TABLE DR1. COMBINED EMPA AND LA-ICP-MS DATA FOR WATERSHED 2 AND 34 MINERALS USED IN THE MASS BALANCE CALCULATIONS

Oxide	Weight Percent Oxide									
	Allanite					Plagioclase				
	C17-3 E1C	C17-3 E1R	C17-3 E1C3	C17-3 E1R4	Mean†	C17-3 P6	C17-3 P7	C17-3 P8	C17-3 P9	Mean†
SiO_2	31.63	34.17	31.80	34.54	33.04	60.21	61.67	60.59	58.50	60.24
TiO_2	0.03	0.05	0.05	0.05	0.04	0.01	BDL	0.01	0.02	0.01
Al_2O_3	17.34	21.64	17.86	21.99	19.71	24.74	23.86	22.82	24.83	24.06
FeO*	4.35	6.26	5.25	7.34	5.80	0.01	0.02	0.03	0.39	0.11
MgO	0.83	0.28	0.44	0.22	0.44	BDL	0.23	BDL	0.36	0.15
MnO	0.13	0.19	0.20	0.23	0.19	0.02	0.01	BDL	0.01	0.01
CaO	12.83	17.72	12.95	18.18	15.42	6.37	5.03	5.07	6.93	5.85
Na_2O	1.28	0.77	0.99	0.31	0.84	7.80	8.44	9.61	7.15	8.25
K_2O	0.01	0.06	0.03	0.04	0.03	0.04	0.04	0.05	0.04	0.04
La_2O_3	0.143	0.157	0.144	0.161	0.151	BDL	BDL	BDL	BDL	BDL
Ce_2O_3	0.275	0.303	0.278	0.310	0.292	BDL	BDL	BDL	BDL	BDL
Nd_2O_3	0.181	0.201	0.182	0.206	0.192	BDL	BDL	BDL	BDL	BDL
Gd_2O_3	0.033	0.038	0.034	0.039	0.036	BDL	BDL	BDL	BDL	BDL
Dy_2O_3	0.018	0.029	0.018	0.030	0.024	BDL	BDL	BDL	BDL	BDL
Yb_2O_3	0.014	0.020	0.014	0.021	0.017	BDL	BDL	BDL	BDL	BDL
Total	69.09	81.89	70.24	83.65	76.22	99.19	99.31	98.19	98.23	98.73

TABLE DR1. (CONTINUED)

Oxide	Weight Percent Oxide									
	Garnet							Biotite		
	C17-3 G1C	C17-3 G1R	C17-3 G2C	C17-3 G2R	C17-3 G3C	C17-3 G3R	Mean†	C17-3 B3	C17-3 B6	C17-3 B7
SiO_2	36.61	37.27	38.16	37.42	37.57	37.41	37.41	36.58	34.30	35.95
TiO_2	0.01	BDL	0.01	0.01	0.03	BDL	0.01	1.71	1.43	1.66
Al_2O_3	20.29	20.79	21.03	21.32	20.93	21.21	20.93	17.74	15.90	17.16
FeO*	24.97	26.28	26.28	26.39	26.47	26.59	26.16	16.76	15.59	16.89
MgO	2.63	3.21	2.94	2.31	3.30	3.60	3.00	12.65	11.73	12.80
MnO	7.91	6.98	7.24	7.34	7.30	7.31	7.35	0.09	0.12	0.11
CaO	4.90	4.63	5.10	4.71	4.87	4.63	4.81	0.02	0.02	0.03
Na_2O	0.02	0.02	0.01	0.03	0.01	0.01	0.02	0.28	0.27	0.25
K_2O	BDL	0.03	BDL	0.01	0.01	0.01	0.01	9.16	8.68	9.21
La_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ce_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.035	0.04	BDL
Nd_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Gd_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dy_2O_3	0.003	0.002	0.002	0.004	BDL	0.002	0.002	BDL	BDL	BDL
Yb_2O_3	0.014	0.023	0.010	0.027	BDL	0.023	0.016	BDL	BDL	BDL
Total	97.36	99.22	100.78	99.58	100.48	100.80	99.70	95.02	88.07	94.06

