Data Repository Items

Synchronous opening of the Rio Grande rift along its entire length at 20-10 Ma supported by apatite (U-Th)/He and fission-track thermochronology, and evaluation of possible driving mechanisms

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1) **Table DR1** – Apatite Fission Track Data Used in HeFTy Modeling
2) **Figure DR1** – HeFTy Input Data, Modeling Procedures, and Results

Table DR1 - Apatite Fission Track Data Used in HeFTy Modeling

Sample 1 (84MP03)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
13.9	48.3	15.3	15.1	14	74.7	5	50	351 ± 40	1.27E+06	4600	Not Available
12.6	64.5	13.6	65.6	9.8	63.8	4	43				
12.1	72.1	12.1	12.1	14.4	62.9	5	70				
13.8	32.6	15	84.8	12.3	67.9	5	72				
12	55.9	12.1	37.6	13.4	5.6	3	49				
14.7	10.5	17.2	40.8	12.9	11.7	6	112				
13.6	41.4	12.3	20.4	14.2	4.6	5	100				
15.2	33.4	14	86.1	14	44.3	8	140				
16.8	71.8	14.4	16.4	16.7	87.1	13	57				
18.5	1.8	15.6	3.9	12.1	31.4	12	86				
10.2	28.8	13	50.9	12.9	40.1	3	38				
14.9	39.9	14.7	68.6	15.5	51.1	3	60				
16.1	45.7	14.8	22.9			8	113				
12.2	67.1	14.6	39.6			3	42				
11.7	63.9	5.7	60.5			4	60				
11.9	79.9	7.5	74.5			2	29				
11.7	33.9	15.8	81.8			4	80				
11.8	62.9	12.6	86.9			2	42				
15.5	47.1	12.7	75.9			4	70				
11.5	67.5	15.9	43			3	50				
12.4	63.4	13.9	42.9								
13.9	30.8	13.4	44.5								
11.5	68	11.7	58.4								
15.4	52.8	13.7	51.1								
17.2	9.5	15.4	31.5								
15.1	15.9	14.8	39.9								
14.7	4.7	13.8	74.8								
11.9	58.6	16.4	75.7								
15.2	24.8	16.6	80.8								
11.3	69.8	15.3	31.6								
12.4	88.6	12.6	85.3								
12.6	22.9	15.6	86.5								
14.6	51.2	7.5	49.3								
13.8	25.6	14.7	62.6								
8.1	53.9	12.3	18.9								
15.9	72.4	12.6	70.5								
15.4	50.5	12.7	77.7								
12.3	55.7	12.4	80.6								
14.3	75.8	15.1	2.3								
13.4	73.2	13.4	73								
8.4	88.3	17	72.1								
14.9	89.1	15.9	86.2								
8	48.7	14.9	26.2								

Sample 2 (84MP05)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.6	57	12.1	73.4	13.1	41	11	192	351 ± 40	1.31E+06	4600	Not available
13.5	1.7	12.6	70.4	14.2	84.3	2	32				
15.6	31.5	14.1	2.2	16.7	82.2	3	122				
10.5	45.5	6.8	47.2	5.6	49.9	6	214				
14.6	67.3	13.5	6.8	14.9	72.7	3	50				
11	20.9	5.6	89.1	13.8	56.6	2	76				
13.5	35	13.9	46	11.9	83.6	8	249				
16.1	1.3	14.2	34.9	15.3	56.6	3	118				
12.9	39.7	15.2	77.7	14.3	84.9	14	17				
14.9	51.7	14.8	59.1	12.4	48.9	9	77				
11.2	29	14.1	53.3			1	20				
12.6	59	9	47.8			3	135				
13.8	78	16.1	73.6			2	52				
14.4	15.5	10.9	45.2			6	67				
16.3	82.6	13.6	83.7			4	62				
14.4	79.5	12.5	4.5			8	234				
12.6	89.6	14	84.5			6	55				
15	76.5	13.7	23.4			5	85				
12.7	81.6	13.7	88.7			3	48				
15.2	25.6	13.4	57.5			2	44				
14.9	82.3	13.5	72.6								
5.6	82	14.2	33.9								
6.4	57.2	11.7	40.4								
13.2	39.1	15.3	71.2								
14.1	78.6	16.3	29.4								
15.6	76.3	4.6	50.4								
12.4	75.4	13	75.3								
12.6	65.1	15.1	30.7								
13.9	38.9	11.3	37.3								
12	51.4	6.7	36								
12	75	13.7	67.8								
14.1	68.5	12.9	79.9								
13.5	69.2	13.5	75.4								
13.9	87.7	15.4	20.2								
13.6	70.2	12.5	25.3								
13	58.3	14.6	76.2								
8.6	59.7	15.3	21.6								
12.4	73.9	15.1	69.3								
15.4	2.3	14.2	86.4								
11.2	69.5	8.4	54.5								
13.9	66.1	7.3	54.3								
13	82.3	15.3	9.7								
10.8	82.2	14.8	28.8								
12.5	76.8	15.3	42.2								

Sample 3 (84MP06)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.2	64	12.9	17.4	15.7	26.7	8	68	351 ± 40	1.33E+06	4600	Not available
11.7	33.8	15.4	75.8	14.2	28.5	7	47				
12.5	58.4	13.7	64.2	15	77.3	10	61				
15.7	61.7	14.6	52.8	15.7	30.1	6	42				
14.7	46.2	13.1	36.5	15.4	31.5	6	34				
13.4	31.6	13.3	82.1	14.1	60.5	6	38				
13.3	64.8	15.1	81.8	14.9	87.1	2	17				
13.4	81.7	12.8	83.9	15.1	60.9	9	76				
14.5	52.7	13.9	49.6	15	37.8	1	10				
17	89.3	14.1	60.1	16.6	49.6	5	53				
11.3	49	8.6	69.7	15.7	50.6	4	35				
16.5	45.8	12.8	54.8	13.9	88.5	6	62				
15.2	64.1	15.2	10.6			13	180				
13.3	37.9	14.6	35.4			5	69				
14.9	36.2	12.7	89.9			3	58				
14.4	4.7	16.1	65			7	106				
15.1	20.3	14.5	49.5			4	25				
17.9	55.9	8.5	50.9			2	39				
15.2	65.7	15.6	31.9			5	70				
14.7	75.6	14.5	77			3	49				
15.3	35	13.4	53								
14.6	88.9	15.6	27.2								
16.9	21.8	13	58.4								
15.2	75.1	13.3	80.4								
14.6	38.4	13.6	18.8								
16.5	41	14.1	47.9								
14.5	79.7	12.1	89.7								
15.3	54.9	14.9	57.8								
14.1	72.1	14.1	25.2								
15.2	82.9	13.9	48.5								
15.4	86.5	13.4	31.8								
14.8	87.7	16.4	80.2								
13.4	25.8	14.7	63.5								
16.2	34.5	13.3	15.3								
15.1	24.5	13.7	79.3								
14.8	3.9	11.5	87.9								
15.2	85.8	13.9	67								
15.4	58.4	14.3	41.9								
14.9	76.9	11.1	68.8								
14.2	61.6	15.4	85.1								
16.2	80.2	15.4	59.4								
15.5	49.6	16.7	24.4								
14.2	56.1	15.2	88.4								
13	60.6	9.8	88.9								

Sample 4 (84MP08)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
12.8	34.6	14.8	7.2	15	52.9	5	54	351 ± 40	1.36E+06	4600	Not available
14.1	51.7	14.2	88.2	12	72.2	6	43				
13.6	54.5	12.9	85.2	14.1	40.2	6	82				
14.7	38.3	15.4	55.3	14.4	78.4	4	43				
17.1	46.2	9.4	67.2	6.7	60.6	5	46				
13	72.2	15.1	30.2	14.7	64.8	1	7				
14.1	56.4	15.5	78.9	13.7	64.4	4	46				
14.1	66.7	15.7	73.1	16.8	51.2	5	32				
14.3	49.2	13.9	28.4	14.1	77.8	8	147				
16.1	27.8	18.9	45.4	12.9	65.6	8	48				
14.5	70.7	15.1	47.9	15.4	67.8	3	45				
13.5	88.9	15.5	64.1	14.3	73.5	5	64				
16.3	35.9	15.7	44.3			5	32				
14.5	70.2	14.3	31			7	63				
15.3	55.5	14.3	30.4			2	14				
17.6	41.2	14.3	30.9			3	28				
14.6	27.3	15.2	39.7			2	12				
13.3	81.4	14.6	35.4			5	27				
16.4	85.5	14.3	35.9			3	41				
15.6	37	14.3	81.1			5	77				
12.6	51.4	15.7	81.1								
13.8	58.2	14.6	87.2								
8	32.9	13.4	87.9								
15.2	48	14.8	66.2								
14.9	47.3	15.3	80.9								
14.9	61	14.4	32								
16.2	22.2	14.1	53.3								
17.2	27.3	14.1	28.4								
15.1	42.5	15	62.6								
14.4	72.6	15.2	28.7								
14.8	38.7	13.8	79.8								
12.5	74.7	14	88.3								
14.2	51.4	15.7	78.5								
14.9	53.6	15.6	18.5								
17.3	14.8	14.4	27								
14.6	0.8	13	67.6								
13.2	63	12.8	61.4								
14.6	24.2	14.6	88.6								
14.9	68.7	13.8	53.6								
17.1	46.7	15.2	19.5								
13.3	71.6	14.2	59.4								
14.7	39.3	13.9	73.2								
13.9	70.8	13.4	68.3								
15.5	86.6	14.8	21.3								

Sample 5 (84MP10)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
15.5	86.4	15.5	85.6	14.7	59.1	6	51	351 ± 40	1.40E+06	4600	Not available
14.4	62.7	17.5	66.3	14.8	32.4	5	63				
15.8	36.5	8.6	86.9	16.3	63	10	172				
13.8	54.8	16	90	15.3	88.1	3	25				
14.2	76.9	15	68.6	14.5	38.8	4	34				
15.9	24.1	14.6	42.8	14.9	87.9	1	25				
16.3	58.1	15.3	87.6	14.4	83.7	5	54				
15.2	35.7	15.4	58.5	12.7	32.7	3	33				
15.3	54.3	16.1	69.3	14.5	81.1	6	85				
15.3	9	16.6	27.4	9.4	56.9	3	23				
15	75.9	14.6	27.7	7.5	41	5	73				
16.5	15	16	11.1	13.6	41.4	2	27				
14.3	71.3	15.8	42	14.5	52.6	8	52				
14.2	58.9	14.6	68.2			4	44				
14.6	76.3	16	58.7			6	97				
15	80.3	13.8	65.1			7	110				
13.8	62.3	15.8	34.9			2	17				
15.3	83.8	15.7	28.2			12	152				
16.2	62	13.7	34.2			4	36				
14.6	15.3	16.9	18.3			2	23				
16.4	88.1	13.3	52.4								
16	30.7	15.6	30.9								
14.7	61.7	13.5	67.8								
14.3	32.9	15.5	35.8								
14.1	81.6	13.8	76.6								
14.2	57.9	14.5	69.3								
12.9	44.3	13.1	76.4								
13.2	50.5	8.7	78.7								
7	52.6	15.4	82								
13.8	73.6	14.5	49.2								
15.1	48.7	12.7	51.5								
14.5	54.2	14.2	63.2								
14.5	33.7	17.3	28.2								
14.8	33.9	13.5	58.4								
13.5	85.3	14.7	48.4								
14.6	72.9	15.8	54.3								
15.9	32.6	13.8	56.2								
15.6	37.3	15.1	80.3								
12.9	71.9	14.2	38.4								
14.2	76	15	56.6								
14.4	24.7	15.5	63.9								
14.7	50.5	14.1	74.9								
14.5	60.1	16.9	28.4								
6.7	77.6	15.8	38.4								

Sample 6 (84MP12)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
15.6	48.1	15.1	66.3	16.7	36.5	5	101	351 ± 40	1.44E+06	4600	Not available
13.9	35	13.1	88.1	15.4	16.2	3	78				
18.2	17.4	13.8	83.3	13.7	88.3	3	42				
16.5	51.5	12.3	78.7	14.8	79.4	9	159				
16.4	18.5	7.7	63.4	13.8	48	2	30				
15.9	21.6	15.3	43.7	16	17.5	3	50				
14.9	51.9	15	44.9	12.6	61	3	60				
9.9	87	14.1	82.8	15.6	84.3	2	21				
14.1	58.6	12.3	8.5	11.2	44.6	2	28				
14.4	37.8	14.6	12	14.5	62.1	1	39				
13.3	57	13.1	54.5	13.9	49.4	9	170				
14.6	42.6	12.6	54.2	14.6	48.3	1	48				
14	84.2	15.3	71.6			2	21				
15.1	52.1	13.6	21.3			4	68				
14.6	51.5	15.4	39.3			1	10				
15.6	71.4	15.6	47.4			2	17				
14.4	29.5	14.9	3.6			2	40				
13	65.2	13.1	70.7			6	105				
15.2	72.5	15.1	75.7			10	130				
14.9	68.7	13.9	47.4			4	39				
15.5	2.4	7.7	60.9								
11.5	4.7	13.7	89.2								
14.3	84.6	7.8	14.9								
15.1	53.4	14.9	57.6								
12.9	60.1	5.9	72.9								
15.1	49.4	14.8	45								
14.8	67.1	13.7	15.3								
14.8	58	15	75.2								
13.8	78.7	15.5	40.7								
13.1	66.5	14.6	85								
15.6	41	15.6	89.7								
14.9	83.9	14.7	69.5								
13.7	20.3	14.9	47.2								
14.5	49.1	15.2	83.5								
13	78.5	15.5	69.4								
16.7	16.1	15.5	48.3								
13.5	38.1	14.3	82.4								
14	86.6	13.9	87.7								
15.7	48.9	14.5	75.8								
11.6	82.3	14.2	73.8								
13.6	72.5	14.4	42.9								
15.7	34.8	15.7	62.5								
17.4	32.7	15.1	87.1								
13.3	77.4	15.1	83.4								

Sample 7 (88SG03)

Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
10.7	23.3	11.3	65.5	3	120	351 ± 40	2.22E+06	4600	0.02 - 0.09
11.3	8.1	12.6	22.3	3	130				
13.3	46.1	17.1	21.8	4	89				
14	77.3	11.4	0.8	2	153				
14.4	66.2	15.5	39.1	2	91				
14.7	69.7	13.8	29.2	5	285				
13.9	87.7	14.4	17.5	4	216				
14.1	37.6	8.1	5.2	6	173				
12.8	25.9	17.1	33.2	2	56				
13.6	75.9	14.7	89.5	3	113				
14.5	66	13.2	80.5	4	117				
14.6	77.2	12.4	33.2	3	166				
15	25.2	15	36.2	3	106				
16.6	67.6	13.6	31.5	5	91				
15.1	1.3	14.2	71.5	3	101				
16.7	13.9	15.2	34.6	2	129				
16.3	13.5	14.8	8.9	2	86				
14.4	2.7	15.5	59.8	3	105				
13.6	49.6	13.8	67.3	5	183				
14.8	59.9	16.8	17.7	9	206				
13.5	77	11.8	11.7						
15.2	73.1	12.3	4.6						
10.3	88	12	28.6						
11.3	37.2	14	39.7						
9.4	8.6	9.9	8.7						
13.8	54.4	14.7	27.9						
12.1	79.4	13.4	76.5						
13.4	55.8	15	45.9						
8.5	16.5	15.9	78.2						
14.9	34.2	15.8	54.8						
16	47	14.6	16.6						
14.3	66.2	13.8	88.3						
15.5	88.5	11.1	63.3						
15	87	14.7	11.6						
14.7	59.5	13.9	77.4						
14.2	63.1	17.5	29.5						
15.4	35.9	15.9	70.8						
13.2	6.7	15.1	49.8						
12.5	3.5	16.8	46.4						
14.4	89.8	15.8	12.4						
14.9	25.5	15.9	13						
15	53.5	9.4	68.7						
16.1	13.1	14.5	61.6						
15.4	35.8								

Sample 8 (88SG07)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
15.5	66.9	16.4	86	15.4	23.7	1	5	351 ± 40	9.93E+05	4600	0.05 - 0.10
13.5	10.1	15.9	49.7	13.8	47.7	2	12				
16.4	43.7	15.9	82.3	13.1	55.3	2	20				
15.8	50.1	7.5	80.6	7.8	34.9	4	18				
14.9	30.7	16.2	18.4	14.5	49.6	1	3				
14.7	36.6	13.5	66.5	16	54.1	1	3				
13.3	22.6	15.6	81.6	16	29.9	2	13				
15.9	43.3	15.6	67.2	15.9	80.3	13	110				
14.3	0.3	15	64.6	15.3	78.5	14	70				
15.2	60.8	14.2	84.3	14.3	82.1	10	62				
15.5	87	16.2	64.3	13.6	5.8	3	8				
14.9	57	9.1	72.7	12.5	24.1	2	8				
11.9	24.1	16.6	22.8			7	36				
15.9	84.7	15.7	36			2	9				
13.7	55.2	11.1	45.2			1	4				
15	12.3	14.5	40.7			4	16				
14	79.4	16.1	28			1	7				
14.4	12.3	8	72.3			11	68				
12.1	15.8	15.5	44			3	11				
15.8	86.6	7.7	58.8			2	7				
15.2	58.6	14.4	65.7								
14.7	16	15.8	59.9								
15.7	7.6	18.1	64.6								
15.9	18.3	10.7	84.9								
14.6	68.9	15.6	22.9								
15.9	55.5	12	24.3								
15	80.4	14.5	72.8								
14	11.2	9.2	54.5								
10.8	87.9	9.8	43.1								
14.2	88	14.4	34.1								
16.1	30.7	12.8	60.8								
14.4	53.7	12.4	37.4								
15.6	61.9	12.2	86.9								
15.9	45.4	16	33.1								
14.8	14.5	14	82.2								
15.6	53.9	7.6	31.4								
6.1	45.5	12	58.1								
13.4	58	8.3	55.9								
15.1	37.5	15.4	52.8								
14.2	49.2	15.7	36.9								
15.2	63.7	16.1	6								
10.8	49.1	15.8	73.9								
10.2	17.3	15.9	39.5								
14.2	77.5	10	65.9								

Sample 9 (88SG09)

Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
13.1	78.8	15.8	37.7	4	26	351 ± 40	9.75E+05	4600	0.03 - 0.20
13.2	67.1	15.7	84.8	6	56				
13.7	9	11.9	32.1	5	21				
14.7	8.3	15.1	81.6	2	8				
15	77.2	15.5	49.1	3	20				
19.8	21.4	15.6	70.2	12	177				
5.9	84	16.4	27.1	4	85				
14.7	67	3.9	77.1	3	12				
13.5	88.6	16.3	37.7	6	71				
15.6	35.2	16.8	19.9	10	55				
14.8	18.6	12.2	36	9	52				
16.7	26.9	15.4	67.2	3	41				
17.2	34.9	15	33.5	11	113				
14.9	27.2	12.5	12.3	3	13				
14.3	79.3	14.8	58.7	2	43				
13	71.8	16.2	7.5	11	67				
15.9	66	16.5	8.7	2	8				
15.7	40.5	10.4	70.2	2	26				
16.4	59.2	17.6	31.8	6	50				
13.7	57.1	16.8	15.8	2	17				
15.3	79.6	14.8	0.2						
15.3	44.6	10.5	60						
14.7	35.9	15.7	55.3						
11.8	76.8	17.1	62						
14.3	23	15	47.1						
15.6	3.4	15.9	63.2						
11.2	84.4	14.4	87.8						
15.7	65.8	12.9	71.4						
16.7	64.6	19.9	0.2						
14.6	66.9	13.8	83.8						
15.7	69.9	12.2	58.7						
10	4.7	13.6	70.1						
16.2	59.5	14.1	30.4						
16.1	63.9	13.7	19.2						
14	68.9	14.8	33						
14.6	59.9	15.7	79.3						
12	42.5	15.2	87.1						
13.1	7.7	16	11.2						
11.8	85.8	14.9	36.1						
15.7	36.4	13.5	25						
17.3	57.4								
15.2	57.5								
11.4	53.5								

Sample 10 (88SG10)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
10.1	88.4	13.4	54.2	12.8	84.7	5	21	351 ± 40	9.65E+05	4600	0.03 - 0.22
14.3	68.7	14.6	47.7	14.9	56.5	3	21				
10.1	59.2	14.4	60.2	12.9	32.8	7	68				
10.2	65.4	12.7	42.9	13.5	47.5	2	10				
9.9	59	11.1	17.1	14.3	51.6	10	42				
14.9	20	15.4	33.1	13.3	72.4	9	28				
11.5	76.6	15.1	32.9	13.4	66.9	6	81				
15.3	45.1	13.2	47.8	11.7	41.3	7	24				
14.8	42.6	13.6	51.2	12.1	65.9	8	43				
14.2	19.2	16.5	69.2	14.4	45.2	4	20				
11.5	57	8.9	3.8	9	36.6	7	23				
8.9	69.2	12.3	41.7	10.8	86	1	15				
11.2	16.7	11	81.4			2	8				
10.9	56.1	13.4	10.9			11	56				
11.2	52.7	9	69.1			1	8				
12.5	25.6	12.8	55.4			30	84				
18.9	81.6	13.9	87.6			4	25				
15.4	82.1	12.1	25.7			2	12				
13.1	75.8	10.4	18.9			19	82				
13.5	30.3	9	45			25	57				
11.7	14.4	13.1	75.8								
12.9	52.9	11.2	49.4								
13.7	69.2	11.1	48.7								
16.5	30.4	14.3	58.7								
11	74.4	14.8	43.2								
3.2	16.8	11.1	66.3								
14.5	64.5	8.8	52.1								
9	82.4	8.2	26.9								
14.9	48.7	11.5	57.3								
14.7	40.8	13.6	45.6								
12.2	33.1	10.5	73.9								
9.6	68.4	13.1	44.1								
12	53.5	12.4	30								
12.8	75.4	13.2	77.2								
9.7	83.2	12.9	23.3								
11.4	48	7.3	17.3								
11.2	26.8	13	27.7								
11	51.2	10.1	73.2								
16	50.9	14.1	54.8								
12	80.3	13.3	47.9								
15.2	33.6	11.9	6.7								
13.8	67.2	13.9	33.1								
13.3	42.3	14.8	26.3								
13.7	37.8	11.6	30.6								

Sample 11 (88SG11)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
12.2	23.9	13.2	42.4	13	13.7	5	19	351 ± 40	9.55E+05	4600	0.03 - 0.20
15.1	31.8	13.2	80.7	13.5	39.9	16	106				
12.1	1.3	14.6	61.1	14	29.5	2	5				
14.8	53.6	13.5	50.7	15	39.6	15	147				
13.8	76.3	12	56.7	16.1	8.3	3	10				
12.1	63.7	13.4	61.4	12.8	72.9	9	50				
11.6	29.2	15.3	17.4	14.5	34.8	11	78				
12.3	35.1	12.3	83.3	13.6	21	16	86				
11.8	84	14.3	75.4	14.9	45.6	7	32				
11.2	69.8	12.2	47.7	13.7	1.5	11	70				
13	64.1	13.2	42.7	4.9	78.5	20	197				
14.3	23.2	15.9	44.3	12.7	79.6	22	78				
11.5	68.6	14.2	59.4	13.1	67.4	10	50				
13.8	29.4	13.3	11.7			14	78				
15.7	39.4	15.6	76.5			2	8				
12.1	63.9	10.8	64.2			15	78				
10.7	84.1	14.1	13.5			6	33				
14.5	83.9	15.2	32.8			19	92				
12.7	72.6	13.1	76.6			6	43				
11.2	34.1	9.3	68.5			11	67				
10.9	42.8	11.4	68.4								
15.7	63.7	14.3	62.2								
11.4	57.9	13.4	29.8								
14.9	32	11.9	29.9								
13	26.5	14.2	15.2								
13.4	40.5	14.9	89.8								
12.1	33	14.7	78.6								
11.8	89.3	12	27.3								
11.3	67.6	11	87.4								
12.1	78.9	11	15.3								
12.1	30	14.1	25.1								
13.2	35.1	10.8	56.5								
11.7	65.1	12.3	81.1								
14.6	59.6	6.8	75.2								
15.1	24.2	15.6	72								
13.5	7.8	11.8	59.1								
10	52.2	12.6	1.2								
13.6	22.6	6.6	70.4								
14.4	42.4	14.6	36.7								
10.4	80.1	14.9	11.4								
12.7	44.2	14.8	39.8								
12.9	67.6	11.7	54.5								
12.7	63.8	12.5	46.4								
15.9	34.4	10	70.7								

Sample 12 (88SG12)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
7.2	62.9	13.2	74.5	15	70.2	2	15	351 ± 40	9.71E+05	4600	0.02 - 0.09
15.1	21.3	9.5	43.6	14.5	43.5	10	141				
15.4	35.3	14.5	64	15.6	87.5	3	25				
13.8	63.1	16.1	84.6	14.5	31.5	4	62				
14.6	72.9	7.4	52.5	13.8	84	8	81				
15.4	34.2	15.1	60.8	13.3	75.2	5	46				
17.1	87.9	9.1	41.6	15	32.7	9	60				
14.1	75.9	16	83.1	9.8	72.8	7	50				
13.9	42.2	15	56	12.6	82.7	20	151				
10.7	21.7	15.2	86.2	8.7	45.9	3	36				
15.1	82.8	15.4	82	4.5	52.7	9	62				
15.9	3.1	16.2	49.5	9.3	30.5	6	73				
14.6	68.8	14.4	42.7	12.5	71.4	5	62				
11.1	49.6	13.9	82.6	14.9	67.9	40	192				
13.2	70.6	15.2	41.4	14.8	29.6	30	164				
11.5	56.3	15.8	13	8.6	39	4	37				
15	12.4	15.8	1.3	15.4	33.9	15	127				
14.6	40.9	10.4	68.3	14.8	60.2	7	50				
16.6	86.9	6.2	52.8	15.6	73.3	15	92				
16	59.7	15.3	87.8	16	42.2	9	108				
15.9	84.3	11.3	17.7	8.9	6						
13.9	62.5	9.1	55	11.3	60.6						
8.9	33.7	8.2	30.8	13.2	54.9						
14.6	70	14.6	55	9.5	29.4						
11	28.2	10.2	37.3	14.1	40.6						
15.2	66.5	15.2	46.5	15.1	52.8						
16.2	70.5	15.4	59.5	13.4	70.7						
15.4	85.6	11.6	11.5	14.2	47.8						
15.6	65.4	14.4	64.1	14.4	66						
11.6	9.5	14.7	68.1	9.9	70.1						
10.4	31.1	9.3	45.6	9.5	50.2						
12.3	80.7	16.3	31	9.8	37.3						
14.9	75	3.5	63.2	13.4	18.2						
14.5	59.9	14.5	85.5	14.7	41.3						
10.3	54.5	14.1	53.2	12.2	82.7						
5.5	81.2	13.9	55.7	7.8	58.8						
15.9	26.7	15.2	67.5	15.3	74.9						
15.5	86.4	14.4	22.9	16	23.5						
15.6	78.4	15.5	2.7	16.4	86.6						
10.2	22.1	14.6	77.2	12.6	50.8						
13.9	51.2	11.9	8.5								
13.3	52.2	14.1	61.2								
15	76.5	15.6	1.9								
14.2	77.1	14	88.2								

Sample 13 (88SG13)

Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
15.4	44.3	3	21	351 ± 40	9.61E+05	4600	0.23 - 0.51
15.3	24.3	7	91				
14.2	48.8	2	10				
16	66.1	4	24				
14.5	21.1	12	120				
16.2	32.1	12	101				
15.7	50.8	1	8				
12.8	50	6	47				
14.4	42.5	9	68				
14.5	55	11	104				
15	9	3	20				
16	57.5	13	127				
14.1	31.8	4	37				
15.1	57.4	7	99				
14.5	68.4	4	29				
15.1	76.9	6	62				
8.9	71.8	3	37				
16.7	62	5	51				
14.5	80.3	3	23				
13.1	81.5	2	17				
13.9	84.5						
15.9	64.9						
16.2	33.9						
13.2	79.5						
15.5	68.8						
10	79.9						
15.5	69.9						
14.7	68.7						
15.5	70.8						
13	41.3						
15.6	60						
13.8	83.7						
15.2	70.4						
15.1	20.8						
16.5	85.5						
15.6	44.5						
7.8	55.6						
14.8	54.6						
15.7	35.4						
13.3	74						

