006	0.000156	2.69E-05	-3.60E-06	2.05E-05	0.0000368	4.95E-06	5.65	0.18	82	409.8	13.4	
90431-08	Sandstone	0.040174	0.000409	0.005678	5.12E-05	0.000106	2.62E-05	-5.39E-06	2.42E-05	0.0000153	4.88E-06	6.02	0.29	85	436.3	21.1	
90431-09	Sandstone	0.034904	0.000484	0.006355	3.76E-05	9.35E-05	2.42E-05	-2.81E-05	2.27E-05	2.79E-06	4.68E-06	5.55	0.25	96	402.1	18.2	
90431-10	Sandstone	0.022803	0.000349	0.002015	2.68E-05	4.73E-05	2.62E-05	-1.82E-05	2.42E-05	0.0000356	4.75E-06	2.28E-16	5.80	0.79	51	420.1	57.0
90431-11	Sandstone	0.026599	0.000368	0.003825	4.18E-05	4.22E-05	2.55E-05	-5.45E-05	2.27E-05	0.000152	4.53E-06	5.40	0.40	78	391.2	28.8	
90431-12	Sandstone	0.019137	0.000349	0.003601	3.53E-05	6.19E-05	2.41E-05	-1.43E-05	2.41E-05	-2.98E-06	4.46E-06	4.07E-16	5.45	0.42	103	395.1	30.4
90431-13	Sandstone	0.034904	0.000403	0.005818	4.74E-05	0.000069	2.48E-05	0.000105	2.33E-05	0.0000126	4.46E-06	6.57E-16	5.39	0.26	90	390.4	19.0
90431-14	Sandstone	0.024901	0.000376	0.003907	3.99E-05	6.89E-05	2.41E-05	0.000182	2.19E-05	0.0000162	4.31E-06	5.32	0.37	84	385.5	27.2	
90431-15	Sandstone	0.041339	0.000414	0.005865	5.04E-05	0.000101	0.000025	-8.49E-05	2.06E-05	0.0000206	4.76E-06	6.63E-16	5.62	0.27	80	407.8	19.6
90431-16	Sandstone	0.020092	0.000322	0.002956	3.32E-05	4.73E-05	2.58E-05	-3.68E-05	2.64E-05	0.0000102	4.53E-06	5.44	0.52	80	394.4	37.9	
90431-17	Sandstone	0.018687	0.000319	0.003	3.64E-05	3.30E-05	2.34E-05	5.40E-06	2.55E-05	4.75E-06	4.60E-06	5.26	0.47	93	381.4	34.2	
90431-18	Sandstone	0.025611	0.000407	0.003898	3.55E-05	-3.3E-05	2.55E-05	-3.74E-05	2.48E-05	0.0000117	4.40E-06	5.41	0.40	83	392.5	29.2	
90431-19	Sandstone	0.016697	0.000351	0.002325	2.77E-05	2.23E-05	7.60E-06	2.48E-05	0.0000133	4.67E-06	2.63E-16	5.54	0.68	77	401.8	49.1	
90431-20	Sandstone	0.024632	0.000361	0.003835	3.23E-05	4.65E-05	1.71E-05	0.000035	2.27E-05	0.0000137	4.46E-06	5.57	0.39	87	403.9	28.4	

Backgrounds 0.005442 0.00014 0.000176 0.000013 3.52E-05 0.000015 0.0003487 0.000012 0.0000296 2.80E-06

Table 1: ³⁹Ar/⁴⁰Ar Isotope data with calculated ages. Sample SMH, EK64 C V1, J: 0.0000401 ± 0.00000013, Age: 550.7 ± 4.1 ka (no data rejected). Sample BC, EK64 C V1, J: 0.0000401 ± 0.00000013, Age: 405.3 ± 5.1 ka (no data rejected). Atmospheric argon ratios and discrimination = (⁴⁰Ar/³⁶Ar) atm 298.56 ± 0.31; (⁴⁰Ar/³⁸Ar) atm 1583.7 ± 2. Minor irradiation parameters = (³⁸Ar/³⁷Ar) Ca 0.0000196 ± 8.160000E-7; (³⁸Ar/³⁹Ar) K 0.0122 ± 0.000027; P (³⁶Cl/³⁸Cl) 262.9 ± 1.1. Decay constants = Lambda ⁴⁰K epsilon 5.757000E-11 ± 0; Lambda ⁴⁰K Beta 4.955000E-10 ± 0; Lambda ³⁷Ar 0.01975 ± 0; Lambda ³⁹Ar 7.068000E-6 ± 0 Lambda ³⁶Cl 6.308000E-9 ± 0.