TABLE DR1. (CONTINUED)

Oxide	Weight Percent Oxide			
	Vermiculite			
	W2-9 V1	W2-9 V2	W2-9 V3	W2-9 V4
SiO_2	38.33	38.78	37.42	37.67
TiO_2	1.84	0.79	1.22	1.26
Al_2O_3	19.12	28.10	19.64	20.98
FeO*	15.08	7.99	15.82	14.98
MgO	13.94	6.52	13.80	14.16
MnO	0.11	0.04	0.09	0.08
CaO	0.14	0.19	0.16	0.34
Na_2O	0.17	0.08	0.26	0.23
K_2O	8.90	2.88	7.34	5.14
La_2O_3	0.001	0.008	BDL	0.038
Ce_2O_3	0.001	0.001	BDL	0.017
Nd_2O_3	BDL	0.007	BDL	0.046
Gd_2O_3	BDL	0.001	BDL	0.009
Dy_2O_3	BDL	0.001	BDL	0.006
Yb_2O_3	BDL	BDL	BDL	0.003
Total	97.64	85.40	95.74	94.94

†Indicates composition used in the mass balance calculations.
BDL = Below detection limit.

TABLE DR2. COMBINED EMPA AND LA-ICP-MS DATA FOR WATERSHED 27 MINERALS USED IN THE MASS BALANCE CALCULATIONS

Oxide	Weight Percent Oxide									
	Allanite									
	C9-7 E1C	C9-7 E2C	C9-7 E2R	C9-7 E3C	C9-7 E3R	C9-7 E4C	C9-7 E4R	C9-7 E5C	C9-7 E5R	Mean†
SiO_2	36.78	35.54	35.87	32.34	36.94	29.87	34.65	29.97	29.14	33.46
TiO_2	0.06	0.09	0.09	0.05	0.06	0.05	0.06	0.07	0.06	0.07
Al_2O_3	22.99	22.91	22.93	20.97	23.65	16.71	20.99	19.11	16.98	20.80
FeO*	8.77	8.16	9.02	5.90	9.17	5.22	8.24	5.38	4.27	7.13
MgO	0.16	BDL	BDL	0.06	0.33	0.13	2.72	0.32	0.80	0.50
MnO	0.17	0.26	0.30	0.14	0.22	0.06	0.07	0.24	0.10	0.17
CaO	18.83	19.58	19.49	15.80	21.12	8.60	12.76	12.97	12.90	15.78
Na_2O	0.50	0.01	0.01	BDL	0.03	0.59	0.48	1.62	0.20	0.38
K_2O	0.09	BDL	BDL	BDL	0.02	0.26	0.17	0.07	BDL	0.07
La_2O_3	0.547	0.303	0.166	0.081	0.212	0.898	0.613	0.061	0.066	0.422
Ce_2O_3	0.680	0.517	0.272	0.142	0.388	1.377	0.955	0.098	0.086	0.650
Nd_2O_3	0.567	0.270	0.139	0.087	0.242	0.886	0.571	0.062	0.073	0.412
Gd_2O_3	0.158	0.046	0.028	0.028	0.072	0.220	0.117	0.024	0.022	0.100
Dy_2O_3	0.175	0.028	0.020	0.050	0.101	0.163	0.084	0.048	0.032	0.090
Yb_2O_3	0.037	0.016	0.011	0.028	0.036	0.034	0.025	0.031	0.016	0.028
Total	90.52	87.73	88.35	75.67	92.61	65.07	82.50	70.06	64.74	80.06

TABLE DR2 (CONTINUED)