Sample 14 (88SG23)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
12	83.7	12.8	69.5	13.6	20.6	3	39	351 ± 40	2.22E+06	4600	0.00 - 0.31
10.6	23.4	12.4	77.7	11.4	57.6	5	68				
10.4	65.3	12.8	23.6	13	59	6	68				
11.9	74.1	17	37.2	12.6	41.2	3	40				
13	81	12.4	84.3	12.8	33.4	3	48				
11.8	82	12.9	89.5	12.5	83.8	4	39				
11.9	87.9	13.3	38.2	14.9	43.5	7	43				
15.5	48.2	14.9	38.4	9.4	29.1	2	22				
14.2	7.6	15	29.2	14.7	62.6	4	37				
14.9	87.2	14.5	33.6	12.1	46.5	5	60				
15	25.2	12.2	75.2	12.3	21.4	7	73				
13.2	74	13.7	69.7	14	46.4	7	108				
13.2	65.9	12.2	6.8			2	41				
16.4	34.7	12.9	64.5			7	90				
11.6	70.1	14.8	23.3			6	81				
13.4	87.2	13.7	75.2			3	39				
15.5	76.6	13	11.4			4	52				
16.5	2.6	11.8	65.3			2	16				
10.4	65.3	15.7	57			2	22				
13.2	77.5	11.7	53.5			5	52				
14.2	26.7	12.6	38.2								
12.1	88.6	12	47.5								
16.4	55.8	16.2	87.7								
14.7	25	13.7	54.6								
14.7	67.6	12.7	11.4								
13.9	28.1	12.5	71.4								
13.7	7.9	11.8	12.6								
12.6	60.8	12.6	78.2								
13.2	28.1	11.6	81.1								
13.6	38.5	12	65.2								
14.7	33.6	11.8	68.4								
14.9	45.2	13.8	57.7								
13.1	70.1	12.5	65.4								
13.5	42.9	12.1	80.9								
11.9	86.4	12.5	71.3								
14.6	50.7	14.4	23.3								
14.4	25.4	14.7	49.2								
13.1	31.1	14.8	58.9								
5	75.4	16	24.9								
14.5	35.5	13.8	78.8								
13.1	51	15.9	30.7								
11.6	43.3	17.1	67.2								
13.7	33.7	13	81.8								
11.7	86.8	11.6	51.8								

Sample 15 (88NAC02)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.2	10.4	14.6	81.8	14.2	45.7	6	95	351 ± 40	1.44E+06	4600	Not available
14.2	15.5	14.7	24.2	14.0	75.9	31	196				
8.2	41.7	13.3	59.3	13.8	74.5	11	78				
14.2	48.0	12.6	10.3	12.0	82.4	10	57				
14.2	72.6	15.6	67.8	14.3	26.6	40	204				
14.8	3.6	12.0	56.8	14.3	56.4	44	293				
10.8	53.0	15.5	65.9	13.3	79.9	15	108				
14.6	48.4	14.6	45.2	10.8	61.9	13	128				
10.4	79.2	15.0	17.1	13.7	40.2	35	187				
14.8	78.3	14.3	47.6	12.9	64.6	11	81				
15.2	66.6	12.4	52.0	12.9	60.9	24	127				
12.7	77.6	11.5	39.1	14.0	56.9	18	130				
14.7	55.5	12.6	9.6	14.7	47.6	14	115				
13.1	33.9	12.8	88.9	14.6	64.1	22	174				
14.0	1.3	13.6	81.4			9	78				
13.1	79.7	12.6	71.5			10	46				
14.3	56.2	13.8	75.0			19	103				
13.2	52.4	12.5	80.1			17	123				
13.4	87.2	14.5	12.3			13	64				
13.6	74.7	16.0	7.7			81	435				
13.4	49.2	13.4	56.4								
13.7	19.8	12.9	89.5								
13.5	82.6	16.3	59.2								
14.1	69.2	13.3	85.5								
11.9	78.8	15.1	17.2								
14.1	26.2	13.1	26.4								
16.2	31.5	12.3	71.5								
13.4	82.5	12.3	59.8								
15.0	46.9	13.2	46.2								
13.9	61.0	13.1	83.6								
14.5	87.3	13.8	34.7								
15.5	52.4	9.8	71.9								
15.1	80.8	14.1	82.0								
13.2	80.2	13.6	55.8								
10.7	82.8	14.7	46.9								
16.5	51.6	17.9	27.0								
12.8	44.6	8.6	40.4								
15.3	29.1	11.4	59.1								
14.0	86.1	13.9	43.5								
13.8	34.3	12.9	78.8								
15.5	31.4	13.4	36.6								
13.4	67.5	13.8	16.7								
13.2	72.3	14.1	30.3								
12.9	46.4	15.3	63.7								

Sample 16 (88NAC15)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
15	50.4	13.1	28.3	11.3	66.2	11	46	351 ± 40	1.48E+06	4600	0.13 - 0.39
10.7	72.8	15.1	78.9	12.6	36.2	65	207				
7.8	6.4	14.5	82.3	16.4	52.5	31	161				
14.9	26.8	11.8	53.6	15.5	2.7	10	51				
10	54.5	11	61.1	11.1	26.9	10	45				
14.1	71.2	16.7	40.7	13.9	23.8	38	129				
10.1	67.5	7.3	71.2	14.1	9.1	4	19				
10.2	81.1	13.8	40.7	15.3	30	63	294				
10.6	75.6	15.5	58.3	13.9	30.5	6	20				
11.2	31.2	13.5	67.9	12	70.5	3	11				
16.2	77.1	15	80.3	13.8	72.4	7	33				
12.8	79.8	15.2	77.2	14.3	56.5	6	23				
9.9	60.1	9.9	85.3	13.5	64.5	8	27				
16.1	37.3	10.2	75.7			8	34				
8.6	52.6	14	45.8			7	34				
8.7	69.4	10.5	57.2			11	70				
11	41.9	13.7	64.5			86	191				
13.9	47.5	11.8	76			25	135				
14.1	87.5	15.8	59.5			29	87				
10.8	81.1	12.1	65.4			5	17				
11.4	57.5	14.3	86.8								
11.9	0.5	14.6	87.6								
14.1	48	14	74.3								
8.2	31.9	14.9	49.9								
8	53.5	14.8	32.2								
13.7	82.2	14.9	46.7								
12.4	18.2	14.8	67.8								
12	63	16.1	32.1								
15	26.2	11.4	13.7								
13.5	76.4	10	63								
13.6	73.8	11.5	75								
14.8	13.4	10.7	79.7								
13.3	82.7	9.5	53								
14.3	52.5	10.6	71.1								
14.6	50.8	16	88.8								
7.9	57.1	13.4	86.7								
13.9	62	15.7	37.2								
12.3	78	10.4	40.2								
13.2	56	10.6	85.3								
11.2	52.6	11.6	12.5								
14.7	78.4	14.5	3.4								
13.2	47.9	13.9	60.2								
16.2	28.5	9.1	57.6								
9.3	6.5	16.4	48.2								

Sample 17 (88MAN03)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.6	73.5	8.3	39.7	12.2	73.9	5	16	351 ± 40	1.33E+06	4600	0.08 - 0.15
14.7	31.1	7.4	48.3	11.1	69.0	4	20				
14.8	57.7	16.3	19.7	14.6	27.8	9	83				
10.4	61.9	12.6	1.1	14.2	88.8	7	39				
16.9	42.1	14.2	48.6	14.0	51.5	4	22				
11.3	61.1	13.6	59.1	13.3	60.2	9	38				
10.3	53.8	14.4	61.5	15.2	64.9	5	35				
12.3	27.0	14.8	70.5	14.8	73.9	3	27				
14.6	53.4	12.7	49.6	15.0	80.6	9	36				
10.4	87.9	15.1	66.6	15.8	81.2	5	32				
14.0	71.9	13.9	63.0	14.6	34.6	6	35				
11.5	71.7	14.5	43.5	11.1	75.5	1	10				
14.7	41.8	11.6	52.9			10	53				
12.6	67.4	12.5	50.5			8	35				
13.2	36.9	12.7	73.4			4	26				
10.1	50.2	13.3	67.0			11	66				
10.4	12.0	14.5	61.3			5	35				
11.7	84.5	14.0	84.4			3	22				
13.8	75.0	7.6	77.7			12	78				
12.5	60.8	9.1	85.4			8	58				
14.0	86.3	12.5	83.4								
14.0	68.9	15.3	40.5								
13.5	45.9	12.8	79.4								
10.6	68.6	12.6	40.9								
14.0	67.4	14.9	49.9								
14.4	64.3	11.9	44.8								
11.5	40.0	10.8	78.0								
15.8	47.9	11.6	89.8								
13.9	32.7	13.7	62.4								
15.0	21.4	13.4	52.3								
15.2	56.9	13.2	68.4								
12.1	70.4	13.5	41.7								
9.1	83.4	12.6	23.1								
9.6	56.3	14.6	54.9								
13.1	71.1	12.7	37.2								
11.1	28.7	13.1	44.7								
9.9	60.4	13.7	57.5								
12.8	39.4	11.6	74.7								
14.3	72.3	15.3	22.5								
10.8	37.9	11.5	30.8								
13.4	39.8	10.9	63.3								
11.5	26.5	13.7	72.7								
12.9	51.7	13.5	50.6								
9.6	26.2	12.3	64.8								

Sample 18 (88MAN04)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
13.8	72.6	10.7	36.5	13.7	59.7	12	81	351 ± 40	1.33E+06	4600	0.09 - 0.14
9.5	50.7	12.5	64.2	14.8	50.0	22	160				
15.6	79.0	13.7	81.0	15.1	3.8	12	149				
15.8	63.2	8.2	37.2	12.8	69.5	2	11				
12.5	49.4	11.7	76.9	11.0	30.9	6	45				
16.3	49.2	10.5	75.8	10.8	30.3	8	79				
14.4	35.7	13.9	24.7	15.4	2.5	3	25				
14.8	51.9	9.4	31.3	11.9	48.9	9	90				
16.4	76.1	15.0	71.7	14.6	59.2	5	50				
10.7	49.0	15.2	88.1	15.0	55.7	6	65				
8.9	69.9	14.6	48.8	17.0	59.0	13	86				
13.1	53.9	13.6	33.5	12.3	80.4	5	29				
6.4	5.8	12.1	33.1			4	38				
10.8	11.0	10.6	67.0			11	65				
10.0	45.5	13.3	17.8			7	36				
13.7	31.5	8.9	54.0			6	33				
14.6	46.9	14.3	58.8			4	40				
9.7	71.5	11.5	22.2			8	72				
14.7	24.2	13.5	24.1			4	42				
15.9	63.4	12.4	53.5			3	30				
12.3	43.7	13.6	76.7								
13.1	32.8	11.2	31.6								
12.1	64.7	9.7	2.4								
8.9	71.8	11.8	46.3								
14.8	59.5	14.3	78.2								
10.7	64.6	15.8	81.4								
13.3	28.6	14.8	75.0								
13.7	60.4	13.1	74.9								
14.8	41.3	12.7	44.1								
6.7	47.9	15.3	55.5								
9.2	65.6	15.7	58.6								
11.6	5.4	10.0	71.7								
9.9	75.5	14.3	39.3								
16.1	49.5	13.8	75.2								
15.8	54.8	5.0	33.4								
11.2	36.9	13.6	86.8								
14.5	30.8	11.6	45.9								
12.1	74.0	13.7	62.4								
14.6	34.1	13.5	55.0								
11.9	76.6	13.5	54.7								
9.2	80.0	14.5	56.8								
11.8	29.8	16.3	60.4								
14.2	71.2	15.0	74.1								
13.3	29.5	13.7	62.4								

Sample 19 (88MAN13)

Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
13.7	69.8	10.0	82.5	1	4	351 ± 40	1.37E+06	4600	0.20 - 0.86
14.6	83.9	14.5	58.8	7	40				
13.1	34.9	13.8	70.7	3	20				
12.9	79.9	14.8	36.5	5	37				
13.9	63.9	14.2	44.1	7	34				
13.9	72.9	15.9	79.2	3	9				
12.8	3.9	16.7	46.1	8	33				
7.4	39.3	14.6	35.9	9	43				
13.1	30.6	13.2	76.4	3	15				
13.0	34.5	13.1	63.4	10	39				
15.4	37.4	15.0	35.6	12	42				
12.9	45.6	13.1	53.6	11	45				
14.5	26.9	12.8	69.3	2	10				
13.3	55.9	13.2	69.5	9	38				
6.5	25.4	11.7	1.9	1	5				
7.9	62.4	13.2	28.2	11	77				
12.8	70.7	14.4	22.5	3	29				
10.9	88.6	14.3	76.1	7	34				
12.8	50.8	14.1	35.8	4	28				
13.1	80.5	7.8	82.2	1	4				
13.2	57.4	13.6	45.6						
14.1	63.8	14.3	55.5						
13.8	57.9	12.7	47.0						
7.6	5.1	12.5	7.9						
13.4	52.8	12.4	63.6						
14.4	34.3	14.0	51.9						
14.6	79.7	15.5	68.0						
13.6	61.0								
14.7	59.5								
10.7	40.8								
14.5	42.0								
12.3	66.4								
14.1	51.1								
15.1	54.1								
15.0	36.5								
13.4	36.4								
13.2	45.8								
10.1	11.9								
14.8	38.6								
12.1	72.7								
14.4	79.0								
12.3	53.6								
14.9	5.7								
13.7	59.9								

Sample 20 (90BR05)

Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.7	30	16.6	65.2	35	300	4265 ± 300	2.80E+05	3756	Not available
15.6	83.7	14.7	77.9	8	77				
15.5	59.5	13.3	52.7	9	111				
15.1	63.9	14.7	62.7	27	236				
13.1	62.7	11	65.2	15	127				
13.8	42.4	13.8	35.4	1	17				
9.5	67.6	16.4	51.4	4	38				
15.6	45.8	15.5	27.2	4	30				
14.6	82.4			11	131				
15	45.3			16	140				
16.1	20.4			12	151				
13.5	78.7			8	75				
15.9	82.7			19	151				
9.5	34.8			42	350				
15.2	43.8			6	41				
11.7	36.6			2	31				
13.3	43			9	87				
15	78.7			15	150				
7.7	67.1			9	118				
15	64.4			20	180				
15.3	40.8								
15	71.7								
15	88.8								
14.3	55.4								
15.9	76.4								
14.1	85.7								
13.2	68								
16.8	76.7								
15.5	86.5								
13.2	53.8								
13.3	89.8								
14.7	53.4								
14.7	49								
13.9	64.1								
14.6	84.3								
16.6	1.8								
13.3	74								
14.3	54.4								
13.3	81.6								
16.7	14.9								
13.7	48.2								
15	35.2								
15.5	38.4								
14.2	46.8								

Sample 21 (90SB02)

Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.4	70.9	15.3	64.8	3	54	4265 ± 300	1.83E+05	3900	Not available
12.9	57.9	15.6	52.3	4	66				
16.4	26.4	14	84.9	4	46				
15.4	69.9	15	19.3	3	55				
15.1	77.9	15.6	79.2	5	81				
15.1	35.3	16.1	59.1	6	83				
15.9	38.5	14.1	69.8	2	36				
14	61.6	16	66.9	8	131				
15.4	50.7	15.3	68	5	133				
15.1	55.6	16.9	25.1	23	369				
15.2	50.9	15.3	71.3	3	52				
14.3	51.4	14	87.2	7	106				
15.1	47.3	14	51.3	3	36				
7.8	55.6	14.7	75.1	2	35				
14.7	73.3	15.3	43.9	3	39				
14.2	25.8	16.1	67.4	4	68				
14.3	46	15.6	88.3	2	34				
7	18	15.2	12.6	7	97				
14.1	64.9	13.5	76.6	4	60				
15.7	47.1	15.4	44	3	67				
13.3	67.8	16	74.1						
15.3	48.1	15.9	9.5						
13.8	53.8	15.1	46.7						
9.7	56	16.9	55.4						
13.6	67.8	15.7	71.3						
15.4	61.8	14.2	38.4						
14	81.2	14.5	61.4						
16	20.5	13.2	77.8						
14.3	88.8	11.3	70.1						
12.6	59.4	16.2	33.3						
15.4	56.6	14.7	48						
16	70.2	14.4	48.2						
14.8	81	10.8	79.1						
14.3	61.3	13.4	68.1						
15.8	56.7	11.7	59.9						
16.1	62	13.9	59.2						
15.5	58.1	15.7	76.8						
8.9	51.2	14.8	48.5						
15.4	85.7	14.7	85						
13.3	85.5	15.5	81						
16.1	37.4	14.8	73.3						
15.4	40.8	6.1	72.4						
15.8	72.8	13.8	64.6						
14.6	74.5	15.6	27.7						

Sample 22 (90SA08)

Length (μm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
Not available	Not available	2	55	4265 ± 300	2.95E+05	3756	Not available
		1	11				
		0	11				
		1	8				
		1	14				
		0	25				
		2	35				
		1	36				
		1	33				
		2	62				
		0	11				
		1	25				
		1	28				
		2	67				
		1	31				
		2	35				
		2	56				
		1	50				
		2	34				
		2	93				

Sample 23 (81OR07)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.41	65.36	14.08	60.62	11.31	45.76	9	138	4265 ± 300	1.25E+05	3027	Not available
15.16	22.39	13.04	72.94	14.62	67.11	5	108				
13.41	69.34	14.45	42.04	15.55	50.35	6	110				
14.72	38.52	7.02	68.47	14.42	50.12	5	193				
15.6	72.22	15.84	28.4	11.77	50.7	2	77				
15.47	42.47	15.95	26.72	14.63	49.09	4	112				
8.02	78.73	14.58	68.93	14.88	54.92	2	77				
14.24	84.21	16.57	48.36	14.43	17.24	3	63				
13.5	43.07	17.24	50.39	13.87	28.36	3	79				
14.9	56.13	15.84	62.72	15.41	51.26	2	72				
15.43	61.09	9.11	74.16	15.45	47.73	3	77				
14	78.04	14.15	83.98	14.7	35.94	6	132				
15.82	61.02	8.31	87.54			4	124				
14.54	74.99	14.15	81.18			4	139				
14.63	62.26	13.38	68.85			3	104				
15.64	66.82	11.23	71.87			1	29				
12.97	77.06	10.51	29.12			5	93				
13.96	80.47	15.05	81.47								
14.85	60.16	14.09	51.47								
15.86	70.28	9.23	77.17								
15.24	29.81	16.07	51								
10.91	55.54	15.28	41.75								
14.86	63.42	13.5	75.89								
10.6	49.81	5.04	47.75								
15.25	64.31	14.73	63.94								
15.17	62.96	15.65	31.85								
15	48.79	14.82	68.7								
14.48	0.22	10.14	45.24								
14.98	67.83	15.17	83.35								
15.87	66.83	15.56	44.29								
14.17	63.1	6.52	66.22								
15.84	39.49	14.99	30.66								
15.15	46.3	16.2	71.66								
13.59	79.21	10.82	34.21								
14.29	46.5	15.68	46.62								
15.83	51.04	16.12	35.71								
14.48	73.08	13.52	52.43								
14.14	80.49	8.94	57.7								
16.28	57.64	14.86	36.97								
14.6	32.68	16.23	42.45								
15.63	22.86	16.16	76.42								
13.31	52.73	13.58	80.01								
15.25	43.35	11.78	62.53								
8.05	77.24	14.6	68.64								

Sample 24 (81OR08)

Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
14.07	70.25	14.71	68.27	15.68	39.68	9	164	4265 ± 300	1.26E+05	3027	Not available
15.75	59.02	8.94	2.11	14.54	36.52	5	78				
13.78	51.48	16.67	17.78	6.84	86.89	4	85				
14.57	71.2	12.07	55.03	14.79	28.68	21	333				
7.77	42.13	16.15	27.32	16.35	66.92	3	46				
15.62	45.71	15.72	36.71	16.17	79.21	7	138				
11.47	61.37	13.8	39.07	4.92	54.46	5	93				
14.11	65.56	12.99	89.12	16.25	28.18	5	85				
14.72	29.21	7.05	42.84	15.52	40.19	7	119				
15.9	17.31	11.99	89.08	15.3	20.32	6	129				
13.2	86.1	14.28	38.84	16.28	35.9	3	41				
15.54	83.38	13.05	35.33	15.47	45.17	5	131				
14.73	32.9	14.24	70.28			6	122				
14.42	24.56	14.51	30.29			8	126				
15	57.1	14.65	10.54			3	60				
15.21	76.62	14.44	80.16			7	208				
12.97	78.99	14.63	74.32			4	117				
15.36	36.7	16.56	25.44			5	144				
12.72	69.28	16.26	48.4								
15.08	67.53	14.94	20.55								
15.89	68.26	16.38	20.53								
15.31	46.05	15.98	57.89								
15.06	30.58	14.11	66.6								
12.01	11.93	15.67	49.49								
15.86	78.12	14.62	48.34								
16.04	60.3	14.09	69.84								
15.31	69.41	16.67	58.75								
15.62	84.46	12.51	61.38								
15.32	59.66	14.74	77.52								
14.03	56.79	15.65	13.86								
15.75	84.31	15.2	69.25								
15.32	54.07	14.64	33.83								
12.5	68.57	13.52	78.21								
15.55	52.54	14.57	87.85								
15.66	83.25	14.03	57.5								
15.76	64.2	15.66	79.74								
13.17	56.59	15.14	55.45								
14.92	52.82	15.89	29.22								
11.49	51.87	17.24	6.04								
14.1	60.32	15	73.4								
9.16	57.49	5.73	40.33								
17.11	21.81	13.63	24.07								
16.61	55.63	9.28	70.93								
16.2	57.19	14.55	6.17								

Sample 25 (81OR15)

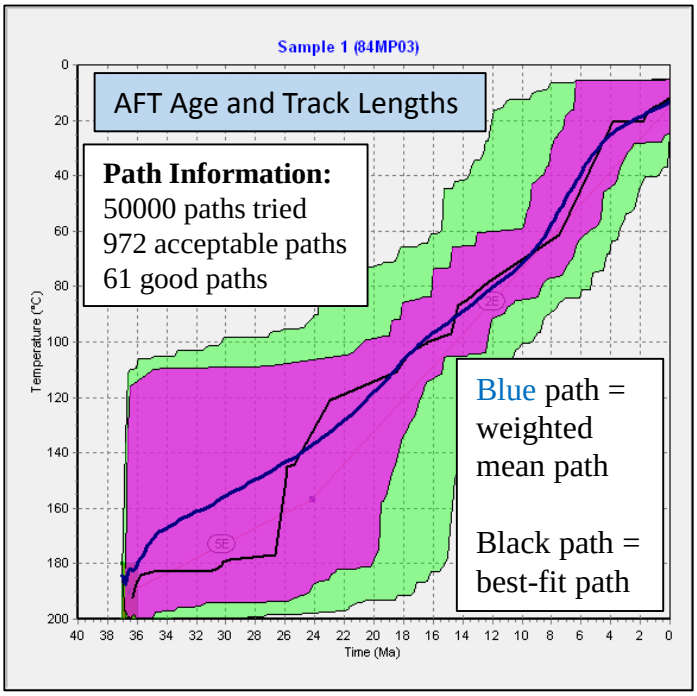
Length (µm)	Angle	Length (µm)	Angle	Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
16.19	16.36	13.93	38.77	14.55	37.43	3	63	4265 ± 300	1.33E+05	3027	Not available
12.53	66.21	14.48	48.24	16.01	12.54	2	51				
14.49	60.83	13.81	64.73	14.66	46.31	4	83				
10.83	28.31	10.28	55.19	15.3	20.32	2	57				
11.96	60.84	15.6	45.23			6	158				
16.41	64.98	16.27	48.04			14	208				
14.74	51.68	12.85	24.54			2	67				
15.84	64.54	8.89	3.8			2	51				
14.47	89.86	14.96	31.81			3	33				
14.57	70.51	16.01	52.39			9	126				
15.95	44.12	12.67	70.28			6	137				
14.79	75.77	17.27	28.6			4	70				
15.68	54.55	16.22	67.56			6	154				
15.38	52.49	15.31	67.37			1	16				
15.13	37.13	14.79	72.66			2	49				
15.26	63.31	14.69	48.76			5	73				
15.67	30.14	14.54	48.07			6	129				
14.62	38.29	14.17	40.49			4	94				
16.65	48.99	13.69	57.97			6	142				
15.48	30.86	8.06	73.52			7	156				
16.42	62.53	14.59	58.38								
19.65	67.5	10.19	52.44								
13.34	42.48	16.08	24								
15.67	73	14.33	52.55								
12.12	40.91	14.74	77.52								
9.52	51.84	15.11	56.57								
14.04	74.22	14.13	71.5								
14.44	41.63	16.03	31.21								
8.35	59.19	15.91	23.23								
14.44	80.13	13.84	59.3								
14.79	46.96	14.07	50.56								
15.22	65.88	16.08	85.48								
11.81	84.64	15	42.31								
7.8	62.93	10.36	37.47								
14.94	63.48	14.49	33.71								
16.59	31.87	14.44	68.34								
14.67	71.3	16.45	50.45								
5.55	57.29	13.8	87.25								
14.95	45.9	17.19	32.04								
7.14	55.48	13.38	88.42								
15.37	61.35	12.86	81.7								
14.71	40.32	10.97	34.37								
15.71	47.42	15.73	32.28								
14.65	64.26	17.05	20.21								

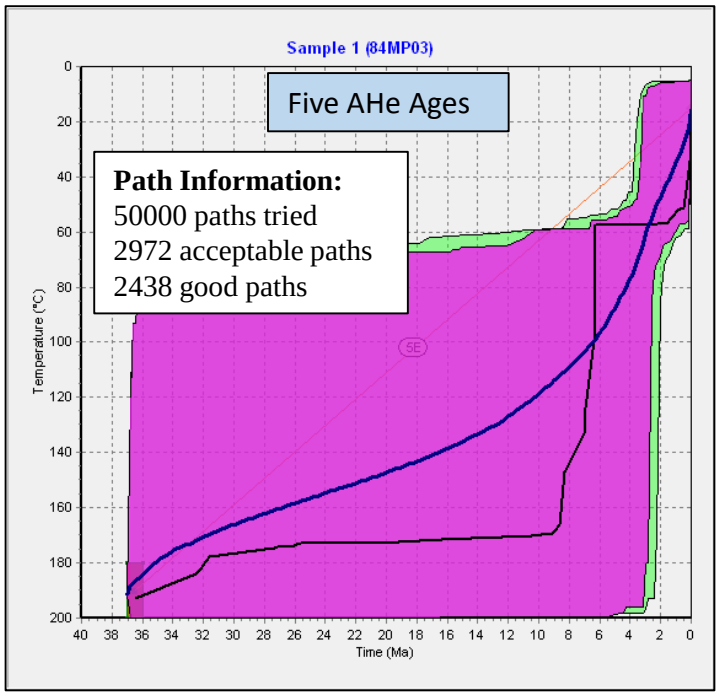
TM

Length (µm)	Angle	Ns	Ni	Zeta	rhoD	Nd	Cl wt%
Not available	Not available	1	40	351 ± 40	1.40E+06	4000	0.02 - 0.13
		2	30				
		4	77				
		4	100				
		2	53				
		3	63				
		1	22				
		5	85				
		1	8				
		4	25				
		6	85				
		1	28				
		1	14				
		1	20				
		7	82				
		2	62				
		12	136				
		3	38				
		3	96				
		1	52				

Figure DR1

HeFTy Input Data, Modeling Procedures, and Results





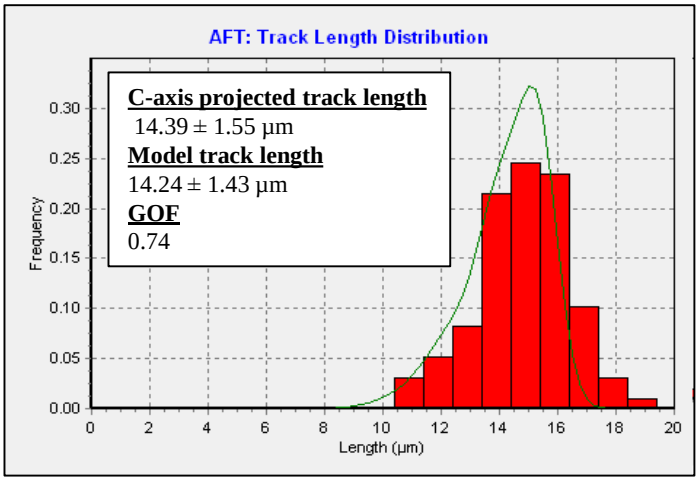
Sample 1 (84MP03)

Sample Location: 38°44.53'N, 106°11.57'W
Elevation: 3055 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
AFT age, track length data and AHe ages would not produce any paths, so they were modeled separately. The left thermal history model incorporates AFT age and track length data. Initial track lengths were estimated using a chlorine value of 0.3 wt %, which lies within the range of reported chlorine values from a nearby sample at Mt. Princeton (Kelley et al., 1992). The right thermal history model incorporates all five AHe ages, but no AFT data. The left thermal history model requires that the sample cool below ~60 °C by ca. 8 Ma, while the right thermal history model requires that the samples remain hotter than ~60 °C until ca. 4-3 Ma. One possible explanation is the AHe system was partially reset due to geothermal fluids from nearby hotsprings. Therefore, we suggest that the left thermal history model is a better indication of cooling due to fault slip in the Mt. Princeton region.