Table 2: AMS Radiocarbon ages for the study area from BETA Analytic. The calibrated (calendar) ages for samples 7, 8 & 9 have been calculated using the INTCAL13 curve (Reimer et al. 2013) in CALIB (Stuiver et al. 2017), see Section 4.8 for further discussion.

Sample No.	BETA Lab No.	Sample type	Site number and log number	Calibration Database used	¹³ C/ ¹² C ratio	Uncalibrated Radiocarbon Age bp	2 Sigma calibrated results (Cal BP).	Average 2 Sigma calibrated (Cal BP) age.
1: TX6	301356	Bulk sediment	TB2, Log 3, Table 15, Appendix 8	INTCAL04	17.7 ‰	8,240 ± 40	9400 to 9360, 9320 to 9080 and 9050 to 9040	9208
2: TX7	301357	Bulk sediment	TB2, Log 2, Table 14, Appendix 8	INTCAL04	-15.7 ‰	8,950 ± 40	10,220 to 10,102 and 10,070 to 9920	10,073
3: ET3TE QMEX	278268	Bulk sediment	TB2, Log 2, Table 14, Appendix 8	INTCAL04	-18.2 ‰	9,690 ± 50	11,220 to 11,070 and 10,950 to 10,870	11,028
4: TX8	301358	Bulk sediment	TB2, Log 3, Table 15, Appendix 8	INTCAL04	-18.7 ‰	9,980 ± 40	11,620 to 11,260	11,440
5: TX5	307721	Bulk sediment	TB1, Log 6, Table 11, Appendix 8	INTCAL09	-12.1 ‰	10,460 ± 50	12,550 to 12,140	12,354
6: (TX1)	301535	Shell	TB1; Log 5, Appendix 8, Table 10	INTCAL04	-4.7 ‰	14,610 ± 60	17,930 to 17,460	17,695
7: BDM2T EQ	278267	Shell	TB10, Log 4, Fig 6.21, Section 6.5.4	CALIB	-7.8 ‰	40,100 ± 500	43,349 to 44,038	43,694
8: BC1TE Q	278266	Shell	TB9, Log 4, Fig 6.35	CALIB	-7.7 ‰	40,670 ± 550	43,905 – 44,564	44,235
9: TX2	301354	Shell	TB3	CALIB	+1.2 ‰	> 43,500	46,172 to 47,095	46,634

Table 3: U – Th isotope data, calculated ages (corrected and uncorrected) and activity ratios. Barranca de Colores, Site TB9 samples C2, C3 and C1. For the locations of the dated samples see Figures 6.29 & 6.33.

Sample Name	U (ppm)	±2s	²³² Th (ppb)	±2s	(²³⁰ Th/ ²³² Th)	±2s	(²³⁰ Th/ ²³⁸ U)	±2s	(²³⁴ U/ ²³⁸ U)	±2s	Uncorrected ²³⁰ Th Age (ka)	±2s	Corrected ²³⁰ Th Age (ka)	±2s	Corrected. Initial (²³⁴ U/ ²³⁸ U)	±2s
01 SG-C1	0.4187	0.0002	697.20	2.984	1.90	0.01	1.0657	0.0027	1.0566	0.0007	481	21	428	327	1.3522	0.23
02 SG-C2	0.7892	0.0006	239.20	2.437	10.07	0.11	1.0258	0.0031	1.0273	0.0011	484	28	475	33	1.1143	0.01
03 SG-C3	1.1990	0.0007	183.41	1.576	20.73	0.19	1.0658	0.0034	1.0368	0.0007	>500		>500			