Oxide	Weight Percent Oxide								
	Plagioclase				Garnet				
	C9-7 P3	C9-7 P4	C9-7 P5	Mean†	C9-7 G1C	C9-7 G1R	C9-7 G2C	C9-7 G3C	Mean†
SiO_2	60.30	59.08	60.24	59.87	35.34	36.79	36.82	36.86	36.45
TiO_2	BDL	BDL	BDL	BDL	BDL	0.04	0.01	BDL	0.01
Al_2O_3	24.72	24.30	24.68	24.57	20.52	20.17	21.54	21.26	20.87
FeO*	0.04	0.03	0.03	0.03	31.29	31.25	31.08	32.14	31.44
MgO	0.15	0.12	0.31	0.19	3.38	3.73	3.68	3.71	3.62
MnO	0.01	BDL	0.01	0.01	4.52	2.63	2.69	2.69	3.13
CaO	6.18	5.87	6.29	6.11	2.47	3.74	4.30	3.46	3.49
Na_2O	7.95	7.99	7.81	7.91	0.02	0.04	0.01	0.01	0.02
K_2O	0.08	0.08	0.07	0.08	BDL	0.01	BDL	BDL	BDL
La_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ce_2O_3	BDL	0.025	0.021	0.015	BDL	BDL	BDL	BDL	BDL
Nd_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Gd_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dy_2O_3	BDL	BDL	BDL	BDL	0.011	0.009	0.013	0.0022	0.008
Yb_2O_3	BDL	BDL	BDL	BDL	0.021	0.011	0.019	0.0035	0.013
Total	99.42	97.49	99.46	98.79	97.57	98.42	100.17	100.14	99.07

TABLE DR2 (CONTINUED)

Oxide	Weight Percent Oxide										
	Biotite						Vermiculite				
	C9-7 B1	C9-7 B2	C9-7 B3	C9-7 B4	C9-7 B5	Mean†	LMS27-1 V4	LMS27-1 V5	LMS27-1 V1	LMS27-1 V2	Mean†
SiO_2	35.42	36.63	35.60	35.92	36.65	36.04	31.60	34.66	32.91	33.53	33.17
TiO_2	1.44	1.91	1.50	1.54	1.67	1.61	1.86	1.94	2.17	2.02	2.00
Al_2O_3	17.25	17.50	17.41	17.22	18.08	17.49	20.65	18.74	18.01	19.67	19.27
FeO*	18.06	18.48	18.14	18.19	17.97	18.17	20.13	19.41	24.16	21.87	21.39
MgO	11.08	12.04	11.51	11.51	11.52	11.53	8.45	8.00	7.92	6.99	7.84
MnO	0.05	0.02	0.06	BDL	0.05	0.04	0.10	0.06	0.08	0.11	0.09
CaO	BDL	0.01	BDL	0.01	BDL	0.003	0.44	0.11	0.13	0.09	0.19
Na_2O	0.22	0.23	0.18	0.16	0.16	0.19	0.07	0.25	0.19	0.24	0.19
K_2O	9.38	9.57	9.18	9.33	9.45	9.38	0.37	2.20	1.67	0.65	1.22
La_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	0.0058	0.0418	0.0580	0.0064	0.0187
Ce_2O_3	BDL	0.054	BDL	0.011	BDL	0.013	0.0057	0.0016	0.0086	0.0010	0.0032
Nd_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	0.0067	0.0442	0.0898	0.0074	0.0243
Gd_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	0.0011	0.0068	0.0145	0.0013	0.0040
Dy_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	0.0009	0.0047	0.0090	0.0009	0.0026
Yb_2O_3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.0020	0.0041	0.0005	0.0011
Total	92.91	96.44	93.57	93.89	95.55	94.47	83.67	85.47	87.43	85.18	85.41

†Indicates composition used in the mass balance calculations.
BDL = Below detection limit.