AFT Input Data

Measured AFT age:
13.2 ± 1.5 Ma (Kelley et al., 1992)
Measured track length:
13.5 ± 0.4 µm
N = 100 (Kelley et al., 1992)



AHe Modeling Results

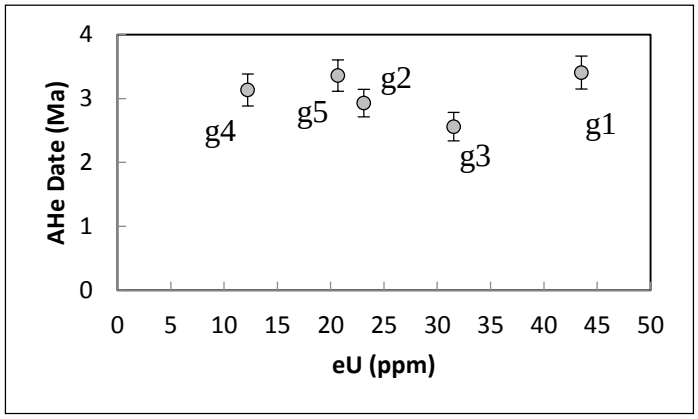
g1 input age: 3.4 ± 0.7 Ma
model age: 3.5 Ma
GOF: 0.88

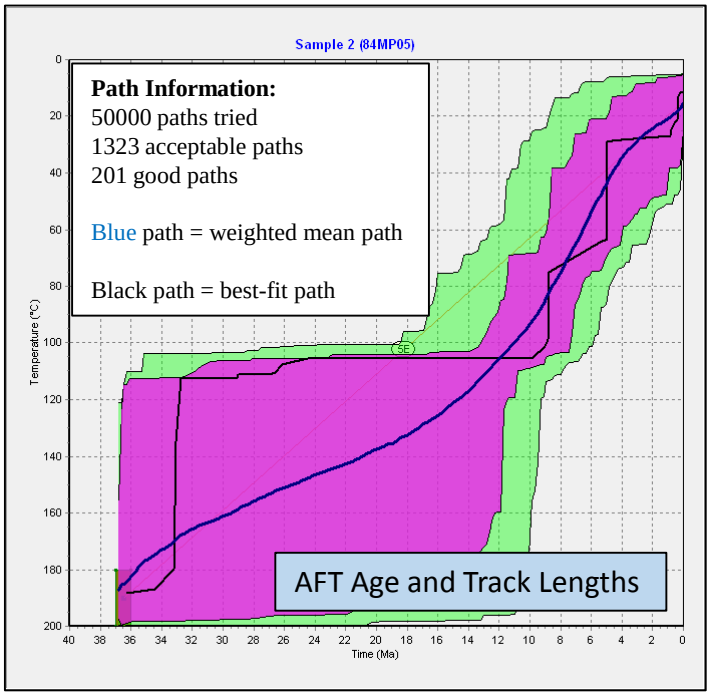
g2 input age: 2.9 ± 0.6 Ma
model age: 2.9 Ma
GOF: 0.99

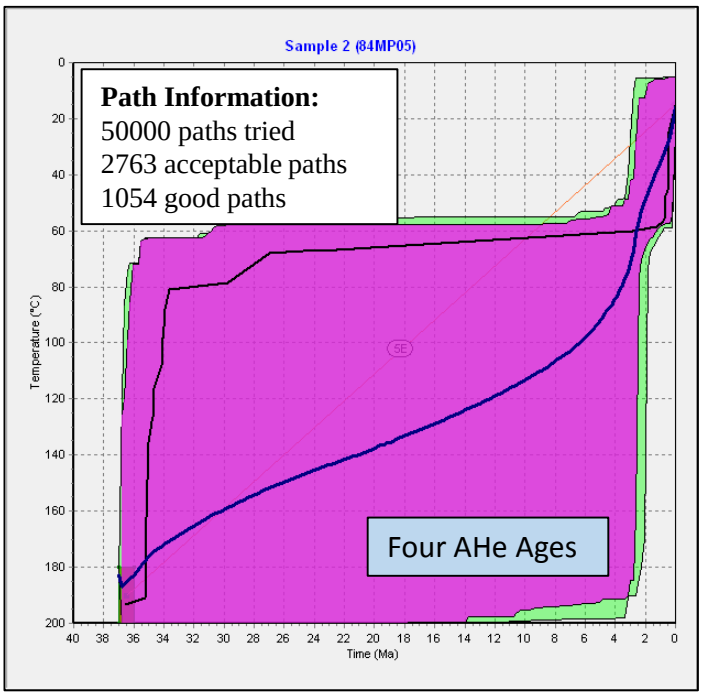
g3 input age: 2.6 ± 0.5 Ma
model age: 2.6 Ma
GOF: 0.96

g4 input age: 3.1 ± 0.6 Ma
model age: 2.8 Ma
GOF: 0.63

g5 input age: 3.4 ± 0.7 Ma
model age: 3.4 Ma
GOF: 0.97







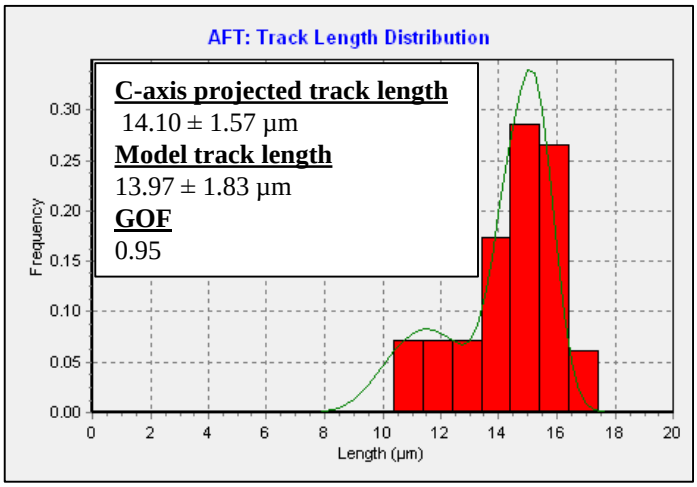
Sample 2 (84MP05)

Sample Location: 38°44.91' N, 106°11.24' W
Elevation: 2899 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
AFT age, track length data and AHe ages would not produce any paths, so they were modeled separately. The left thermal history model incorporates AFT age and track length data. Initial track lengths were estimated using a chlorine value of 0.3 wt %, which lies within the range of reported chlorine values from a nearby sample at Mt. Princeton (Kelley et al., 1992). The right thermal history model incorporates four AHe ages (excluding g3), but no AFT data. The left thermal history model requires that the sample cool below ~50 °C by ca. 8-4 Ma, while the right thermal history model requires that the samples remain hotter than ~50 °C until ca. 2 Ma. As with Sample 1, one possible explanation is the AHe system was partially reset due to geothermal fluids from nearby hotsprings. Therefore, we suggest that the left thermal history model is a better indication of cooling due to fault slip in the Mt. Princeton region.

AFT Input Data

Measured AFT age:
9.6 ± 1.2 Ma (Kelley et al., 1992)
Measured track length:
12.9 ± 0.5 µm
N = 100 (Kelley et al., 1992)



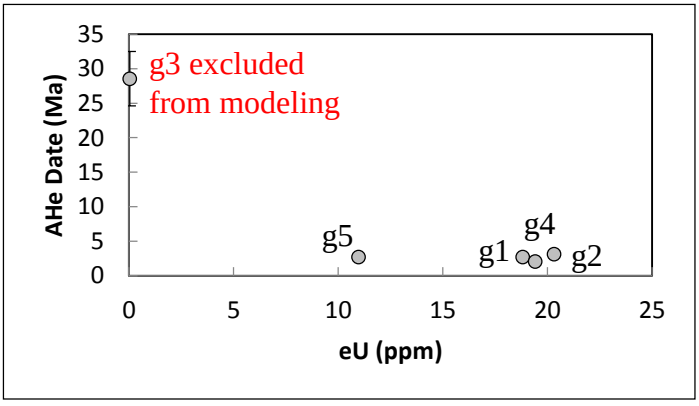
AHe Modeling Results

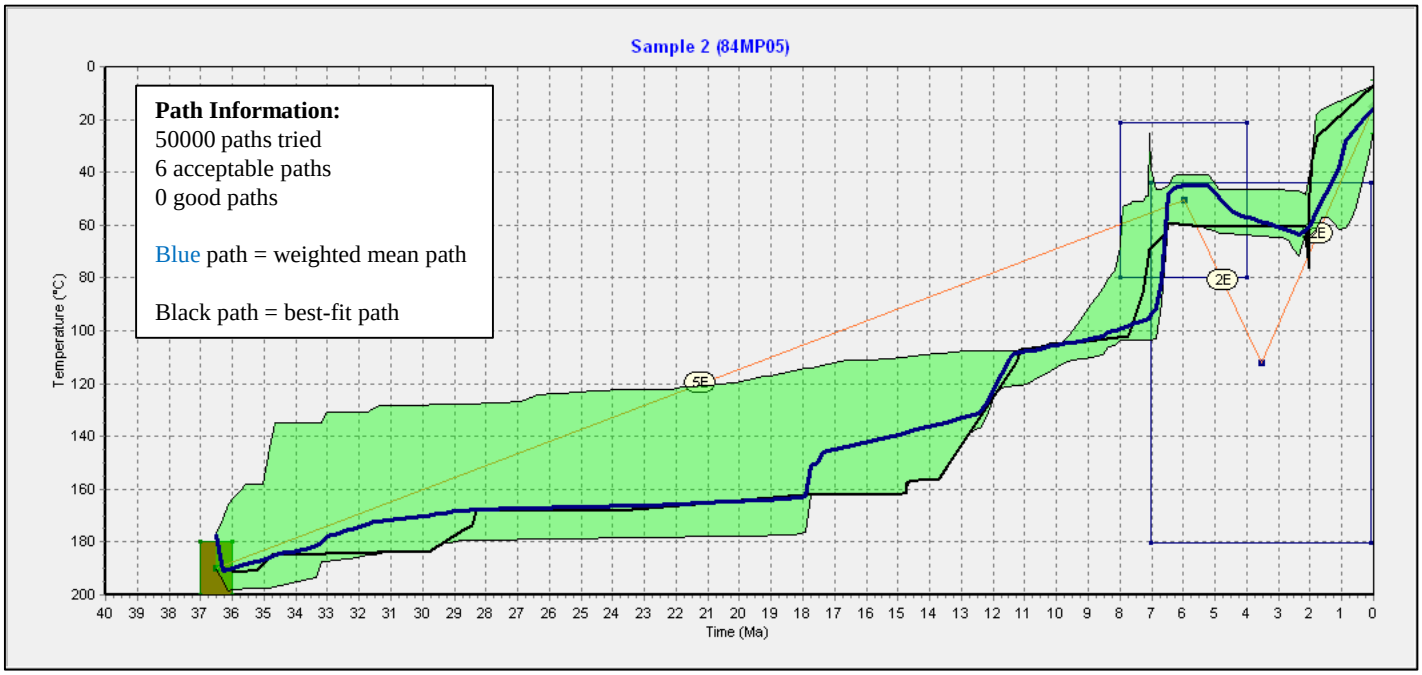
g1 input age: 2.7 ± 0.6 Ma
model age: 2.7 Ma
GOF: 0.99

g4 input age: 2.1 ± 0.5 Ma
model age: 2.4 Ma
GOF: 0.43

g2 input age: 3.1 ± 0.6 Ma
model age: 2.5 Ma
GOF: 0.32

g5 input age: 2.7 ± 0.6 Ma
model age: 2.7 Ma
GOF: 0.98





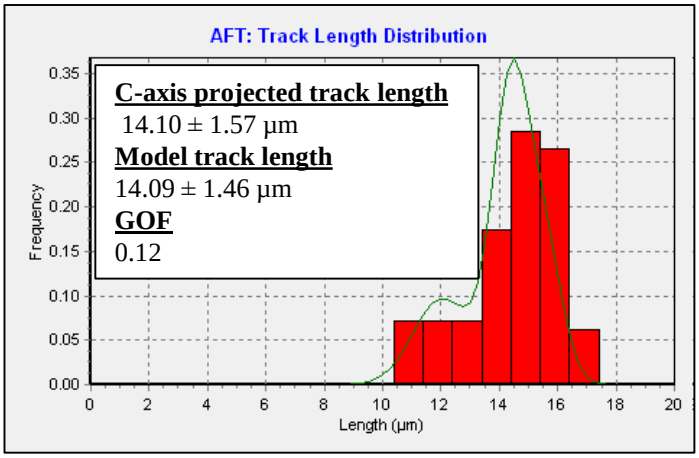
Sample 2 (84MP05)

Sample Location: 38°44.91' N, 106°11.24' W
Elevation: 2899 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and four single grain AHe ages. Unlike the previous two models of this sample, this model was produced using two constraint boxes, The first constrain box, from 8-4 Ma and 20-80 °C, encompasses all paths produced from the first model using only AFT data. The second box allows the sample to heat up to test the hypothesis that it may have been affected by geothermal fluids. The weighted mean time-temperature path suggests that the sample was cooled to ~45 °C by 6 Ma, and was subsequently heated to ~65 °C at 2 Ma, followed by rapid cooling to surface temperatures.

AFT Input Data

Measured AFT age:
9.6 ± 1.2 Ma (Kelley et al., 1992)
Measured track length:
12.9 ± 0.5 µm
N = 100 (Kelley et al., 1992)



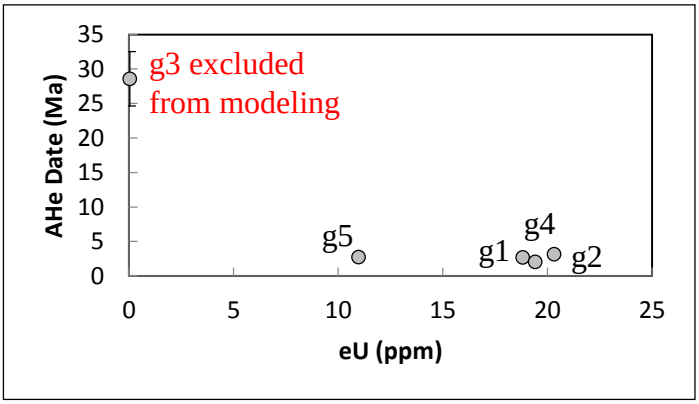
AHe Modeling Results

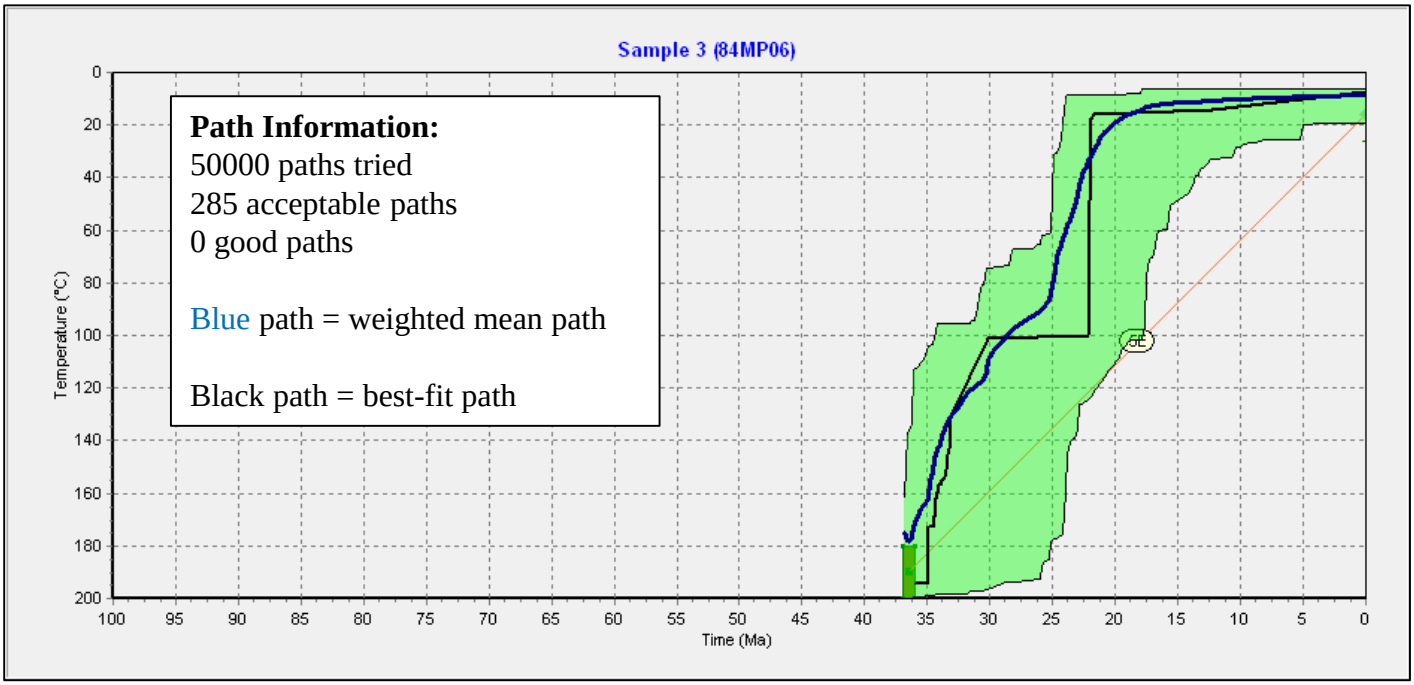
g1 input age: 2.7 ± 0.6 Ma
model age: 3.1 Ma
GOF: 0.54

g4 input age: 2.1 ± 0.5 Ma
model age: 2.8 Ma
GOF: 0.08

g2 input age: 3.1 ± 0.6 Ma
model age: 2.9 Ma
GOF: 0.68

g5 input age: 2.7 ± 0.6 Ma
model age: 3.3 Ma
GOF: 0.30





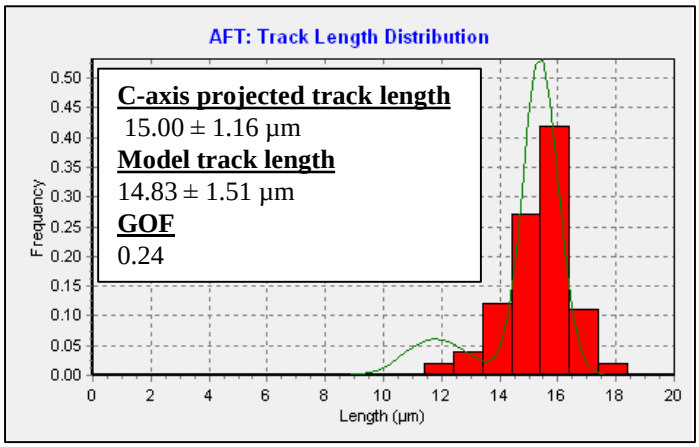
Sample 3 (84MP06)

Sample Location: 38°44.55' N, 106°21.09' W
Elevation: 3896 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and four single grain AHe dates. One AHe date (g3) was excluded because of its anomalously old AHe age. Initial track lengths were estimated using a chlorine value of 0.3 wt %, which lies within the range of reported chlorine values from a nearby sample at Mt. Princeton (Kelley et al., 1992).

AFT Input Data

Measured AFT age:
22.9 ± 2.5 Ma (Kelley et al., 1992)
Measured track length:
14.3 ± 0.3 µm
N = 100 (Kelley et al., 1992)



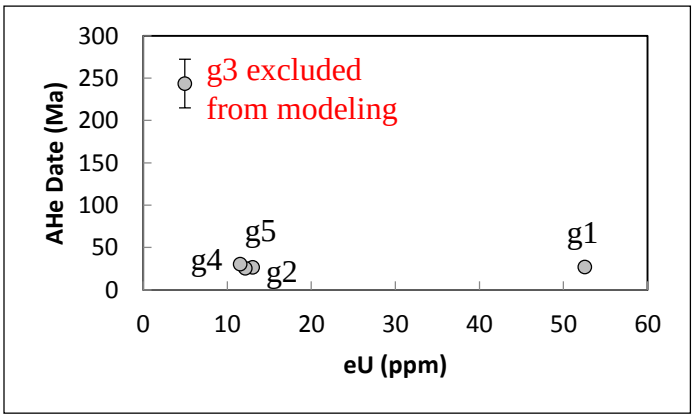
AHe Modeling Results

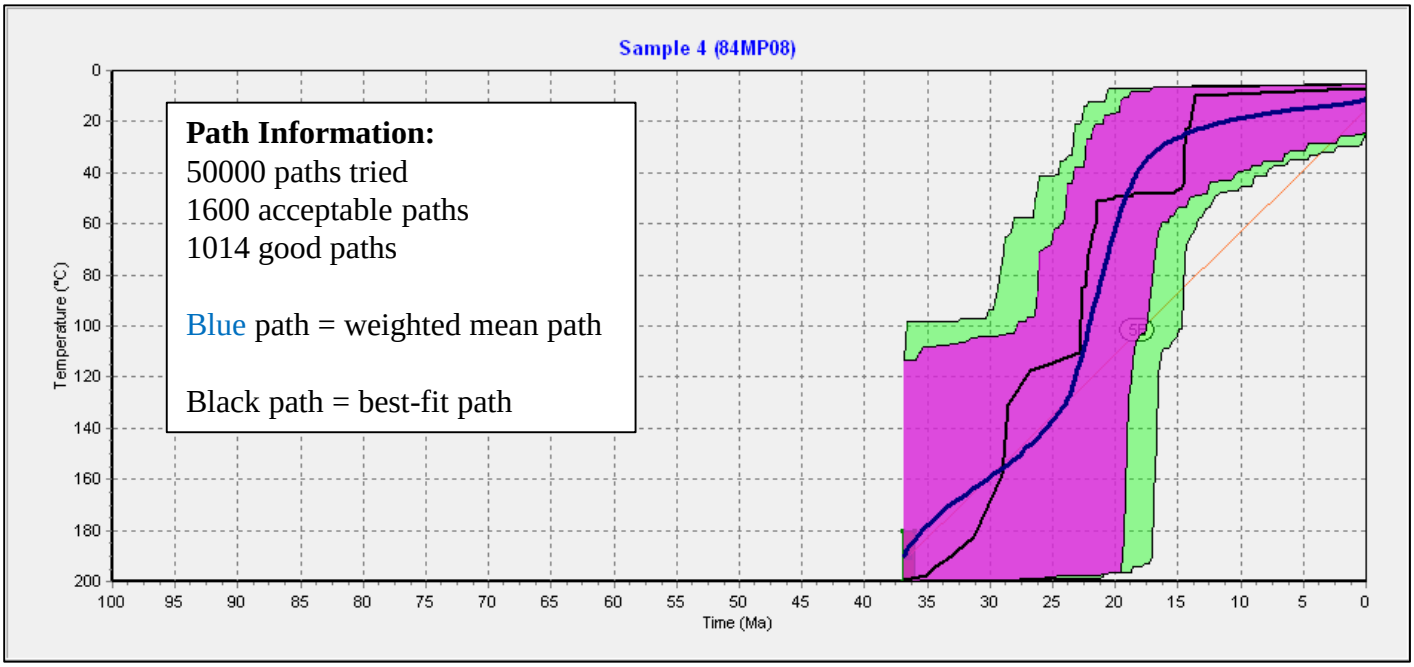
g1 input age: 27.0 ± 5.4 Ma
model age: 21.9 Ma
GOF: 0.35

g4 input age: 25.7 ± 5.1 Ma
model age: 21.5 Ma
GOF: 0.41

g2 input age: 26.7 ± 5.3 Ma
model age: 21.5 Ma
GOF: 0.32

g5 input age: 30.4 ± 6.8 Ma
model age: 21.7 Ma
GOF: 0.20





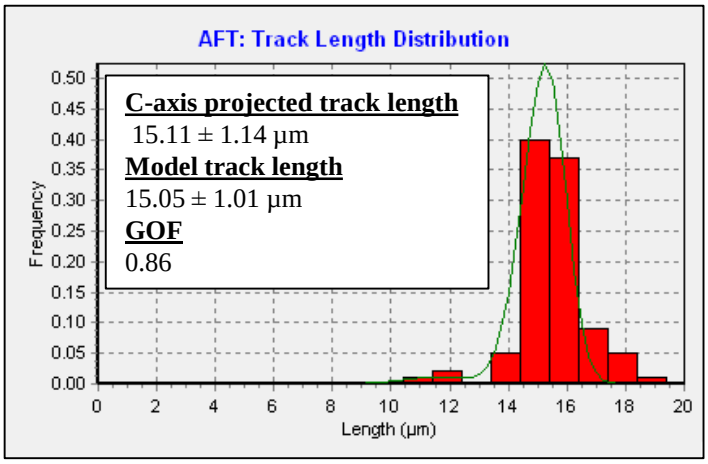
Sample 4 (84MP08)

Sample Location: 38°44.40' N, 106°20.78' W
Elevation: 3747 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five AHe dates. No chlorine data is available for this sample, so initial track lengths were estimated using an assumed chlorine value of 0.1 wt %.

AFT Input Data

Measured AFT age:
23.1 ± 2.8 Ma (Kelley et al., 1992)
Measured track length:
14.5 ± 0.3 µm
N = 100 (Kelley et al., 1992)



AHe Modeling Results

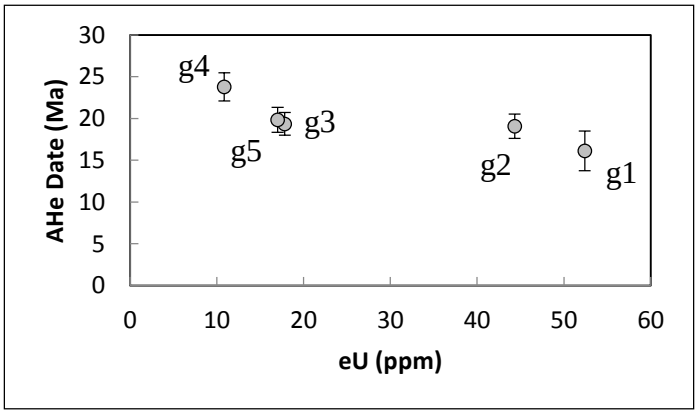
g1 input age: 16.2 ± 3.2 Ma
model age: 18.5 Ma
GOF: 0.47

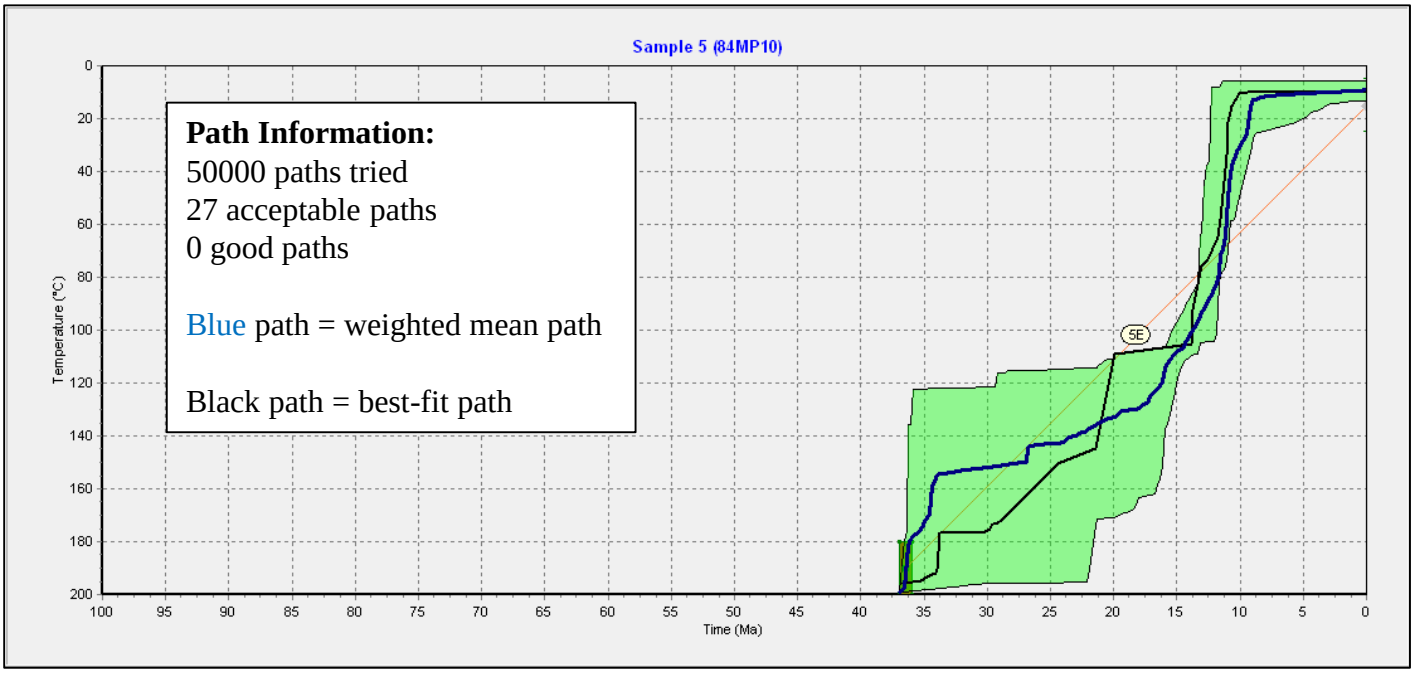
g2 input age: 19.2 ± 3.8 Ma
model age: 19.2 Ma
GOF: 0.94

g3 input age: 19.5 ± 3.9 Ma
model age: 19.6 Ma
GOF: 0.98

g4 input age: 23.8 ± 4.8 Ma
model age: 19.8 Ma
GOF: 0.41

g5 input age: 19.8 ± 4.0 Ma
model age: 19.9 Ma
GOF: 0.97





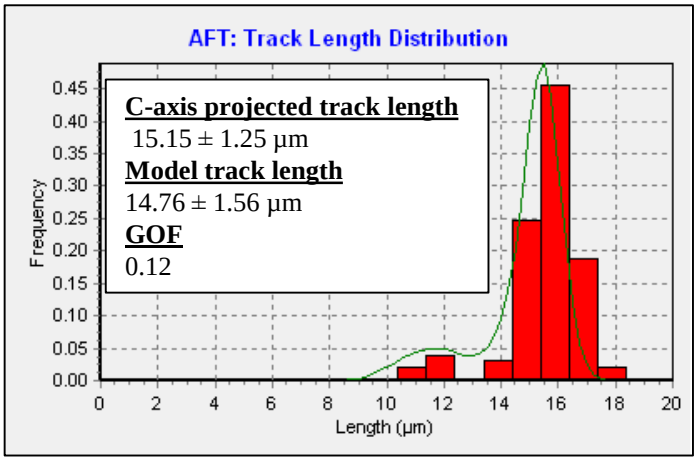
Sample 5 (84MP10)

Sample Location: 38°42.36' N, 106°20.39' W
Elevation: 3041 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five AHe dates. No chlorine data is available for this sample, so initial track lengths were estimated using an assumed chlorine value of 0.3 wt %, which lies within the range of a nearby sample at Mt. Princeton (Kelley et al., 1992).

AFT Input Data

Measured AFT age:
20.1 ± 2.3 Ma (Kelley et al., 1992)
Measured track length:
14.5 ± 0.4 µm
N = 101 (Kelley et al., 1992)



AHe Modeling Results

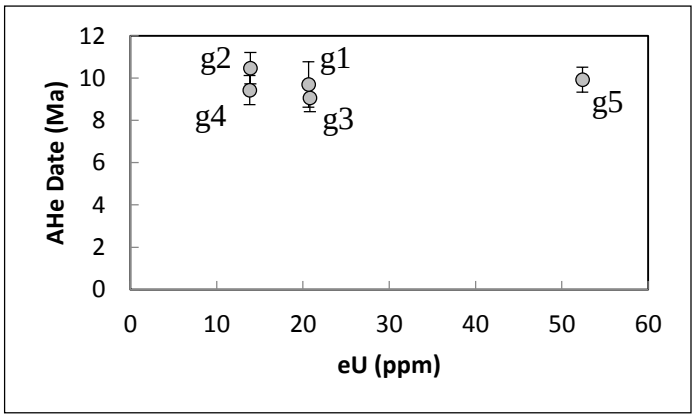
g1 input age: 9.1 ± 1.8 Ma
model age: 11.9 Ma
GOF: 0.12

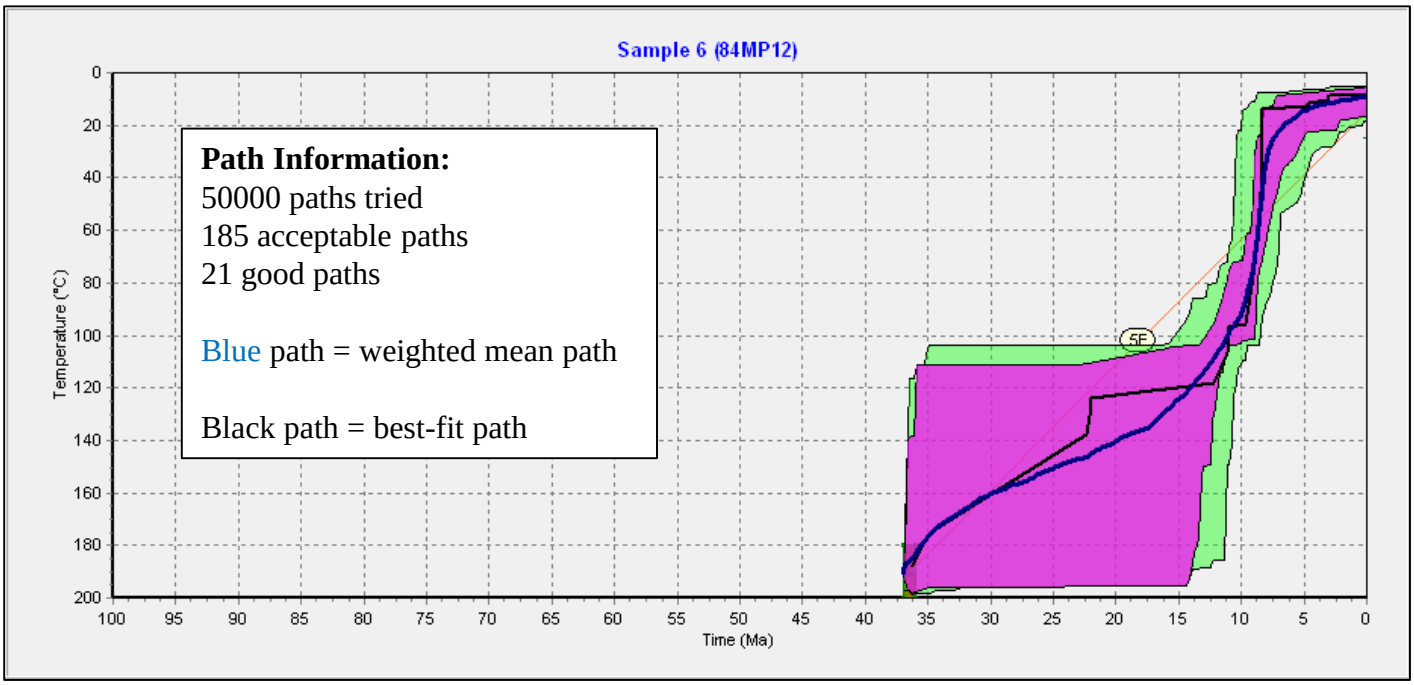
g2 input age: 9.4 ± 1.9 Ma
model age: 11.9 Ma
GOF: 0.19

g3 input age: 9.7 ± 1.9 Ma
model age: 12.1 Ma
GOF: 0.21

g4 input age: 10.5 ± 2.1 Ma
model age: 11.9 Ma
GOF: 0.50

g5 input age: 9.9 ± 2.0 Ma
model age: 12.0 Ma
GOF: 0.29





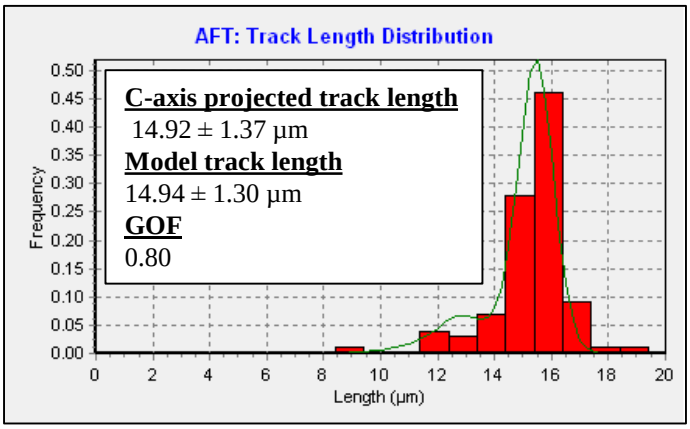
Sample 6 (84MP12)

Sample Location: 38°42.95' N, 106°15.34' W
Elevation: 2768 m
Rock Type: Mt. Princeton Granite
Age: 36.6 Ma (Shannon et al., 1988)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five single grain AHe dates. Since no chlorine data was available for this sample, initial track length was estimated by assuming a chlorine value of 0.1 wt %.

AFT Input Data

Measured AFT age:
14.8 ± 1.9 Ma (Kelley et al., 1992)
Measured track length:
14.2 ± 0.4 µm
N = 100 (Kelley et al., 1992)



AHe Modeling Results

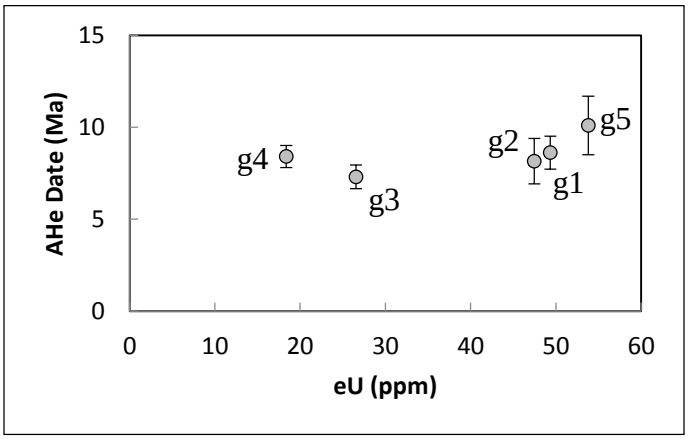
g1 input age: 8.6 ± 1.7 Ma
model age: 8.8 Ma
GOF: 0.90

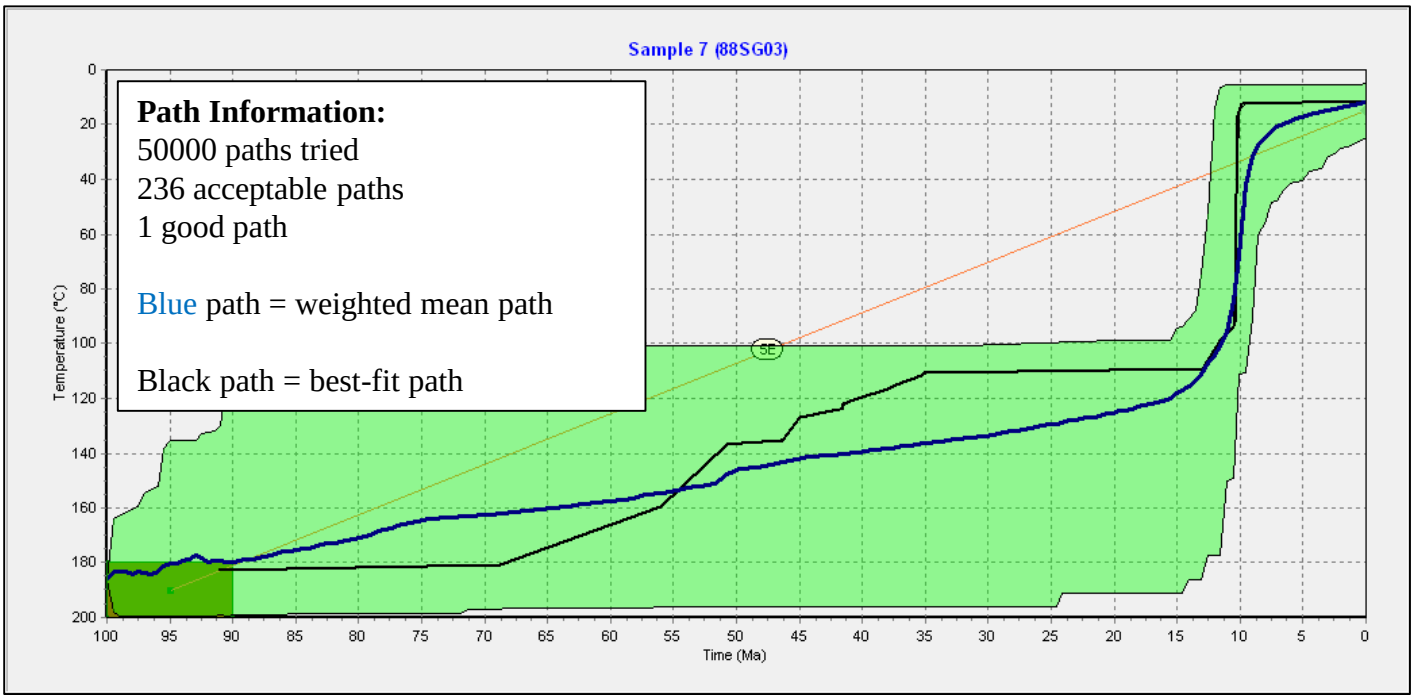
g2 input age: 8.2 ± 1.6 Ma
model age: 8.8 Ma
GOF: 0.74

g3 input age: 7.3 ± 1.5 Ma
model age: 8.8 Ma
GOF: 0.32

g4 input age: 8.4 ± 1.7 Ma
model age: 8.8 Ma
GOF: 0.80

g5 input age: 10.1 ± 2.0 Ma
model age: 8.8 Ma
GOF: 0.51





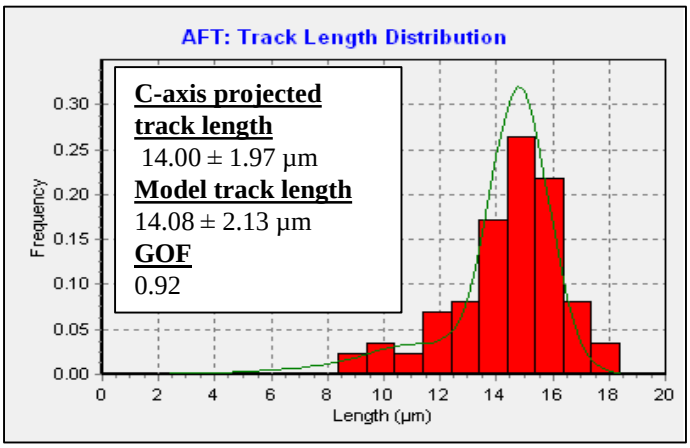
Sample 7 (88SG03)

Sample Location: 37°43.84' N, 105°27.67' W
Elevation: 2927 m
Rock Type: Granite
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and four single grain AHe dates. One AHe date (g5) was excluded because of its anomalously old AHe age. Initial track lengths were estimated using a chlorine value of 0.05 wt %, based on a range of 0.02 – 0.09 wt % reported for this sample (Kelley et al., 1992).

AFT Input Data

Measured AFT age:
10.4 ± 1.3 Ma (Kelley et al., 1992)
Measured track length:
14.0 ± 2.0 µm
N = 87 (Kelley et al., 1992)



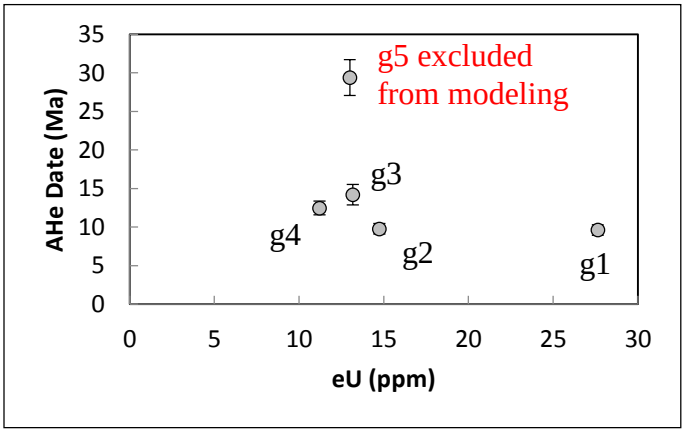
AHe Modeling Results

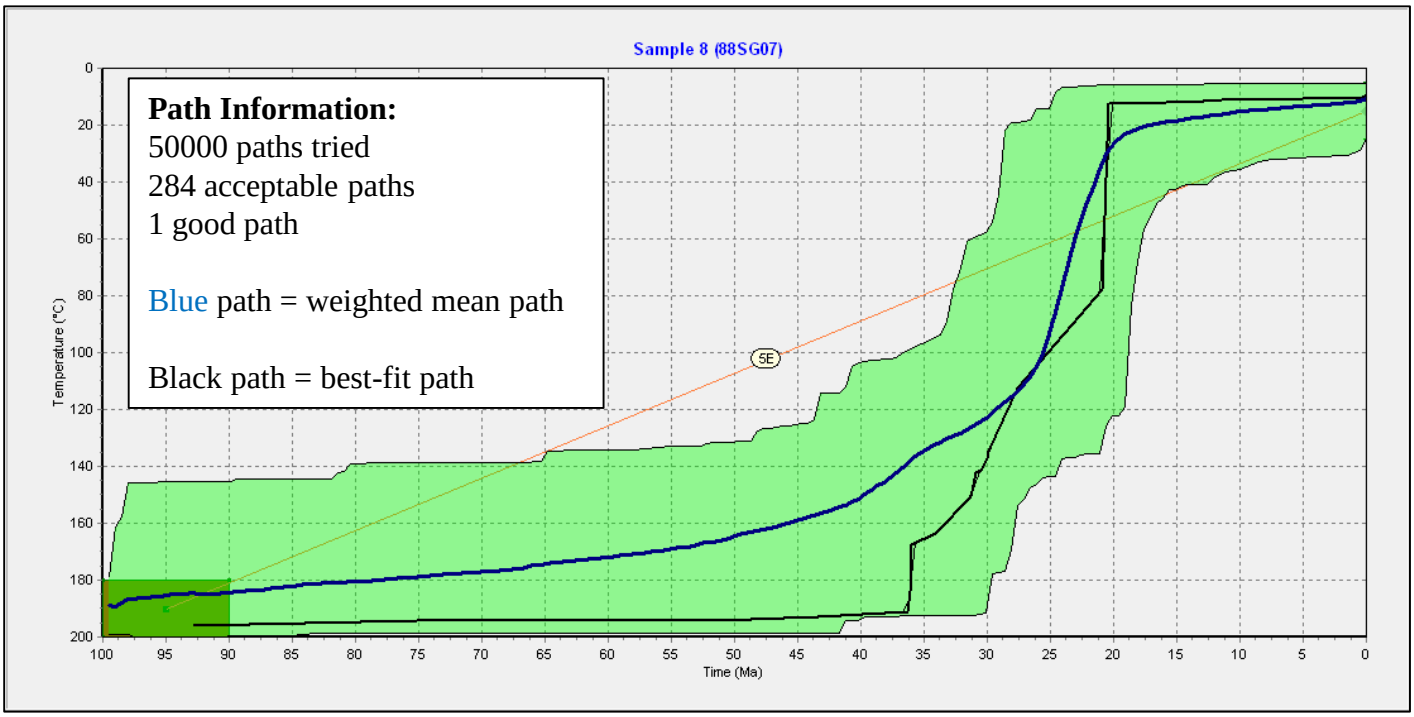
g1 input age: 9.6 ± 1.9 Ma
model age: 10.2 Ma
GOF: 0.77

g2 input age: 9.8 ± 2.0 Ma
model age: 10.2 Ma
GOF: 0.84

g3 input age: 14.2 ± 2.8 Ma
model age: 10.1 Ma
GOF: 0.15

g4 input age: 12.5 ± 2.5 Ma
model age: 10.3 Ma
GOF: 0.39





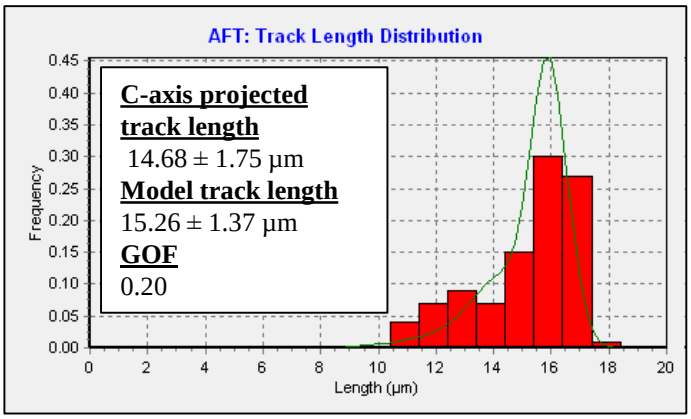
Sample 8 (88SG07)

Sample Location: 37°17.87' N, 105°09.82' W
Elevation: 3847 m
Rock Type: Sandstone (Minturn Fm.)
Age: Pennsylvanian

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and four single grain AHe dates. One AHe date (g5) was excluded because of its anomalously old AHe age. Initial track lengths based on a chlorine range of 0.05 – 0.1 wt % (Kelley et al., 1992) yielded no paths. No paths were produced until the chlorine concentration was increased to 2.5 wt. %. The final thermal history model was produced using a chlorine value of 2.5 wt. %.

AFT Input Data

Measured AFT age:
31.4 ± 4.1 Ma (Kelley et al., 1992)
Measured track length:
13.9 ± 0.5 µm
N = 100 (Kelley et al., 1992)



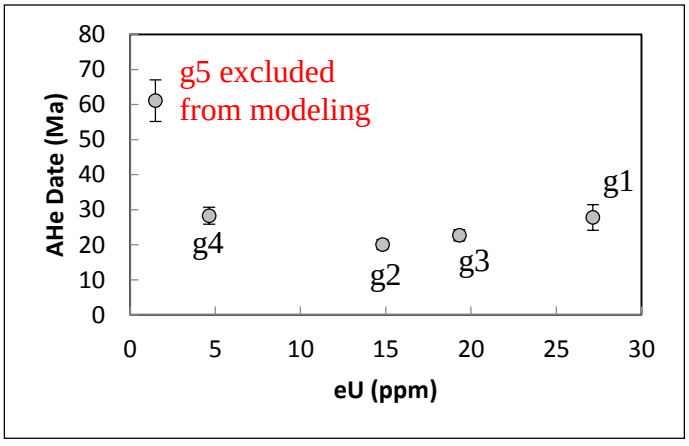
AHe Modeling Results

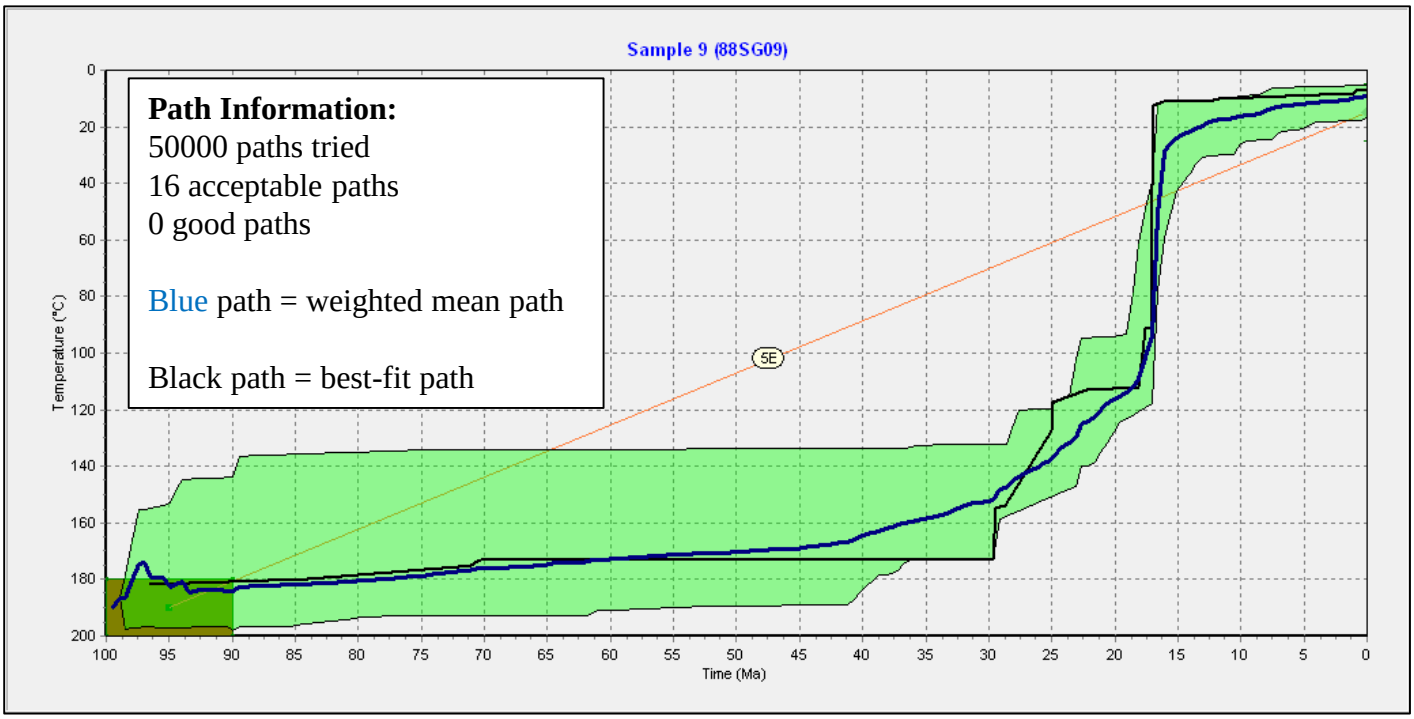
g1 input age: 27.8 ± 5.6 Ma
model age: 20.5 Ma
GOF: 0.19

g2 input age: 20.1 ± 4.0 Ma
model age: 20.6 Ma
GOF: 0.92

g3 input age: 22.7 ± 4.5 Ma
model age: 20.6 Ma
GOF: 0.64

g4 input age: 28.3 ± 5.7 Ma
model age: 20.3 Ma
GOF: 0.16





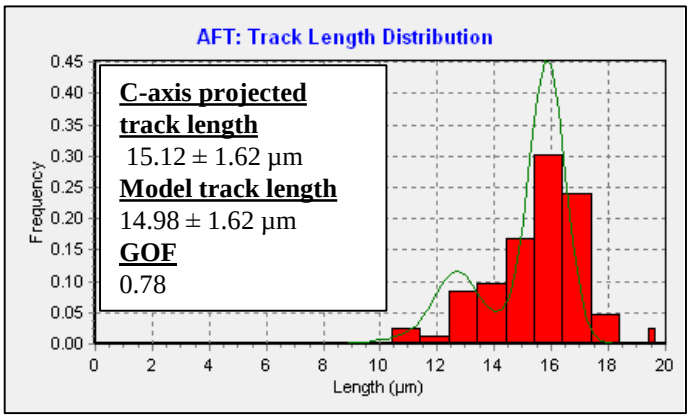
Sample 9 (88SG09)

Sample Location: 37°19.92' N, 105°05.69' W
Elevation: 2829 m
Rock Type: Siltstone (Sangre de Cristo Fm.)
Age: Pennsylvanian-Permian

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and five single grain AHe dates. Initial track lengths based on a chlorine range of 0.05 – 0.1 wt % (Kelley et al., 1992) yielded no paths. No paths were produced until the chlorine concentration was increased to 2.0 wt. %. Therefore the final thermal history model was produced using an assumed chlorine value of 2.5 wt. %.