TABLE DR3. STRUCTURAL AND STOICHIOMETRIC FORMULAE FOR THE MINERALS OF THE OTTO FORMATION (W2 AND W34) AND COLEMAN RIVER FORMATION (W27). THE BIOMASS TERM REFLECTS THE STOICHIOMETRY OF ION CONSUMPTION BY THE BIOMASS AT COWEETA AS DETERMINED BY DAY AND MONK (1977) AND BORING ET AL. (1981)

Bedrock	Phase	Structural/Stoichiometric Formula
Otto	Allanite	
		$(Ca_{1.58}Mn_{0.02}Na_{0.16}La_{0.00533}Ce_{0.0102}{}^{Nd}{}_{0.00657}Gd_{0.00114}Dy_{0.000731}Yb_{0.000503})Fe_{0.46}Mg_{0.06}Al_{2.22}Si_{3.16}O_{12}OH$
Formation	Plagioclase	$Na_{0.72}Ca_{0.28}Al_{1.28}Si_{2.72}{}^{o}{}_{8}$
(W2 and	(oligoclase)	
W34)	Garnet	$Ca_{0.41}Dy_{0.0000565}Yb_{0.00039}Mg_{0.36}Mn_{0.50}Fe_{1.76}Al_2Si_3O_{12}$
	Biotite	$K_{0.88}Na_{0.041}Ca_{0.001}Ce_{0.000968}(Mg_{1.42}Fe_{1.05}Mn_{0.01}Al_{0.32}Ti_{0.097})(Al_{1.25}Si_{2.75})O_{10}(OH)_2$
	Vermiculite	$K_{0.48}Na_{0.032}Ca_{0.026}La_{0.000506}Ce_{0.000224}Nd_{0.000604}Gd_{0.000112}Dy_{0.0000734}Yb_{0.0000284}$- $(Mg_{1.54}Fe^{II}{}_{0.27}Fe^{III}{}_{0.55}Mn_{0.005}Al_{0.33}Ti_{0.07})(Al_{1.25}Si_{2.75})O_{10}(OH)_2 \cdot 0.04Al_6(OH)_{15}$
Coleman	Allanite	
		$(Ca_{1.55}Mn_{0.01}Na_{0.08}K_{0.01}La_{0.0111}Ce_{0.0169}Nd_{0.0106}Gd_{0.00242}Dy_{0.00231}Yb_{0.000729})Fe_{0.55}Mg_{0.09}Al_{2.25}Si_{3.08}{}^{o}{}_{12}OH$
River	Plagioclase	
Formation	(oligoclase-	$Na_{0.70}Ca_{0.30}Ce_{0.000251}Al_{1.30}Si_{2.70}{}^{o}{}_{8}$
(W27)	andesine)	
	Garnet	$Ca_{0.30}Dy_{0.000216}Yb_{0.000321}Mg_{0.44}Mn_{0.22}Fe_{2.13}Al_2Si_3O_{12}$
	Biotite	$K_{0.91}Na_{0.028}Ce_{0.000360}(Mg_{1.31}Fe_{1.16}Al_{0.33}Ti_{0.093})(Al_{1.25}Si_{2.75})O_{10}(OH)_2$
	Vermiculite	$K_{0.13}Na_{0.030}Ca_{0.017}Mg_{0.17}La_{0.00286}Ce_{0.0000492}Nd_{0.000359}Gd_{0.0000546}Dy_{0.0000353}Yb_{0.0000144}$- $(Mg_{0.80}Fe^{II}{}_{0.55}Fe^{III}{}_{0.79}Mn_{0.006}Al_{0.33}Ti_{0.12})(Al_{1.25}Si_{2.75})O_{10}(OH)_2 \cdot 0.05Al_6(OH)_{15}$
All Units	Kaolinite	$Al_2Si_2O_5(OH)_4$
	Gibbsite	$Al(OH)_3$
	Biomass	$Mg_{0.056}Ca_{0.144}Na_{0.008}K_{0.150}$