AFT Input Data

Measured AFT age:
19.4 ± 2.3 Ma (Kelley et al., 1992)
Measured track length:
14.5 ± 0.5 µm
N = 83 (Kelley et al., 1992)



AHe Modeling Results

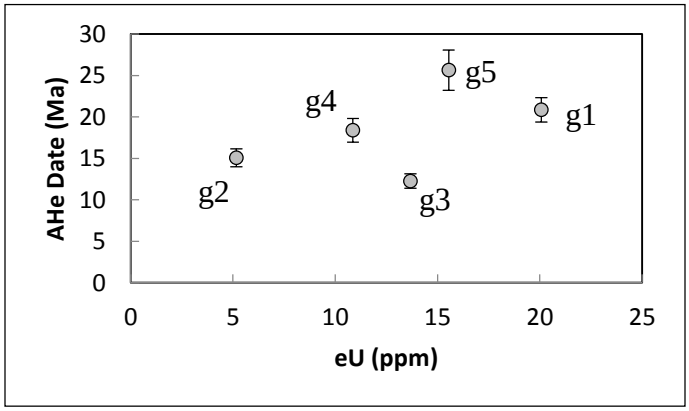
g1 input age: 20.9 ± 4.2 Ma
model age: 16.8 Ma
GOF: 0.33

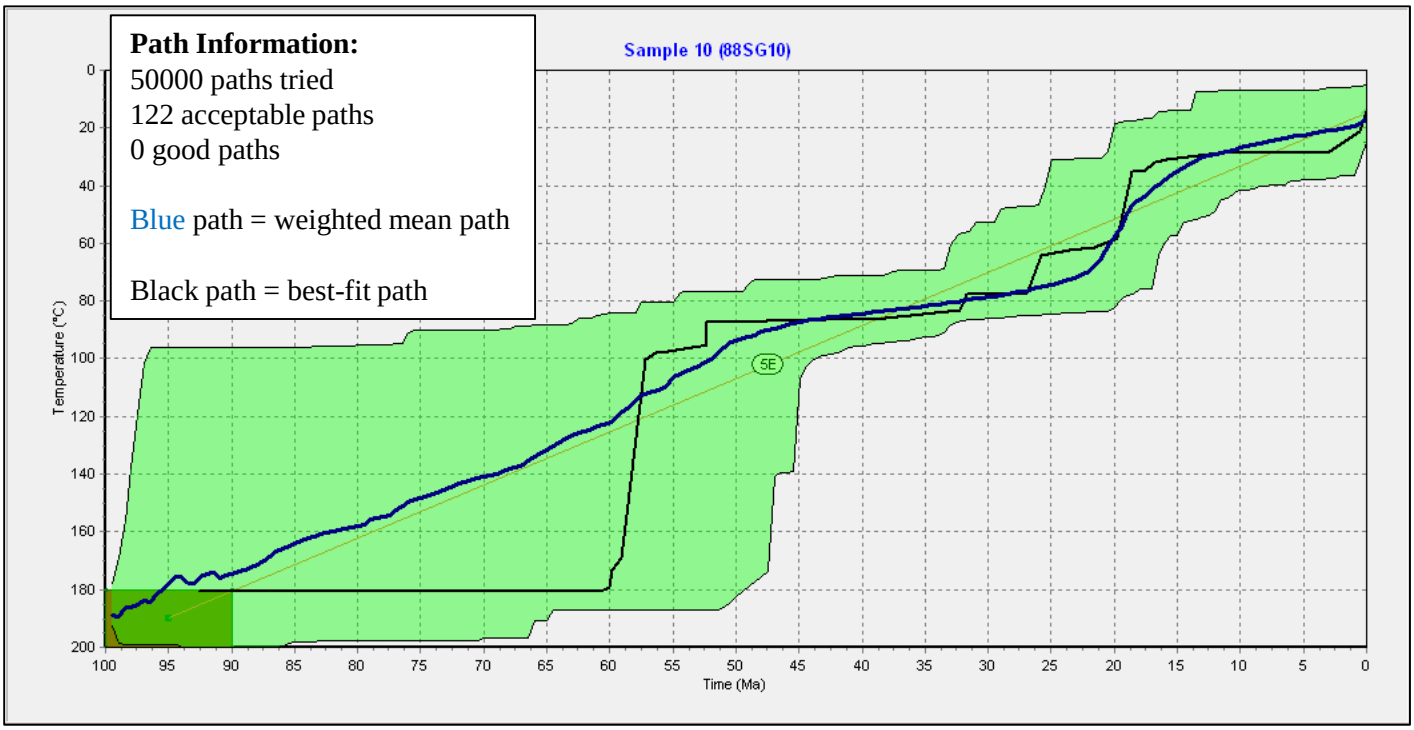
g2 input age: 15.1 ± 3.0 Ma
model age: 16.7 Ma
GOF: 0.59

g3 input age: 12.3 ± 2.5 Ma
model age: 16.8 Ma
GOF: 0.07

g4 input age: 18.4 ± 3.7 Ma
model age: 16.7 Ma
GOF: 0.64

g5 input age: 25.7 ± 5.1 Ma
model age: 16.6 Ma
GOF: 0.08





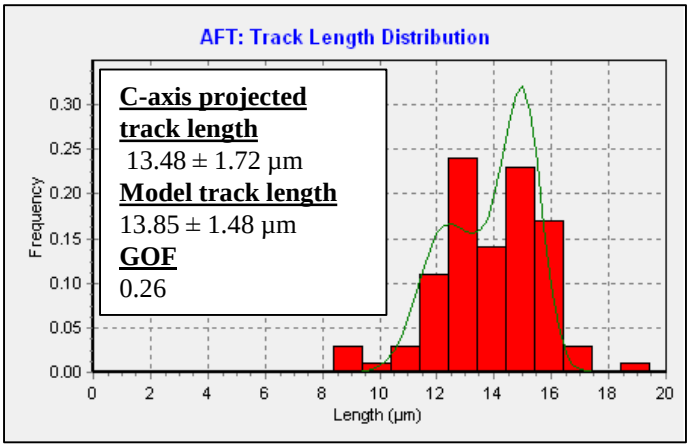
Sample 10 (88SG10)

Sample Location: 37°36.82' N, 105°11.34' W
Elevation: 2870 m
Rock Type: Arkose (Sangre de Cristo Fm.)
Age: Pennsylvanian-Permian

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and three single grain AHe dates. Initial track lengths were estimated using a chlorine value of 0.2 wt. %, which is based on reported values that range from0.03 – 0.22 wt. % (Kelley et al., 1992). No paths were produced when grains g3 and g4 were included, even if they were binned, most likely because of their anomalously old ages without an apparent correlation with eU. Therefore, they were excluded from modeling.

AFT Input Data

Measured AFT age:
38.9 ± 4.0 Ma (Kelley et al., 1992)
Measured track length:
12.4 ± 0.4 µm
N = 100 (Kelley et al., 1992)

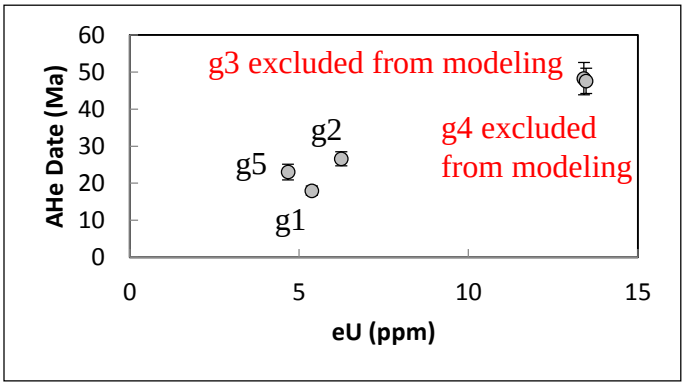


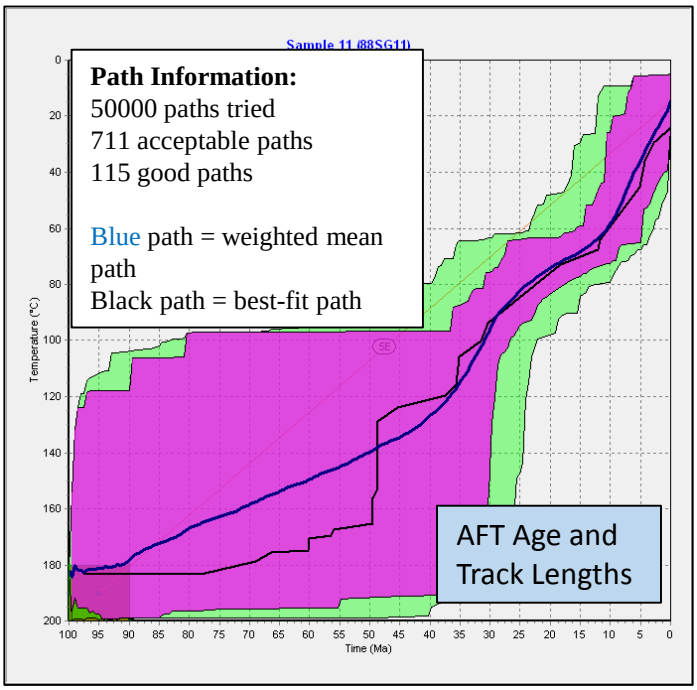
AHe Modeling Results

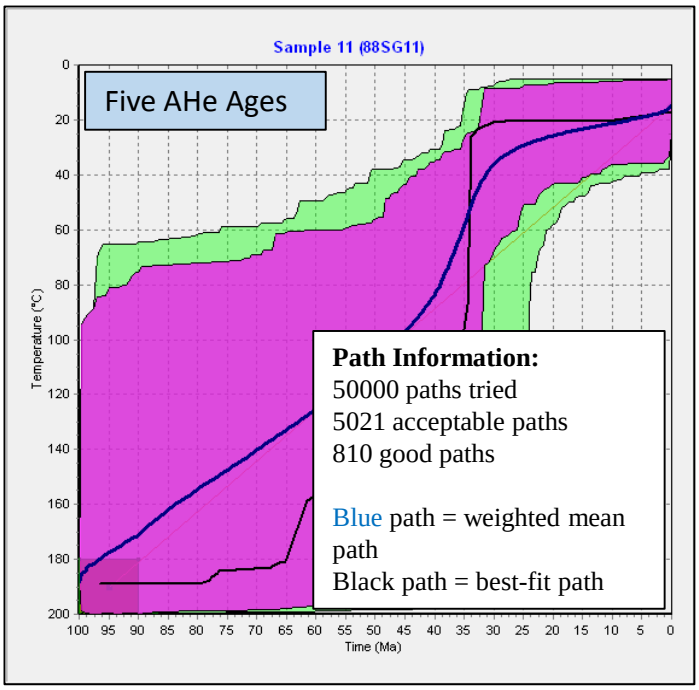
g1 input age: 18.0 ± 3.6 Ma
model age: 19.3 Ma
GOF: 0.71

g2 input age: 26.6 ± 5.3 Ma
model age: 19.2 Ma
GOF: 0.16

g5 input age: 23.0 ± 4.6 Ma
model age: 18.0 Ma
GOF: 0.28







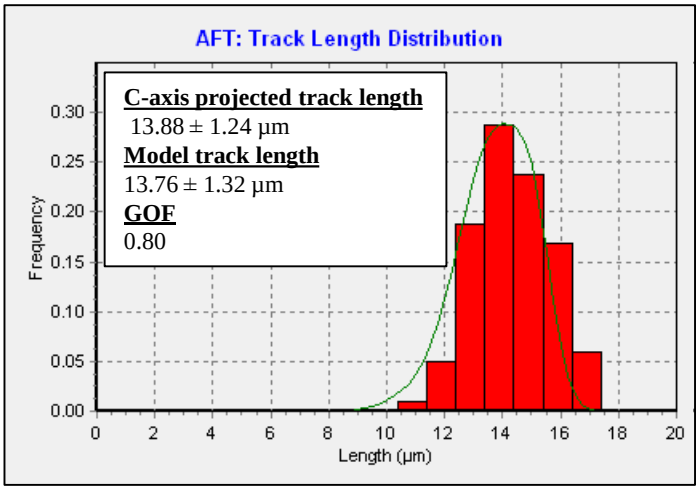
Sample 11 (88SG11)

Sample Location: 37°31.89'N, 105°17.69'W
Elevation: 2536 m
Rock Type: Sandstone (Minturn Fm)
Age: Pennsylvanian

HeFTy Model Description:
Two thermal history models are presented for this sample. The left model incorporates AFT age and track length data. The right thermal history model incorporates five AHe ages. No paths were obtained when AFT data was combined with any AHe data. For this sample, the slightly shortened track lengths require prolonged residence within the partial annealing zone. However, the AHe data seem inconsistent with this because the five AHe dates are relatively uniform despite an eU range from 2-63 ppm, suggesting rapid cooling through the partial retention zone. We choose to not interpret these results too heavily, but include both models for completeness.

AFT Input Data

Measured AFT age:
28.5 ± 2.6 Ma (Kelley et al., 1992)
Measured track length:
12.9 ± 0.4 µm
N = 101 (Kelley et al., 1992)



AHe Modeling Results

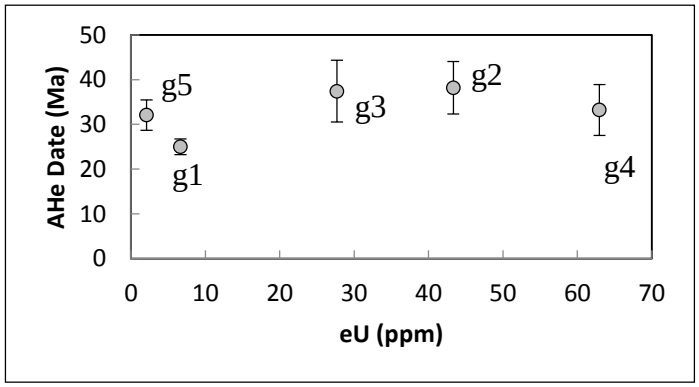
g1 input age: 25.0 ± 5.0 Ma
model age: 31.7 Ma
GOF: 0.18

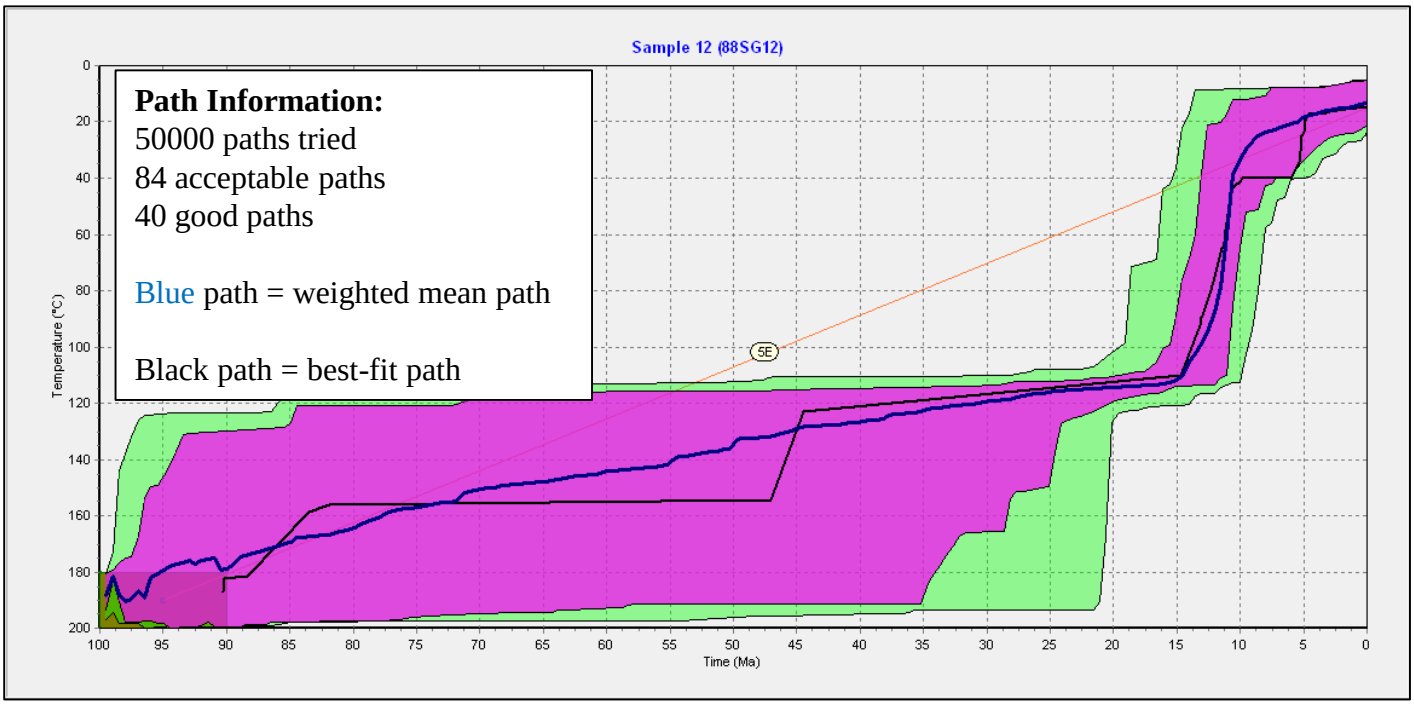
g2 input age: 38.2 ± 7.6 Ma
model age: 33.0 Ma
GOF: 0.49

g3 input age: 37.4 ± 7.5 Ma
model age: 32.3 Ma
GOF: 0.49

g4 input age: 33.2 ± 6.6 Ma
model age: 33.4 Ma
GOF: 0.98

g5 input age: 32.1 ± 6.4 Ma
model age: 31.0 Ma
GOF: 0.86





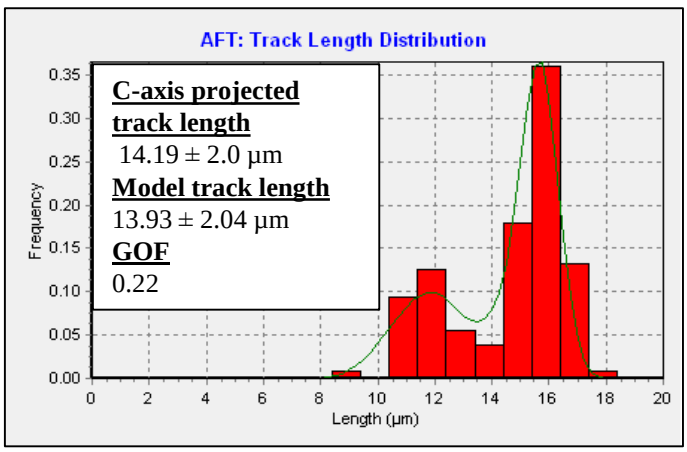
Sample 12 (88SG12)

Sample Location: 37°29.67' N, 105°20.51' W
Elevation: 2530 m
Rock Type: Gneiss
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and five single grain AHe dates. Initial track lengths based on a chlorine range of 0.05 – 0.1 wt % (Kelley et al., 1992) yielded no paths. No paths were produced until the chlorine value was increased to 1.2 wt. %. Therefore the final thermal history model was produced using an assumed chlorine value of 1.2 wt. %.

AFT Input Data

Measured AFT age:
31.4 ± 4.1 Ma (Kelley et al., 1992)
Measured track length:
13.9 ± 0.5 µm
N = 100 (Kelley et al., 1992)



AHe Modeling Results

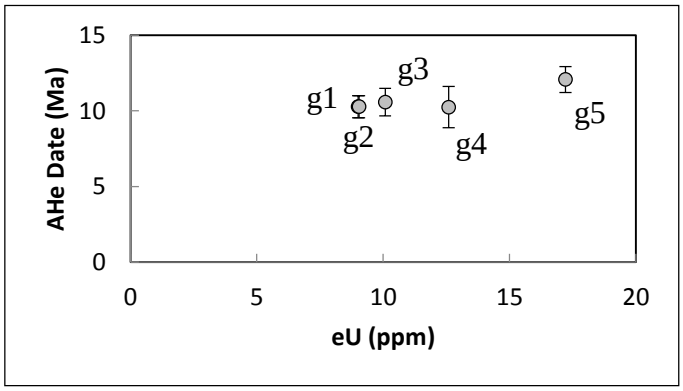
g1 input age: 10.3 ± 2.1 Ma
model age: 10.5 Ma
GOF: 0.93

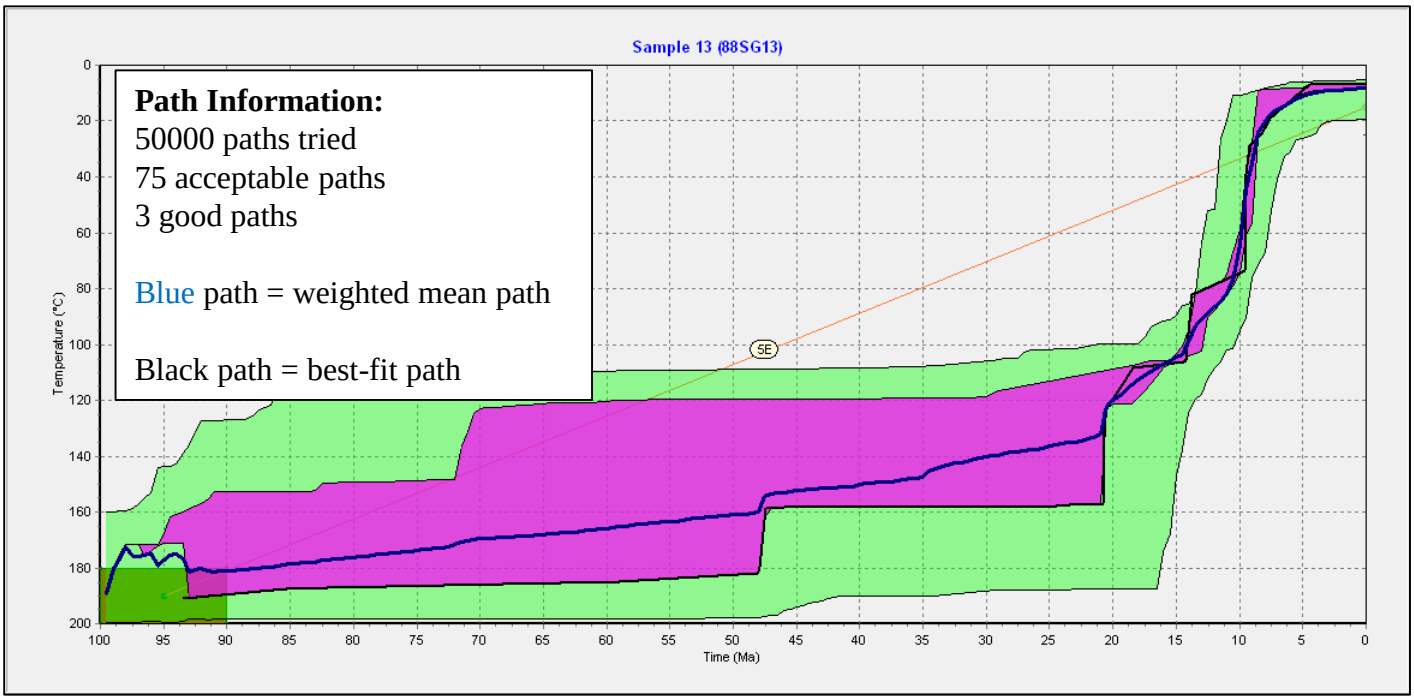
g2 input age: 10.3 ± 2.1 Ma
model age: 10.5 Ma
GOF: 0.92

g3 input age: 10.6 ± 2.1 Ma
model age: 10.3 Ma
GOF: 0.87

g4 input age: 10.2 ± 2.0 Ma
model age: 10.0 Ma
GOF: 0.94

g5 input age: 12.1 ± 2.4 Ma
model age: 10.5 Ma
GOF: 0.50





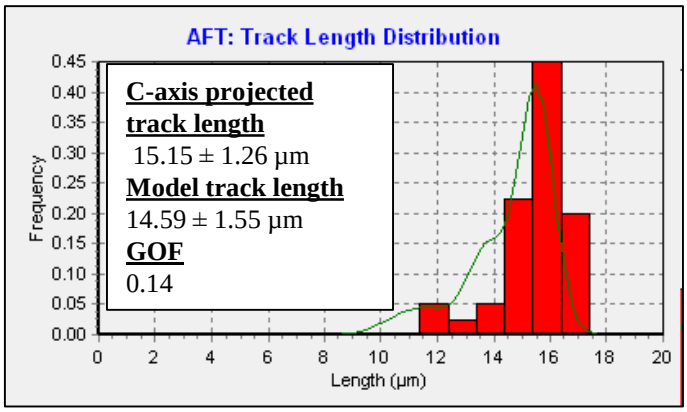
Sample 13 (88SG13)

Sample Location: 37°34.64' N, 105°29.11' W
Elevation: 4373 m
Rock Type: Gabbro
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and five single grain AHe dates. Initial track lengths were estimated using a chlorine value of 0.3 wt. %, which is in the 0.23 – 0.51 wt. % range reported by Kelley et al. (1992).

AFT Input Data

Measured AFT age:
18.0 ± 2.0 Ma (Kelley et al., 1992)
Measured track length:
14.5 ± 0.6 µm
N = 40 (Kelley et al., 1992)



AHe Modeling Results

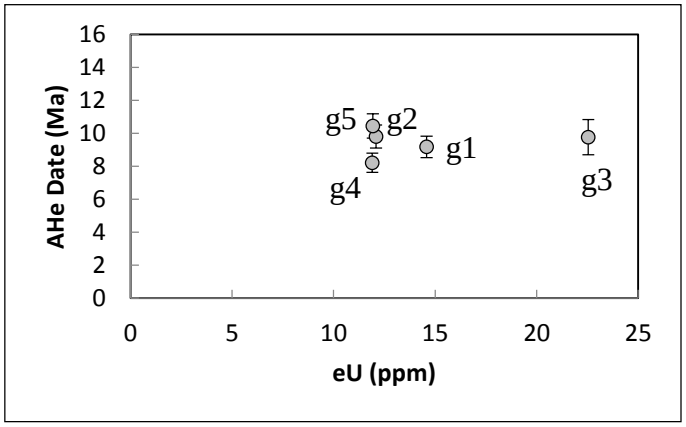
g1 input age: 9.2 ± 1.9 Ma
model age: 9.7 Ma
GOF: 0.82

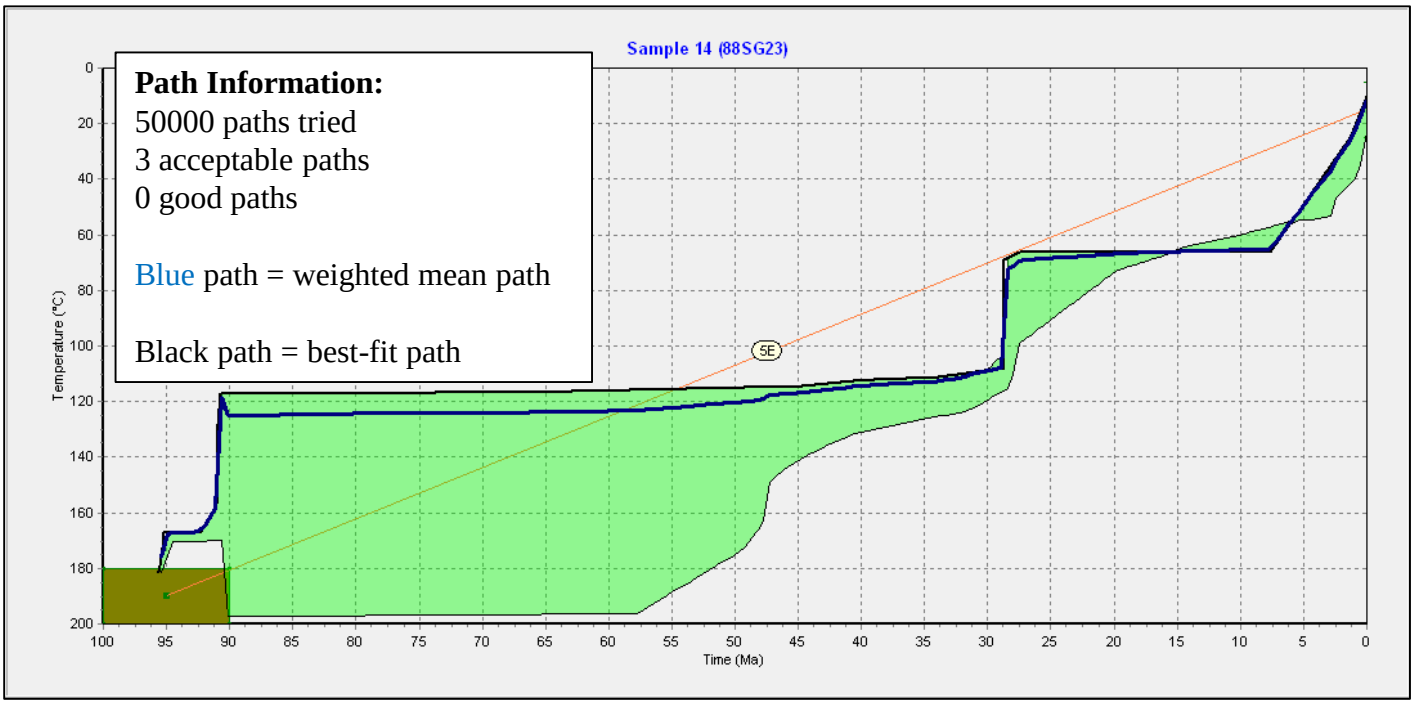
g2 input age: 9.8 ± 2.0 Ma
model age: 9.7 Ma
GOF: 0.96

g3 input age: 9.8 ± 2.0 Ma
model age: 9.6 Ma
GOF: 0.91

g4 input age: 10.5 ± 2.1 Ma
model age: 9.9 Ma
GOF: 0.75

g5 input age: 8.2 ± 1.7 Ma
model age: 9.7 Ma
GOF: 0.36





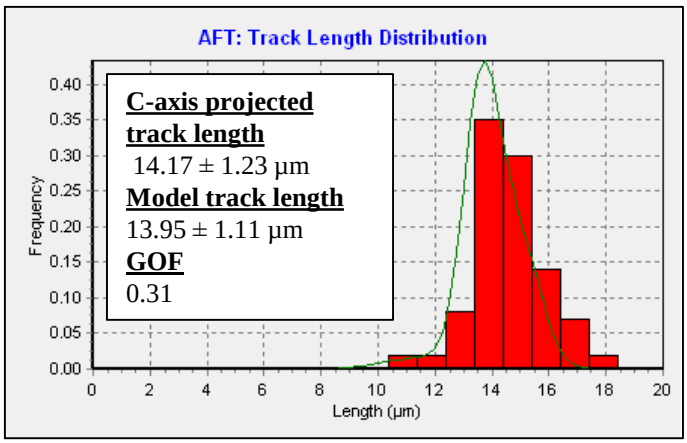
Sample 14 (88SG23)

Sample Location: 37°14.24' N, 105°18.64' W
Elevation: 2878 m
Rock Type: Granitic gneiss
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and three single grain AHe dates. Initial track lengths were estimated using a chlorine value of 0.15 wt. %, based on reported values that range from 0.00 – 0.31 wt. % reported by Kelley et al. (1992). No paths were produced when grains g1 and g4 were included, even if they were binned. Therefore, they were excluded from modeling.

AFT Input Data

Measured AFT age:
32.5 ± 3.9 Ma (Kelley et al., 1992)
Measured track length:
13.3 ± 0.3 µm
N = 100 (Kelley et al., 1992)

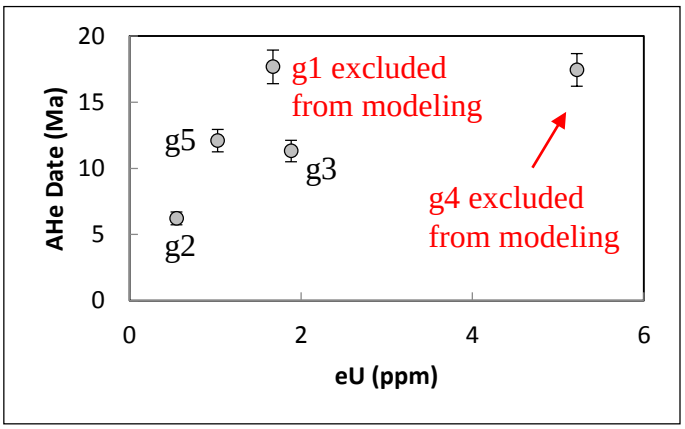


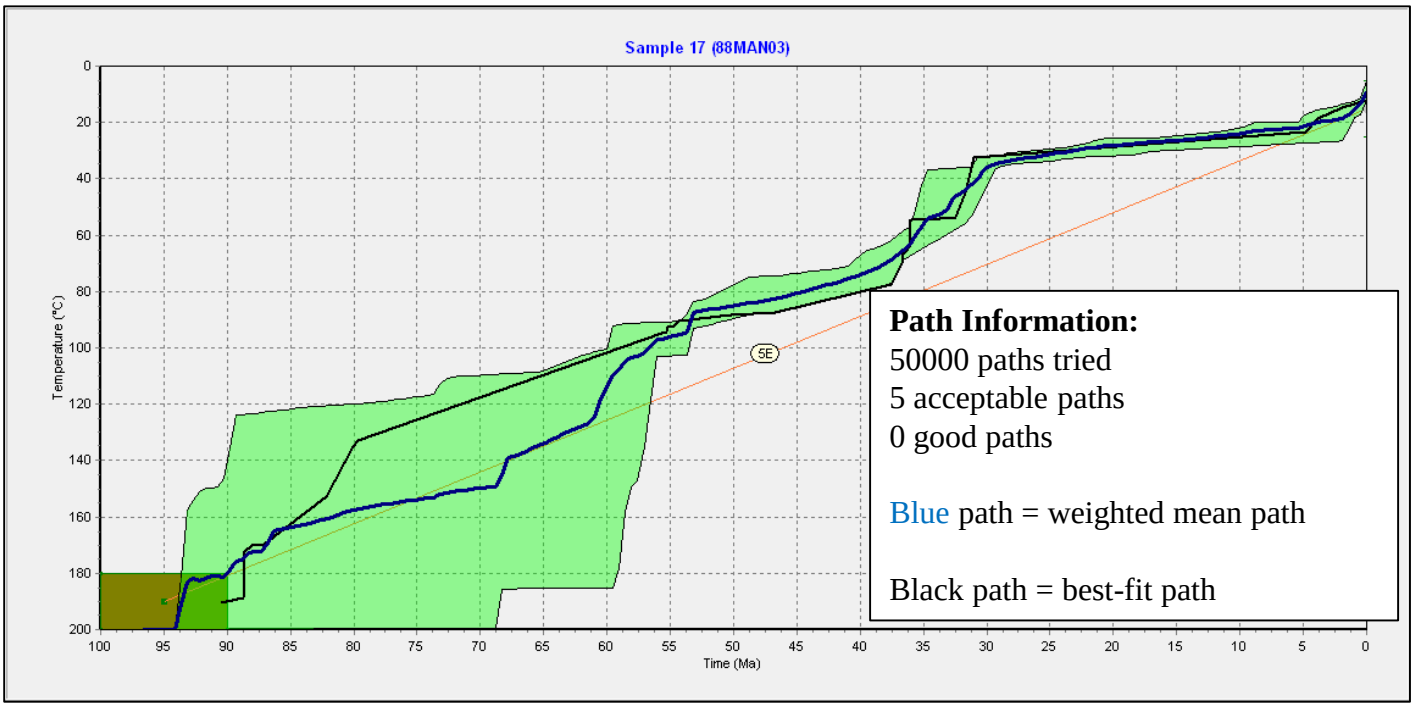
AHe Modeling Results

g2 input age: 6.2 ± 1.3 Ma
model age: 8.5 Ma
GOF: 0.08

g5 input age: 12.1 ± 2.4 Ma
model age: 8.8 Ma
GOF: 0.17

g3 input age: 11.3 ± 1.9 Ma
model age: 7.7 Ma
GOF: 0.06





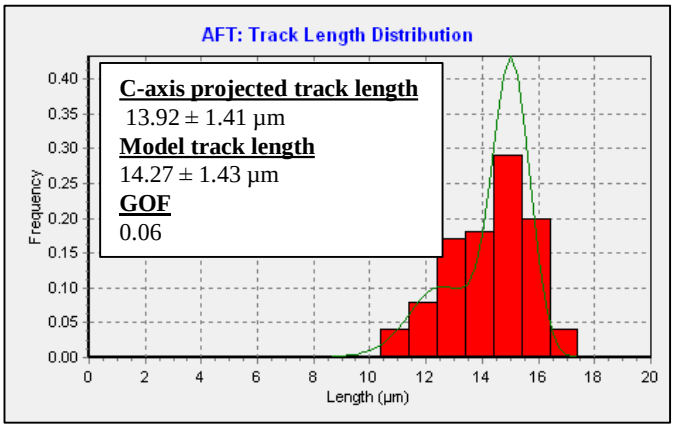
Sample 17 (88MAN03)

Sample Location: 34°47.66' N, 106°23.84' W
Elevation: 2524 m
Rock Type: Granite
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and four single grain AHe dates. One AHe date (g4) was excluded because of its anomalously old AHe age. Initial track lengths were estimated using a chlorine value of 0.1 wt %, based on a range of 0.08 – 0.15 wt % reported for this sample (Kelley et al., 1992).

AFT Input Data

Measured AFT age:
38.8 ± 4.3 Ma (Kelley et al., 1992)
Measured track length:
12.9 ± 0.4 µm
N = 100 (Kelley et al., 1992)



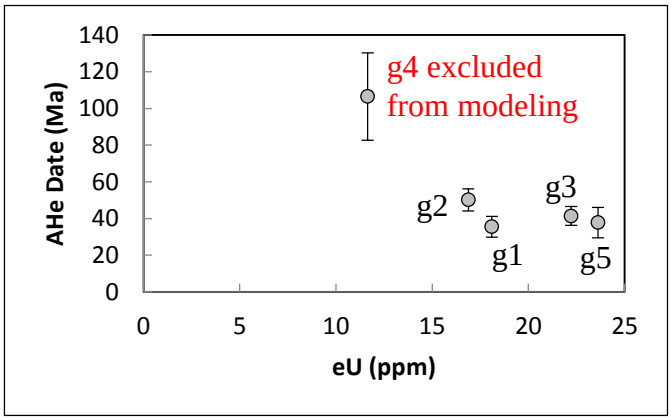
AHe Modeling Results

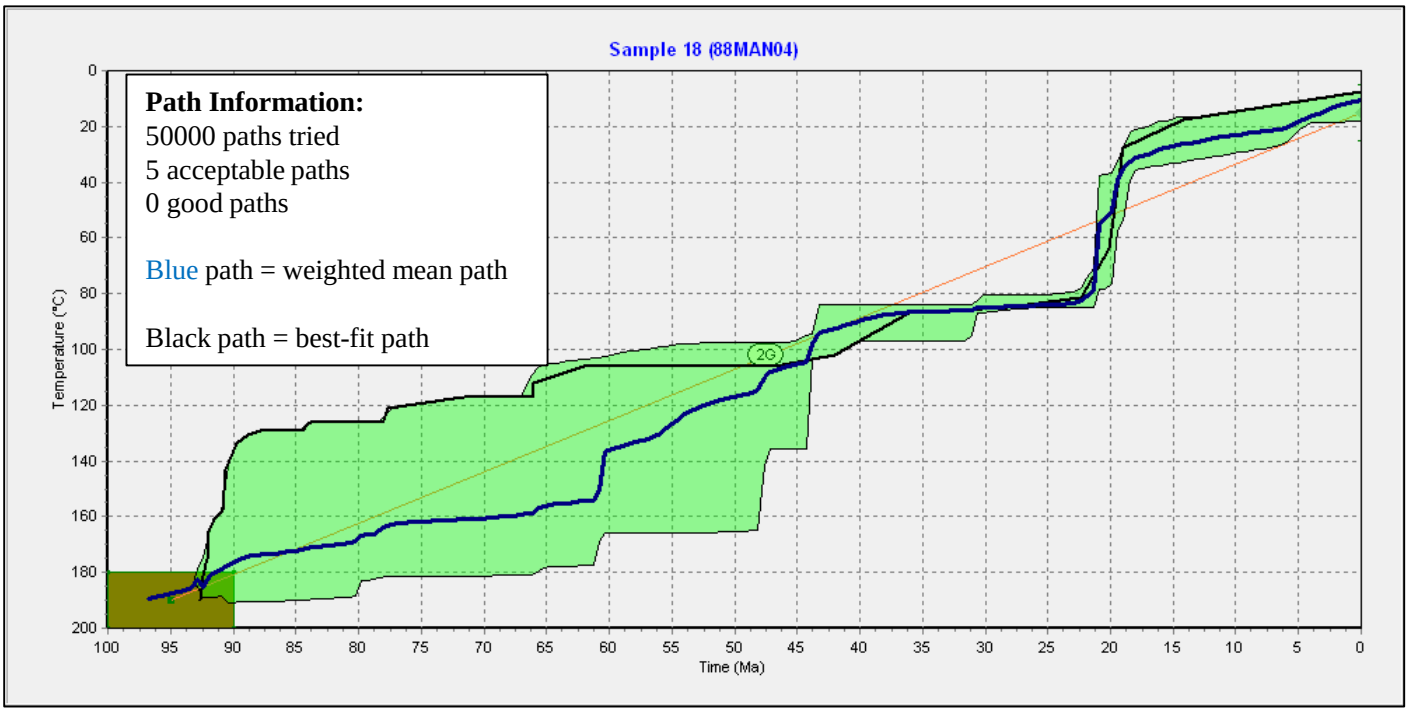
g1 input age: 35.6 ± 7.2 Ma
model age: 30.8 Ma
GOF: 0.50

g2 input age: 50.2 ± 10.1 Ma
model age: 31.4 Ma
GOF: 0.06

g3 input age: 41.4 ± 8.3 Ma
model age: 31.9 Ma
GOF: 0.25

g5 input age: 37.8 ± 7.6 Ma
model age: 31.1 Ma
GOF: 0.38





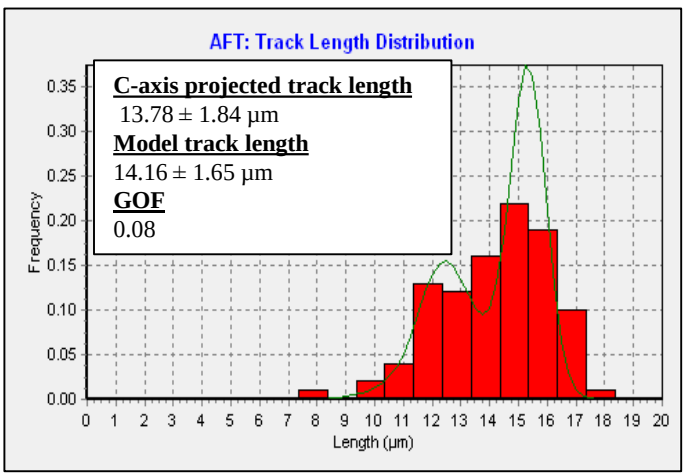
Sample 18 (88MAN04)

Sample Location: 34°47.63' N, 106°23.62' W
Elevation: 2457 m
Rock Type: Granite
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five AHe dates. Initial track lengths were estimated using a chlorine value of 0.1 wt %, based on a range of 0.09 – 0.14 wt % reported for this sample (Kelley et al., 1992).

AFT Input Data

Measured AFT age:
28.5 ± 2.9 Ma (Kelley et al., 1992)
Measured track length:
12.8 ± 0.5 µm
N = 100 (Kelley et al., 1992)



AHe Modeling Results

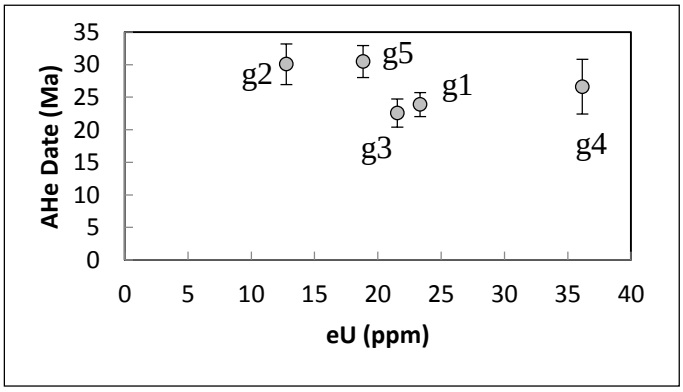
g1 input age: 23.9 ± 4.8 Ma
model age: 20.3 Ma
GOF: 0.45

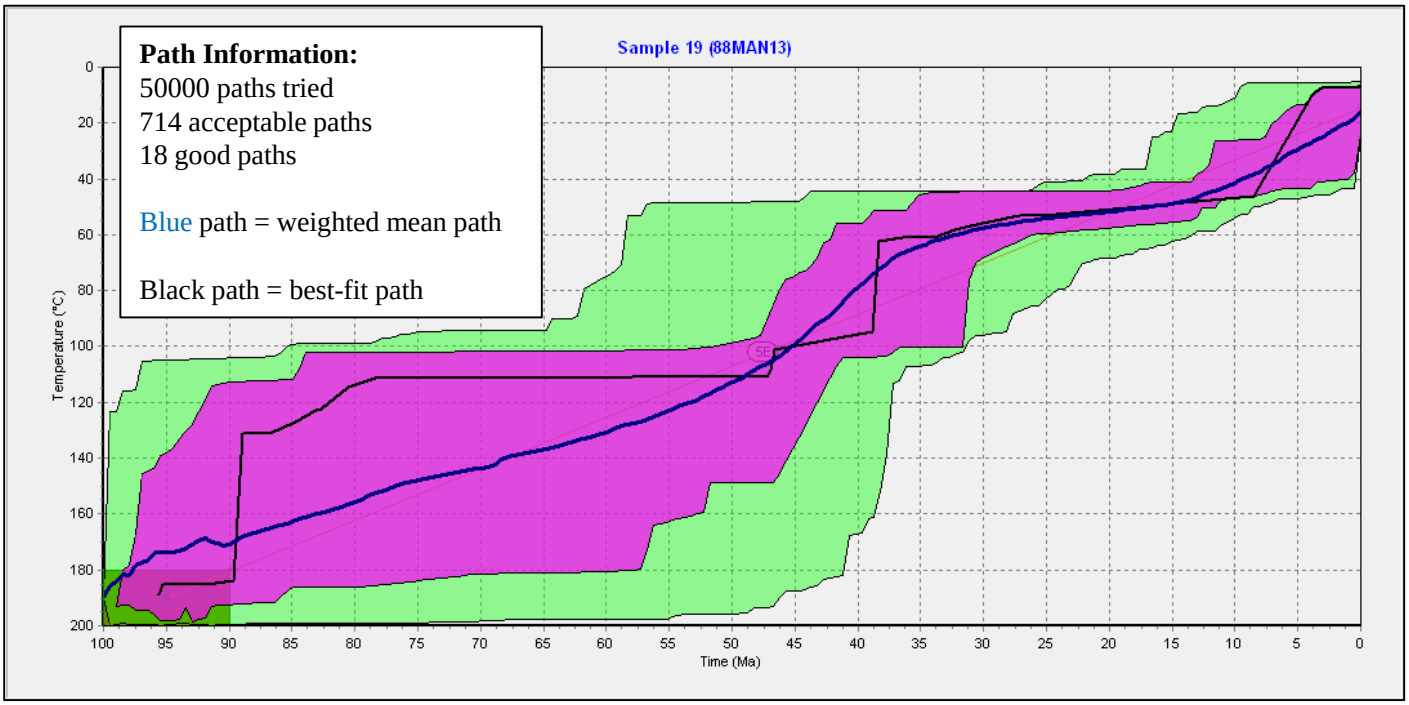
g2 input age: 30.1 ± 6.0 Ma
model age: 19.7 Ma
GOF: 0.08

g3 input age: 22.6 ± 4.5 Ma
model age: 20.1 Ma
GOF: 0.57

g4 input age: 26.6 ± 5.3 Ma
model age: 20.0 Ma
GOF: 0.21

g5 input age: 30.5 ± 6.1 Ma
model age: 20.0 Ma
GOF: 0.09





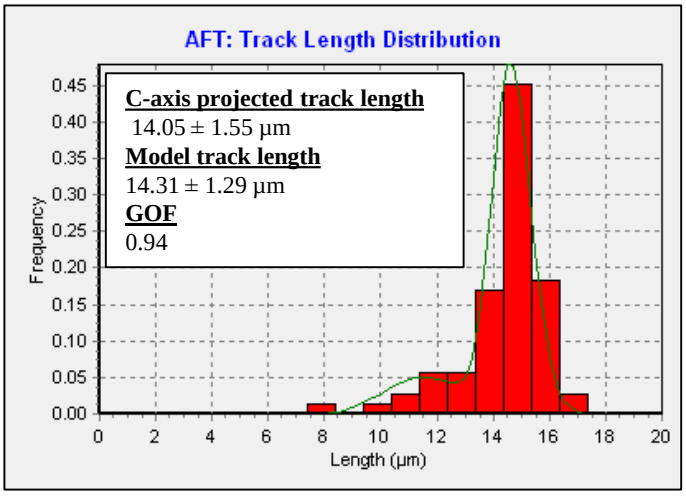
Sample 19 (88MAN13)

Sample Location: 34°40.95' N, 106°27.73' W
Elevation: 1951 m
Rock Type: Metasediment
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and three AHe single grain ages. Reported chlorine values for this sample range from 0.20 – 0.86 wt. % (Kelley et al., 1992). Initial track lengths were calculated using a chlorine value of 0.5 wt. %. Models were run which included AHe grains g1 and g4 separately, as well as binned. Neither attempt produced any paths. Therefore, they were excluded from the final thermal history model.

AFT Input Data

Measured AFT age:
47.7 ± 5.5 Ma (Kelley et al., 1992)
Measured track length:
13.2 ± 0.5 µm
N = 71 (Kelley et al., 1992)

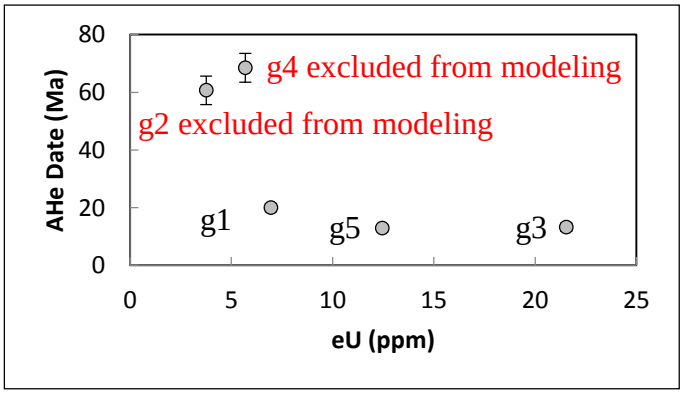


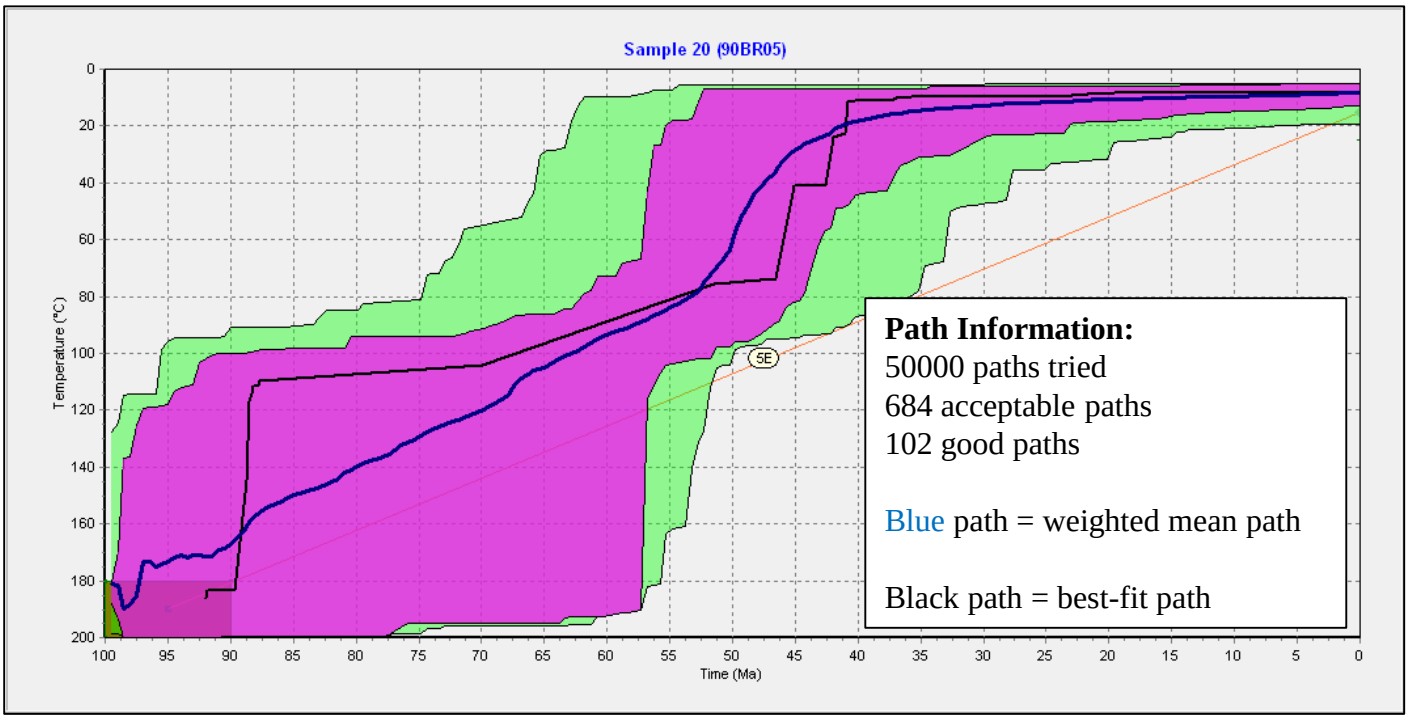
AHe Modeling Results

g1 input age: 20.0 ± 4.0 Ma
model age: 15.1 Ma
GOF: 0.22

g5 input age: 12.9 ± 2.6 Ma
model age: 14.8 Ma
GOF: 0.46

g3 input age: 13.2 ± 6.6 Ma
model age: 16.4 Ma
GOF: 0.63





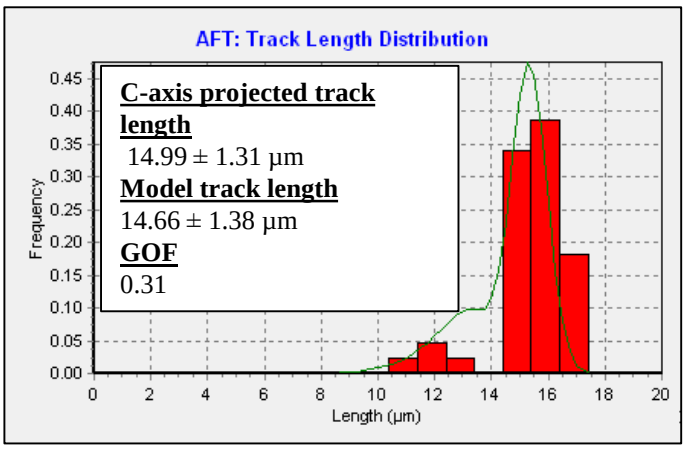
Sample 20 (90BR05)

Sample Location: 32°51.08' N, 107°31.89' W
Elevation: 1594 m
Rock Type: Dacite
Age: 74-75 Ma (McLemore et al., 2000)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and four single grain AHe dates. One AHe date (g4) was excluded because of its anomalously old AHe age. Initial track lengths were estimated using an assumed chlorine value of 0.2 wt %.