TABLE DR4. GRAND MATRIX FOR W2 AND W34 MASS BALANCE CALCULATIONS†

	Allanite	Plagioclase	Garnet	Biotite	Vermiculite	Kaoliniteite	Gibbsite	Biomass
Si	3.16	2.72	3.00	2.75	2.75	2.00	0.00	0.00
Al	2.22	1.28	2.00	1.57	1.81	2.00	1.00	0.00
Mg	0.06	0.00	0.36	1.42	1.54	0.00	0.00	0.056
Ca	1.58	0.28	0.41	0.001	0.026	0.00	0.00	0.144
Na	0.16	0.72	0.00	0.041	0.032	0.00	0.00	0.008
K	0.00	0.00	0.00	0.88	0.48	0.00	0.00	0.150
Dy	0.000731	0.0000	0.0000565	0.0000	0.0000734	0.0000	0.0000	0.0000
La	0.00533	0.0000	0.0000	0.0000	0.000506	0.0000	0.0000	0.0000

†With all element stoichiometries being positive the calculated rates of minerals being destroyed will be positive, and rates of minerals forming will be negative.

TABLE DR5. GRAND MATRIX FOR THE W27 MASS BALANCE CALCULATION

	Allanite	Plagioclase	Garnet	Biotite	Vermiculite	Kaoliniteite	Gibbsite	Biomass
Si	3.08	2.70	3.00	2.75	2.75	2.00	0.00	0.00
Al	2.25	1.30	2.00	1.58	1.88	2.00	1.00	0.00
Mg	0.09	0.00	0.44	1.31	0.97	0.00	0.00	0.056
Ca	1.55	0.30	0.30	0.000	0.017	0.00	0.00	0.144
Na	0.08	0.70	0.00	0.028	0.030	0.00	0.00	0.008
K	0.01	0.00	0.00	0.91	0.13	0.00	0.00	0.150
La	0.0111	0.00000	0.00000	0.0000	0.000286	0.0000	0.0000	0.0000
Nd	0.0106	0.00000	0.00000	0.0000	0.000359	0.0000	0.0000	0.0000

TABLE DR6. LONG-TERM MAJOR ELEMENT SOLUTE FLUX DATA, RARE EARTH AND MAJOR ELEMENT SOLUTE CONCENTRATIONS FOR THE MAY, 2002 SAMPLE EPISODE, AND APPROXIMATE CALCULATED LONG-TERM REE SOLUTE FLUX DATA OF STREAM WATERS

Element	Watershed 2			Watershed 34			Watershed 27		
	May 22, 2002 (ppb)	Ratio (mol ha^{-1} yr^{-1} ppb^{-1})	Long-Term Flux (mol ha^{-1} yr^{-1})†	May 22, 2002 (ppb)	Ratio (mol ha^{-1} yr^{-1} ppb^{-1})	Long-Term Flux (mol ha^{-1} yr^{-1})†	May 22, 2002 (ppb)	Ratio (mol ha^{-1} yr^{-1} ppb^{-1})	Long-Term Flux (mol ha^{-1} yr^{-1})†
SiO_2	4085	0.31	1277	2643	0.50	1321	1206	0.90	1083
Mg	321	0.29	94.2	364	0.40	145	186	0.60	111
Ca	646	0.07	45.4	709	0.17	123	273	0.32	87.1
K	477	0.16	74.2	355	0.22	78.8	162	0.39	62.7
Na	NR		359	NR		324	NR		170
Al	BDL		BDL	BDL		BDL	34		23
La	0.08		0.03	0.04		0.02	0.1		0.09
Nd	0.08		0.02	0.04		0.02	0.09		0.08
Dy	0.02		0.005	0.01		0.005	0.01		0.01

†Major elements from Swank and Waide (1988), REE calculated from SiO_2 ratios.
NR = Not reported.
BDL = Below detection limit.

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