AFT Input Data

Measured AFT age:
63.7 ± 4.5 Ma (Kelley and Chapin, 1997)
Measured track length:
14.3 ± 0.5 µm
N = 52 (Kelley and Chapin, 1997)



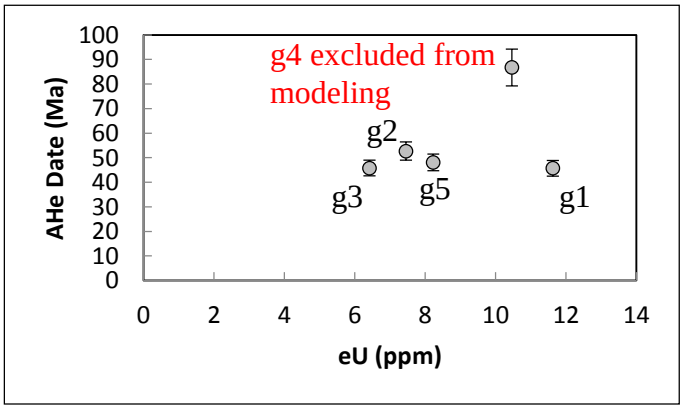
AHe Modeling Results

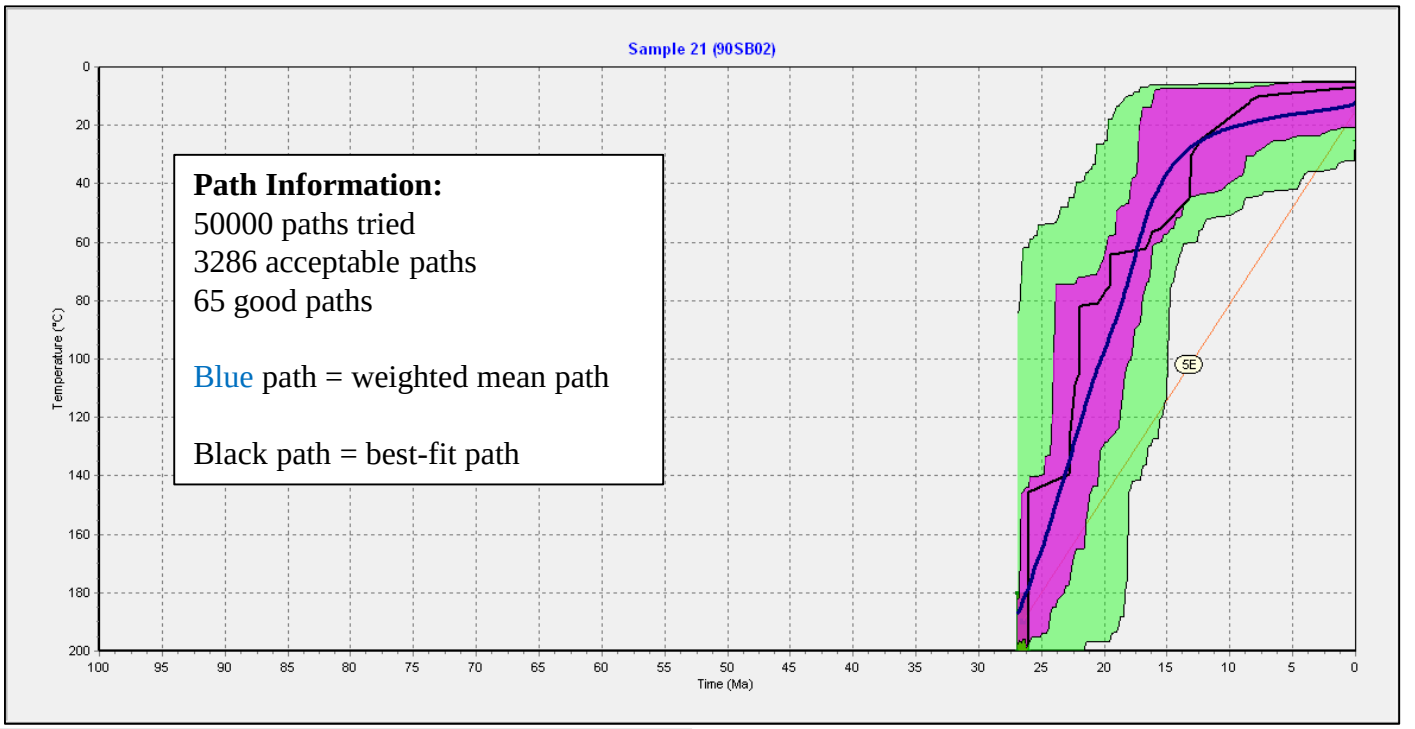
g1 input age: 45.7 ± 9.1 Ma
model age: 45.5 Ma
GOF: 0.98

g3 input age: 45.8 ± 9.2 Ma
model age: 45.0 Ma
GOF: 0.93

g2 input age: 52.7 ± 10.6 Ma
model age: 45.3 Ma
GOF: 0.49

g5 input age: 48.1 ± 9.6 Ma
model age: 45.0 Ma
GOF: 0.75





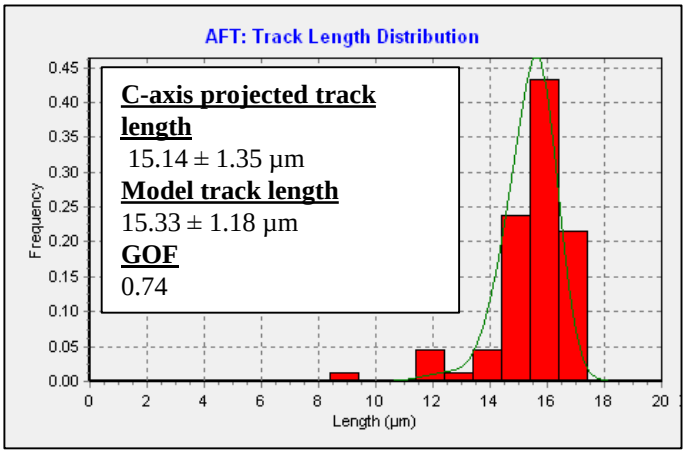
Sample 21 (90SB02)

Sample Location: 33°27.53' N, 105°37.30' W
Elevation: 2265 m
Rock Type: Syenite
Age: 27 Ma (Goff et al., 2011)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five single grain AHe dates. No chorine data exists for this sample, and no paths were obtained using assumed chlorine concentrations of less than 2.0 wt %. Therefore, the thermal history model was produced by assuming a chlorine value of 2.0 wt. %.

AFT Input Data

Measured AFT age:
23.8 ± 2.6 Ma (Kelley and Chapin, 1997)
Measured track length:
14.4 ± 0.4 µm
N = 88 (Kelley and Chapin, 1997)



AHe Modeling Results

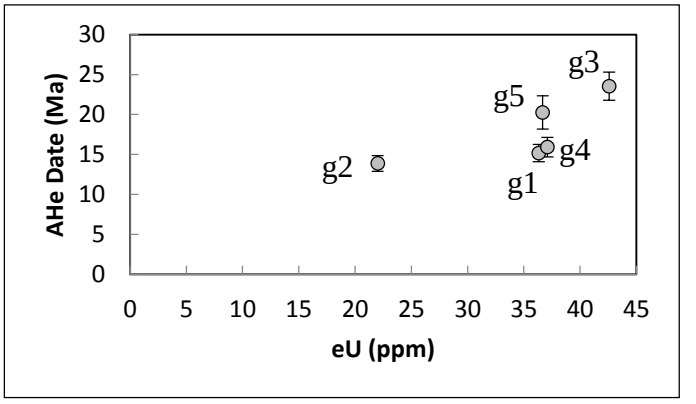
g1 input age: 15.2 ± 3.0 Ma
model age: 16.4 Ma
GOF: 0.71

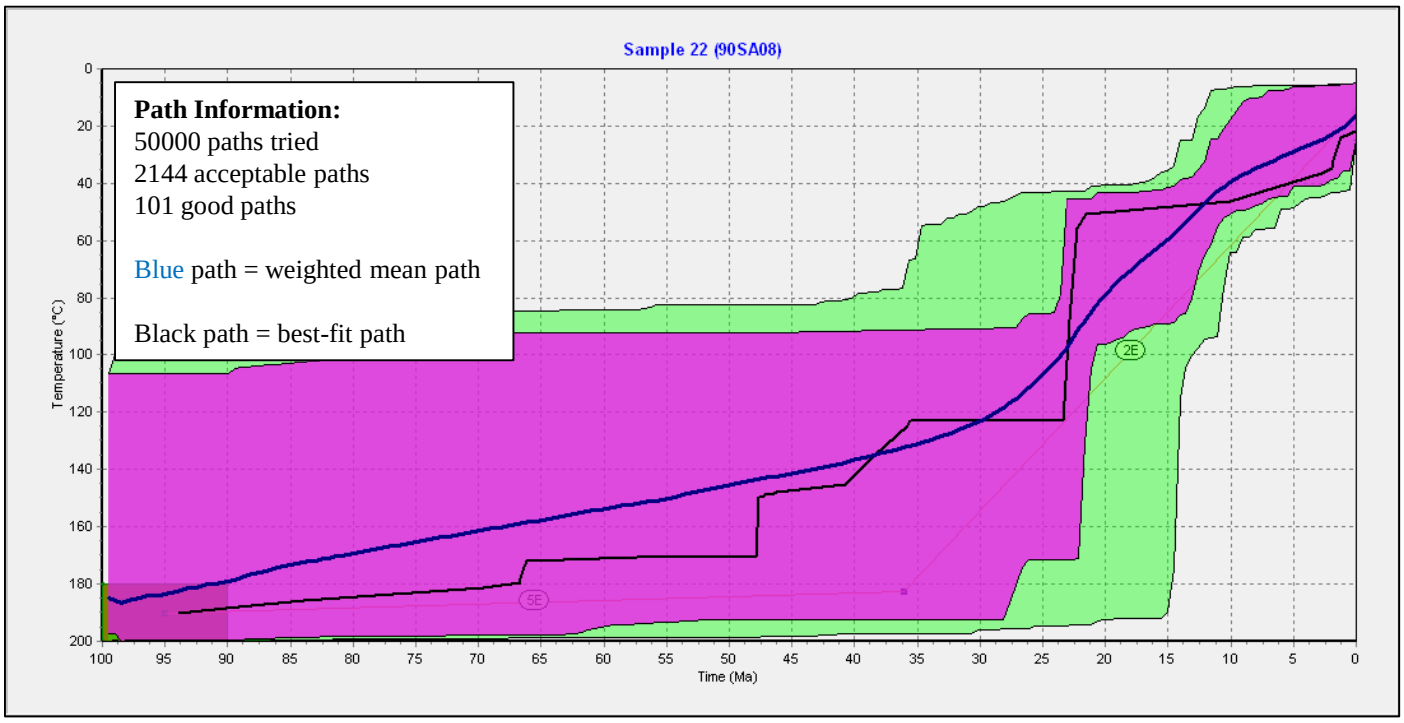
g2 input age: 13.9 ± 2.8 Ma
model age: 16.6 Ma
GOF: 0.35

g3 input age: 23.5 ± 4.7 Ma
model age: 16.4 Ma
GOF: 0.13

g4 input age: 15.9 ± 3.2 Ma
model age: 16.8 Ma
GOF: 0.79

g5 input age: 20.3 ± 4.1 Ma
model age: 15.7 Ma
GOF: 0.25





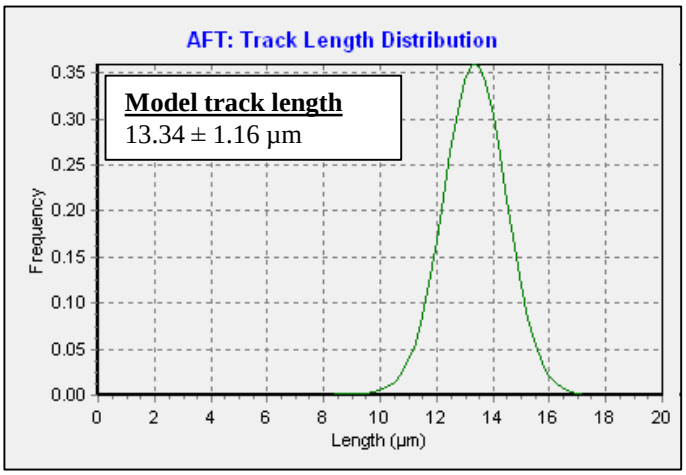
Sample 22 (90SA08)

Sample Location: 32°51.02' N, 106°34.40' W
Elevation: 1456 m
Rock Type: Granite
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age and all five single grain AHe dates. No track length data is available for this sample.

AFT Input Data

Measured AFT age:
21.8 ± 4.5 Ma (Kelley and Chapin, 1997)



AHe Modeling Results

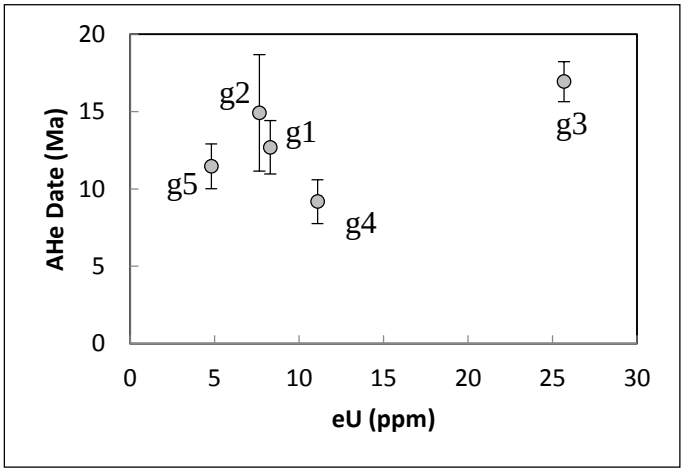
g1 input age: 12.7 ± 2.5 Ma
model age: 10.8 Ma
GOF: 0.44

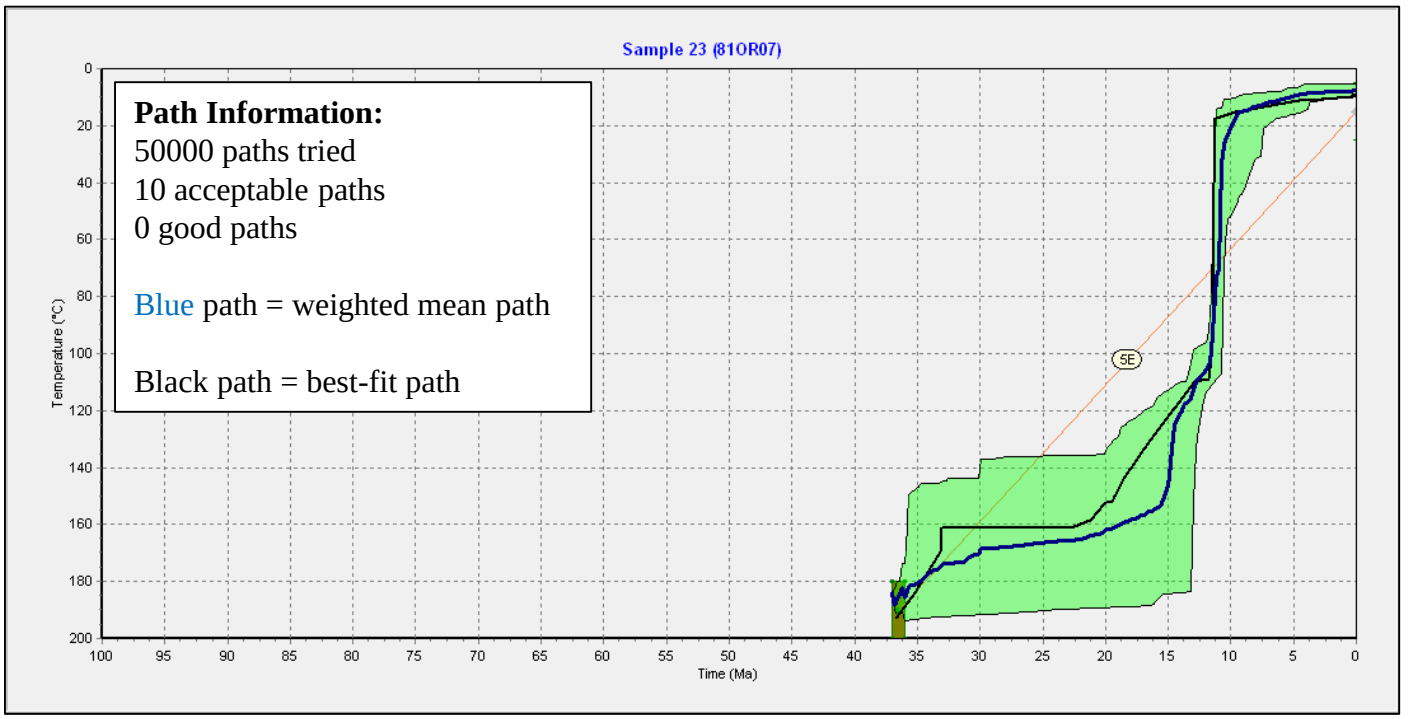
g2 input age: 14.9 ± 3.8 Ma
model age: 9.4 Ma
GOF: 0.15

g3 input age: 16.9 ± 3.4 Ma
model age: 13.3 Ma
GOF: 0.28

g4 input age: 9.3 ± 1.8 Ma
model age: 10.5 Ma
GOF: 0.48

g5 input age: 11.5 ± 2.3 Ma
model age: 11.5 Ma
GOF: 0.99





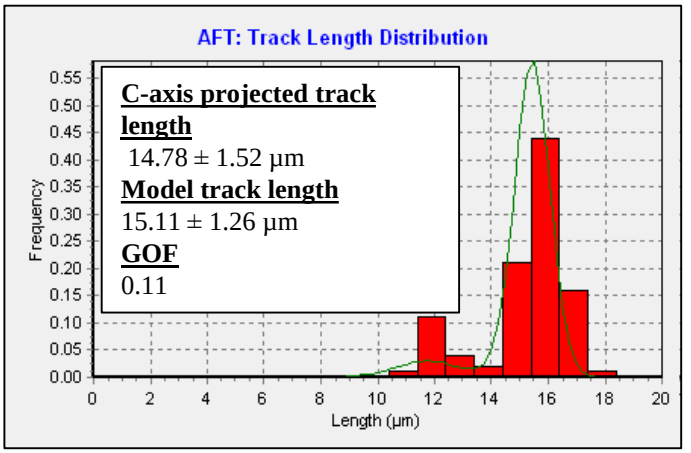
Sample 23 (81OR07)

Sample Location: 32°21.83' N, 106°33.46' W
Elevation: 1890 m
Rock Type: Quartz monzonite
Age: 36-37 Ma (Zimmerer and McIntosh, 2013)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five single grain AHe dates. No chorine data exists for this sample, so initial track lengths were estimated using an assumed chlorine value of 0.2 wt. %.

AFT Input Data

Measured AFT age:
10.3 ± 1.4 Ma (Kelley and Chapin, 1997)
Measured track length:
13.9 ± 0.5 µm
N = 100 (Kelley and Chapin, 1997)



AHe Modeling Results

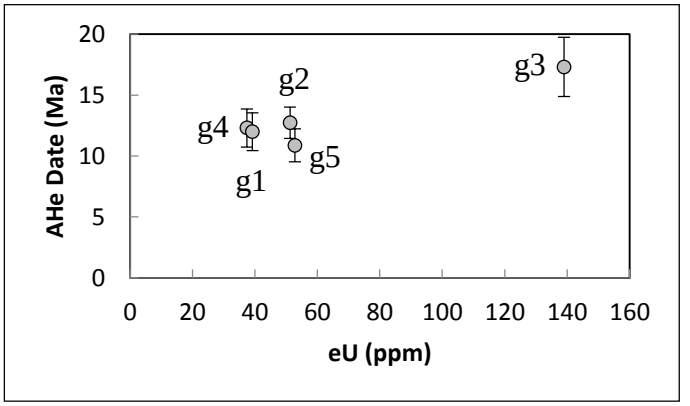
g1 input age: 12.3 ± 2.5 Ma
model age: 11.2 Ma
GOF: 0.67

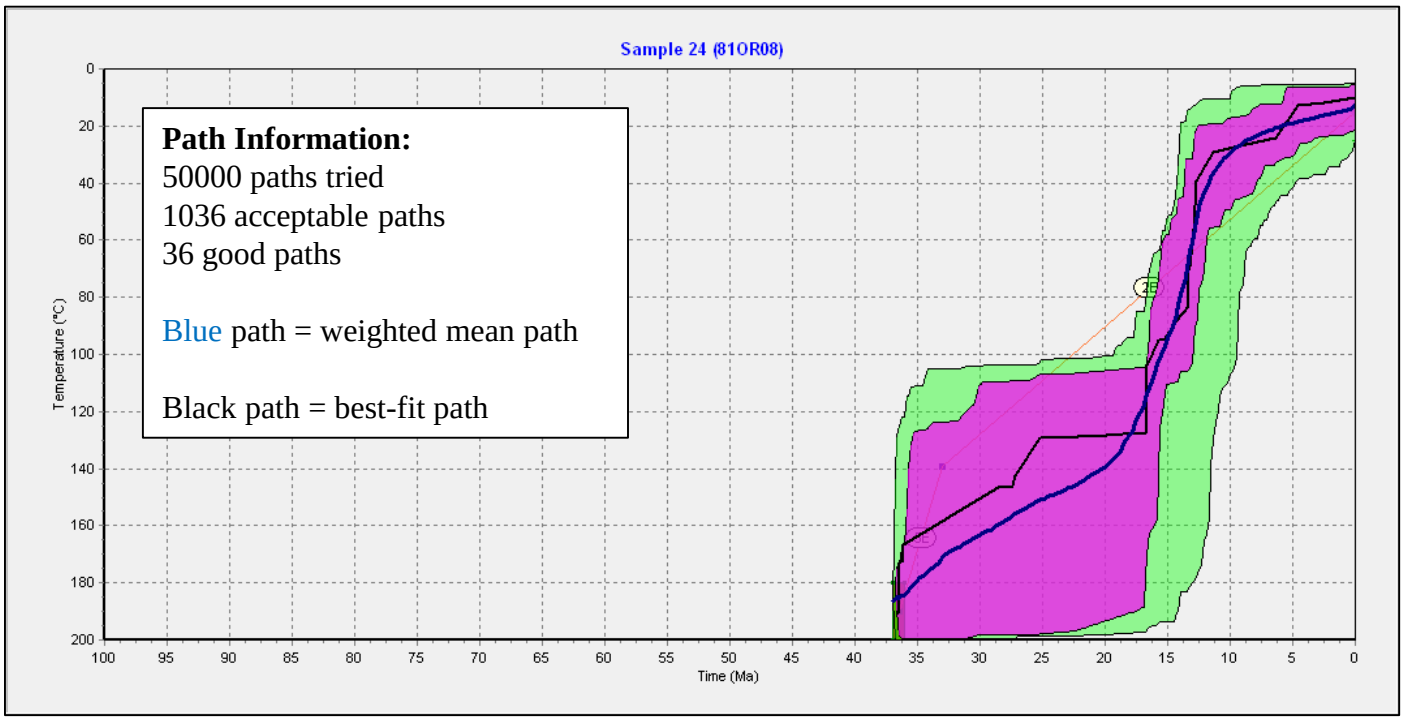
g2 input age: 12.7 ± 2.5 Ma
model age: 11.2 Ma
GOF: 0.55

g3 input age: 17.3 ± 3.5 Ma
model age: 11.3 Ma
GOF: 0.09

g4 input age: 12.0 ± 2.4 Ma
model age: 11.2 Ma
GOF: 0.74

g5 input age: 10.9 ± 2.2 Ma
model age: 11.2 Ma
GOF: 0.88





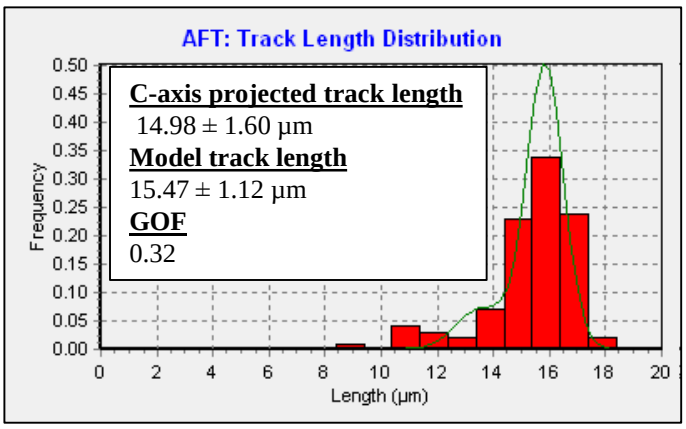
Sample 24 (81OR08)

Sample Location: 32°25.50' N, 106°34.00' W
Elevation: 1744
Rock Type: Quartz monzonite
Age: 36-37 Ma (Zimmerer and McIntosh, 2013)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five single grain AHe dates. Initial track lengths were estimated using an assumed chlorine value of 0.2 wt %.

AFT Input Data

Measured AFT age:
13.7 ± 1.4 Ma (Kelley and Chapin, 1997)
Measured track length:
14.3 ± 0.5 µm
N = 100 (Kelley and Chapin, 1997)



AHe Modeling Results

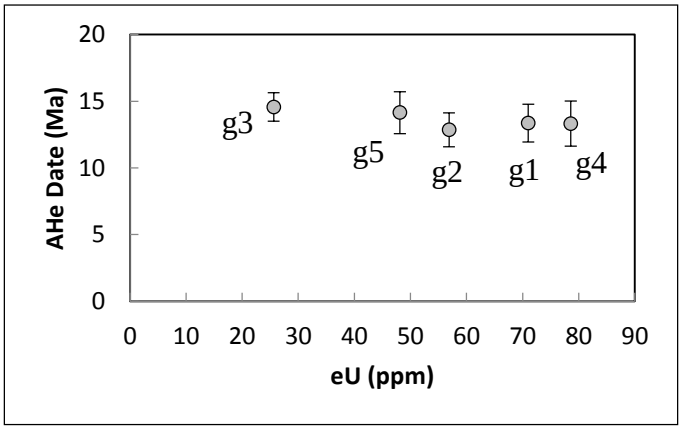
g1 input age: 13.4 ± 2.7 Ma
model age: 12.9 Ma
GOF: 0.85

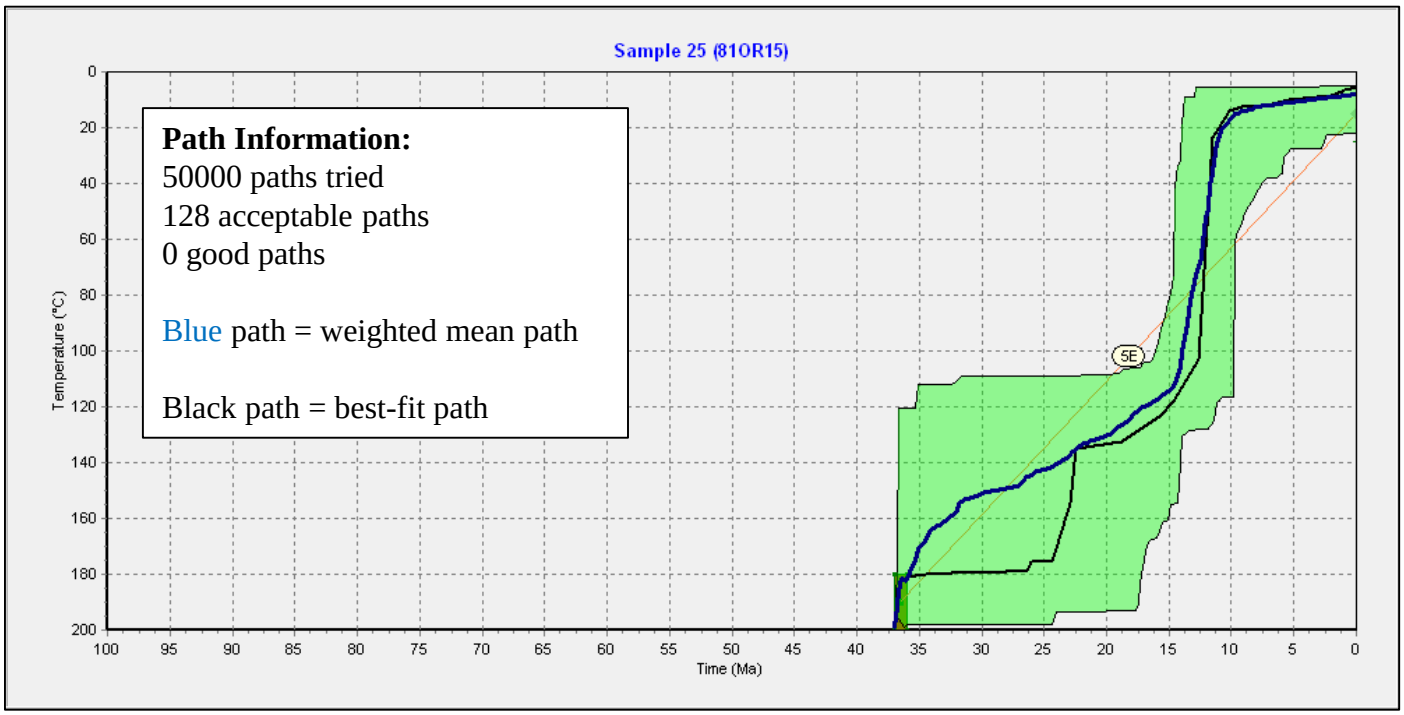
g2 input age: 12.9 ± 2.6 Ma
model age: 12.9 Ma
GOF: 0.99

g3 input age: 14.6 ± 2.9 Ma
model age: 12.9 Ma
GOF: 0.54

g4 input age: 13.3 ± 2.7 Ma
model age: 12.8 Ma
GOF: 0.87

g5 input age: 14.1 ± 2.8 Ma
model age: 12.7
GOF: 0.62





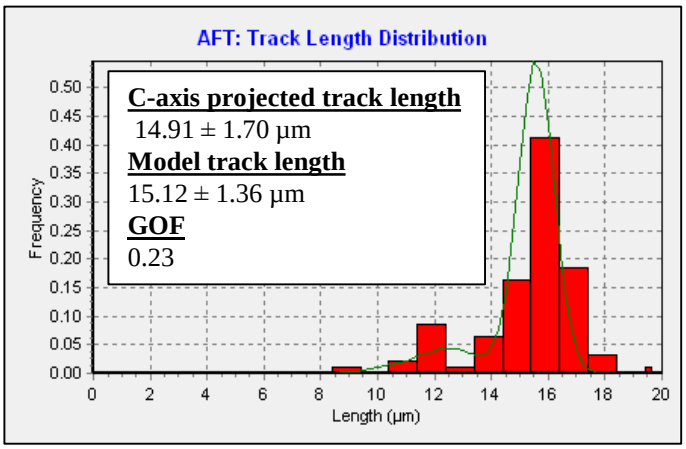
Sample 25 (81OR15)

Sample Location: 32°22.92' N, 106°34.79' W
Elevation: 1951 m
Rock Type: Quartz monzonite
Age: 36-37 Ma (Zimmerer and McIntosh, 2013)

HeFTy Model Description:
Thermal history model incorporates AFT age, track length data, and all five single grain AHe dates. No chlorine data exists for this sample, but no paths were produced until the chlorine content was increased to 0.7 wt. %. This value was used for the final thermal history model.

AFT Input Data

Measured AFT age:
13.8 ± 1.6 Ma (Kelley and Chapin, 1997)
Measured track length:
14.2 ± 0.5 µm
N = 90 (Kelley and Chapin, 1997)



AHe Modeling Results

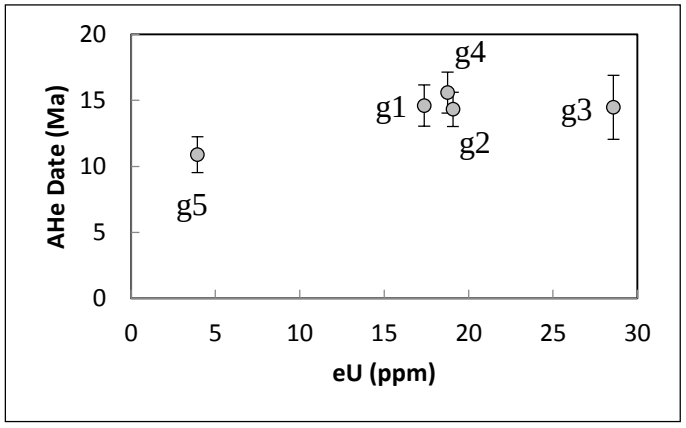
g1 input age: 14.6 ± 2.9 Ma
model age: 11.9 Ma
GOF: 0.35

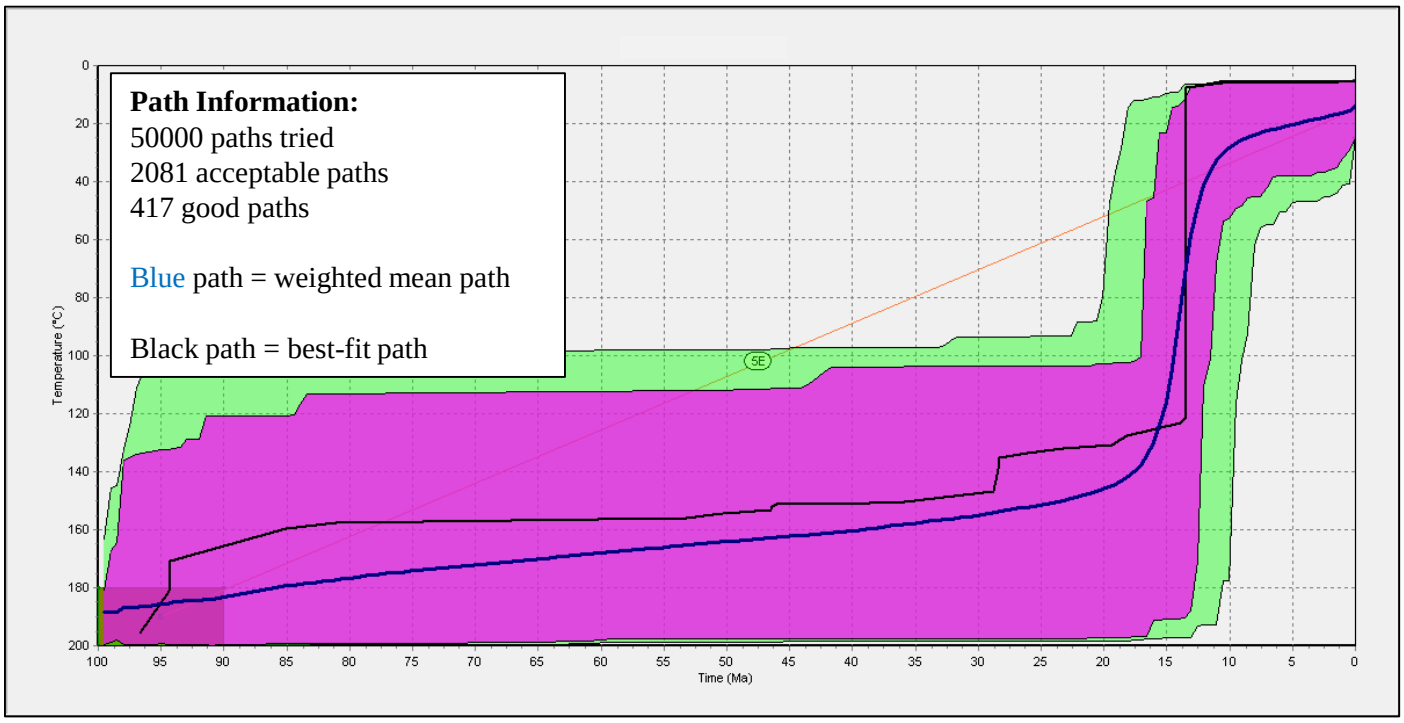
g2 input age: 14.3 ± 2.9 Ma
model age: 12.0 Ma
GOF: 0.43

g3 input age: 14.5 ± 2.9 Ma
model age: 11.9 Ma
GOF: 0.38

g4 input age: 15.6 ± 3.1 Ma
model age: 12.0 Ma
GOF: 0.25

g5 input age: 10.9 ± 2.2 Ma
model age: 12.1
GOF: 0.56





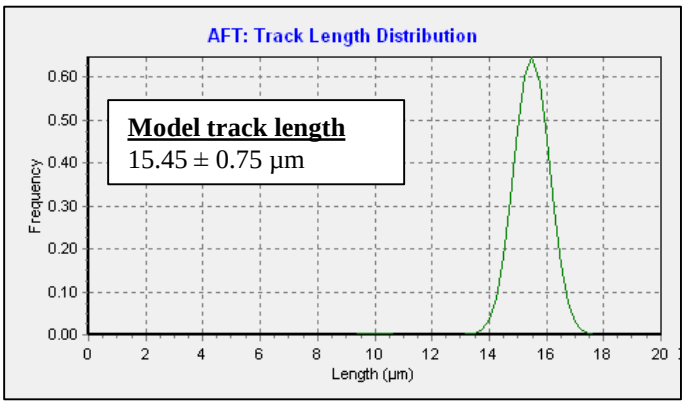
TM

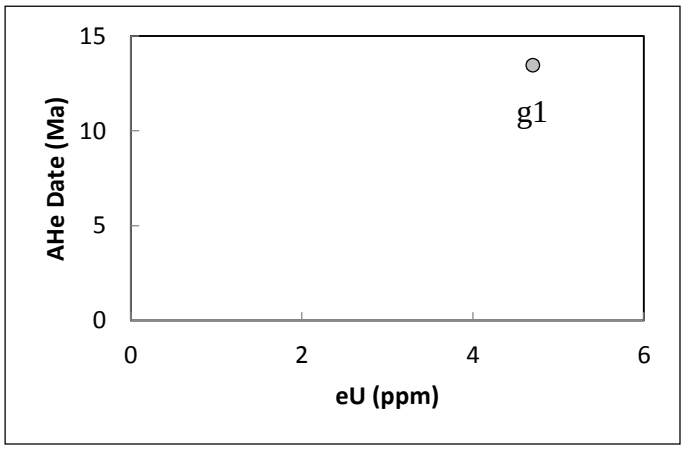
Sample Location: 34°25.65' N, 107°01.73' W
Elevation: 1829 m
Rock Type: Silicified granite
Age: Proterozoic

HeFTy Model Description:
Thermal history model incorporates AFT age and one single grain AHe date. No track length data is available for this sample. AHe date is from Ricketts et al. (2015), and AFT data is from Kelley et al. (1992).

AFT Input Data

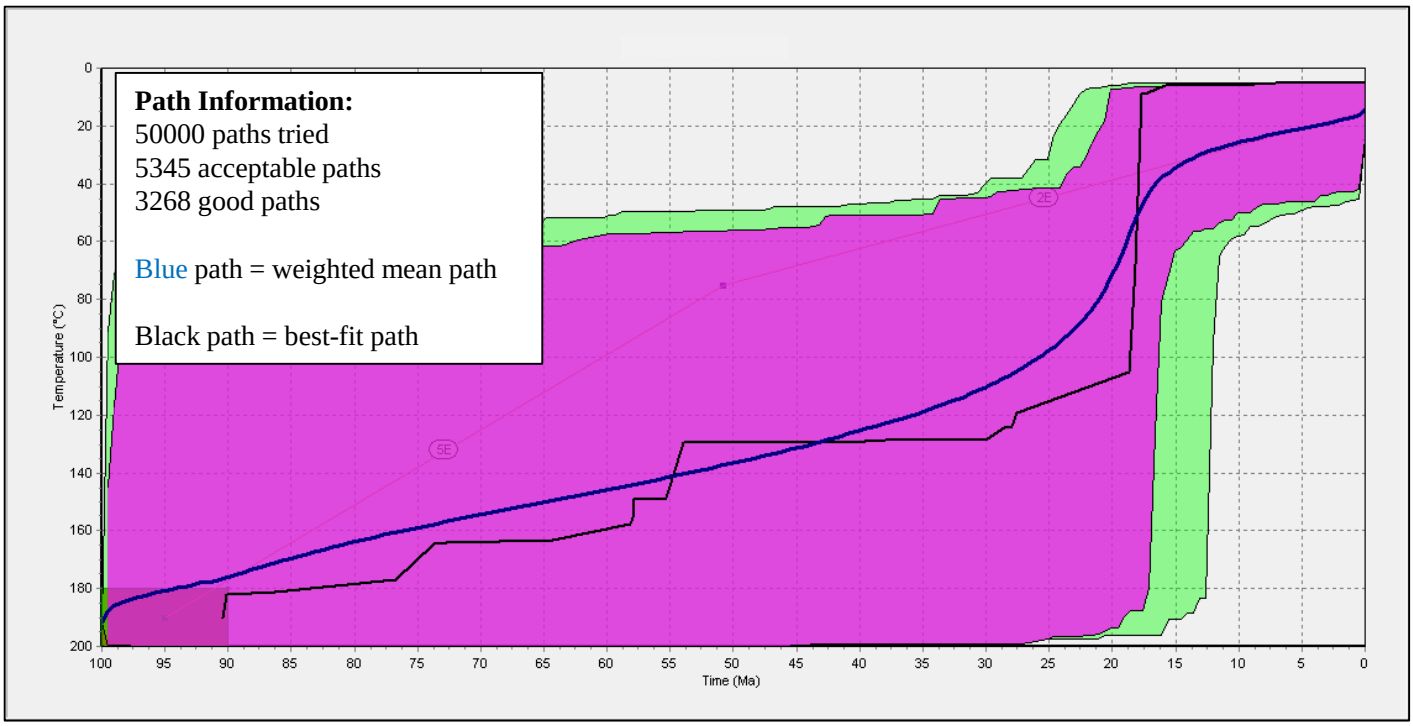
Measured AFT age:
14.1 ± 2.0 Ma (Kelley et al., 1992)





AHe Modeling Results

g1 input age: 12.4 ± 2.5 Ma (Ricketts et al., 2015)
model age: 13.2 Ma
GOF: 0.63



Sample 29 (JR-CAR1)

Sample Location: 34°46.15' N, 107°06.23' W
Elevation: 1752 m
Rock Type: Sandstone (Abo Fm)
Age: Permian

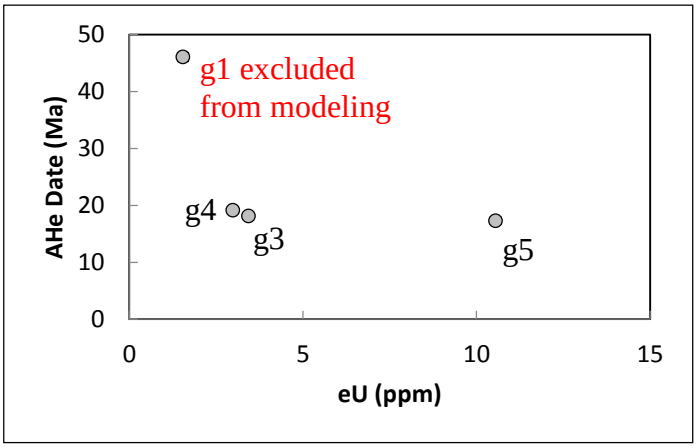
HeFTy Model Description:
Thermal history model incorporates three AHe ages. One AHe age (g1) was excluded from the model because of its anomalously old age.

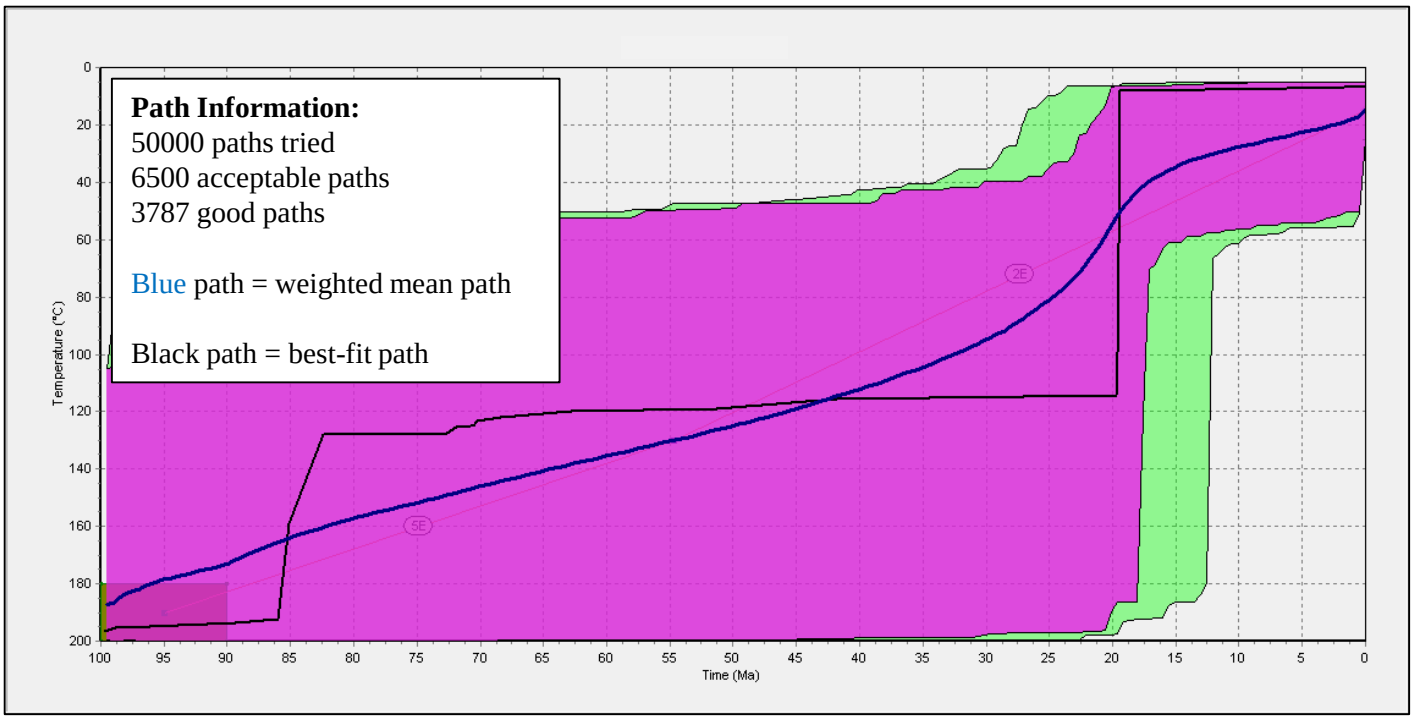
AHe Modeling Results

g3 input age: 18.1 ± 3.6 Ma
model age: 18.1 Ma
GOF: 0.99

g4 input age: 19.2 ± 3.8 Ma
model age: 18.1 Ma
GOF: 0.76

g5 input age: 17.3 ± 3.5 Ma
model age: 18.2 Ma
GOF: 0.79





Sample 30 (JR-BQ-10)

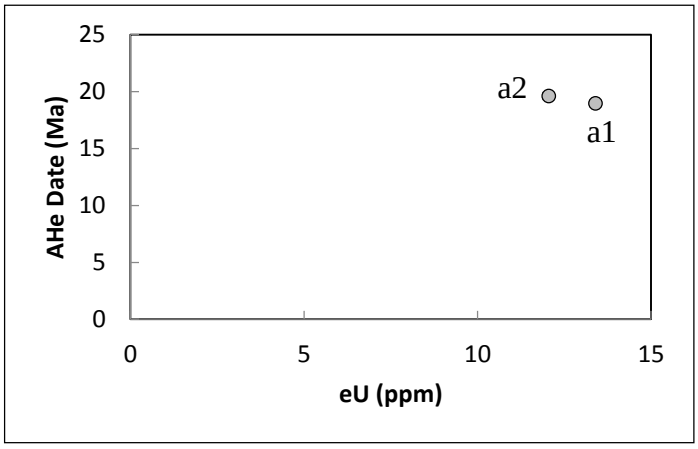
Sample Location: 34°39.18' N, 107°06.78' W
Elevation: 1754 m
Rock Type: Granite
Age: Precambrian

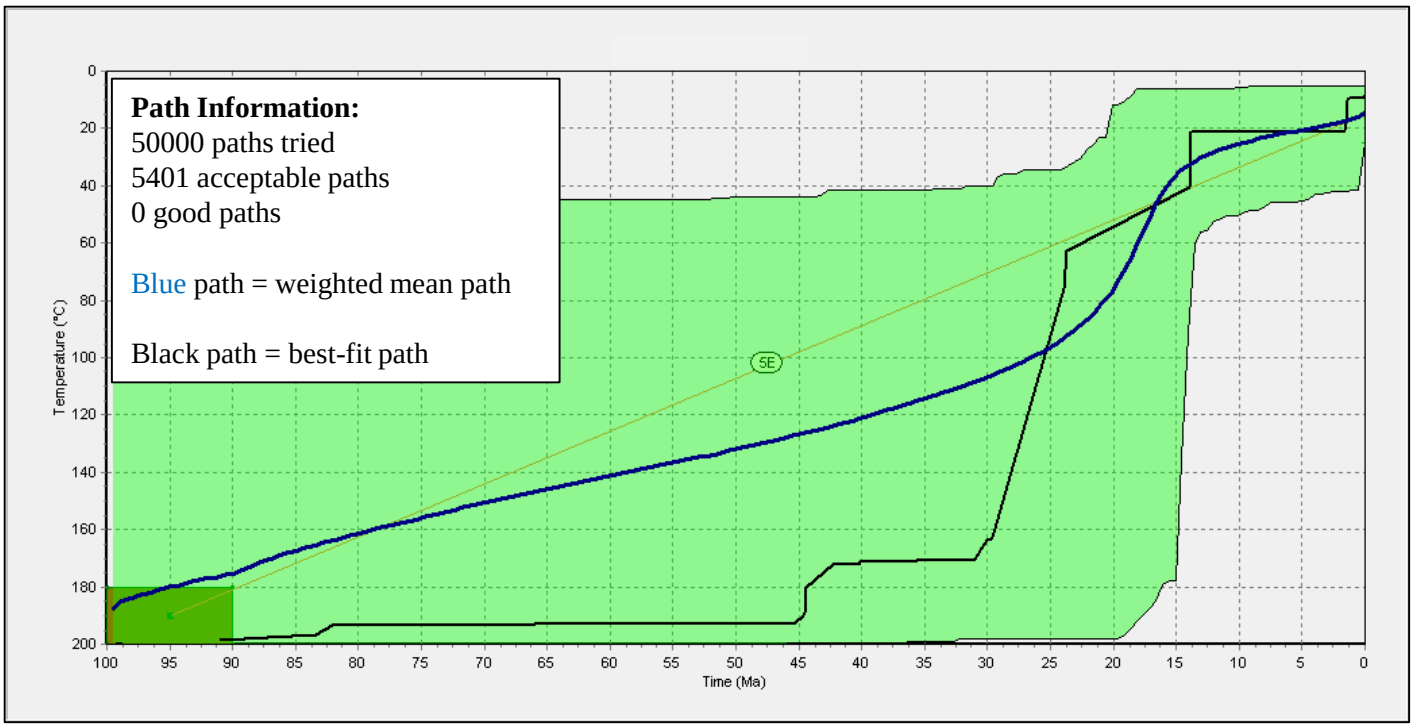
HeFTy Model Description:
Thermal history model incorporates two AHe aliquots (a1 and a2). Each aliquot contained three individual apatite grains.

AHe Modeling Results

a1 input age: 19.0 ± 3.8 Ma
model age: 19.3 Ma
GOF: 0.94

a2 input age: 19.6 ± 3.9 Ma
model age: 19.2 Ma
GOF: 0.93

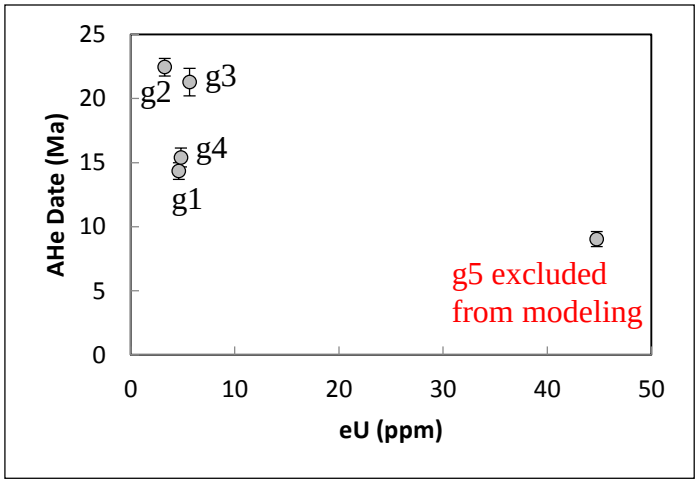




Sample 31 (JR-BQ-11)

Sample Location: 34°39.18' N, 107°06.81' W
Elevation: 1755 m
Rock Type: Sandstone (Sandia Fm)
Age: Pennsylvanian

HeFTy Model Description:
Thermal history model incorporates four single grain AHe ages. One grain (g5) was excluded because no paths were produced when it was included with the other four.



AHe Modeling Results

g1 input age: 14.3 ± 2.9 Ma
model age: 17.4 Ma
GOF: 0.29

g3 input age: 21.3 ± 4.3 Ma
model age: 17.1 Ma
GOF: 0.33

g2 input age: 22.5 ± 4.5 Ma
model age: 17.6 Ma
GOF: 0.28

g4 input age: 15.4 ± 3.1 Ma
model age: 18.5
GOF: 0.31