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Quantifying erosion in a pre-Alpine catchment at high resolution with concentrations of cosmogenic ^{10}Be, ^{26}Al, and ^{14}C

Chantal Schmidt et al.

Correspondence to: Chantal Schmidt (chantal.schmidt@unibe.ch)

Sample	Latitude	Longitude	catch area	altitude average	flow length to apex	mean slope	landslide area	ksn mean	ksn mean std	Mean TRI	Mean TRI std
	[°]	[°]	[km^2]	[m a.s.l.]	[m]	[°]	[%]	$m^{-0.9}$	$m^{-0.9}$		
C1s	46.73025	7.46171	1.24	1523	3987	17.7	1.8	26.5	11.7	4.3	1.9
C3s	46.72989	7.47103	1.27	1393	3055	18.7	4.5	30.0	16.5	4.6	2.2
C4s	46.7431	7.4998	8.11	1274		20.0	26.1	40.5	37.7	4.9	2.2
C5s	46.74296	7.49982	8.11	1274		20.0	26.1	40.5	37.7	4.9	2.2
C6s	46.73607	7.4804	0.48	1317	1932	24.4	54.3	43.4	23.8	6.1	2.5
C7s	46.73847	7.48562	0.61	1315	1370	21.3	53.3	38.8	29.0	5.2	2.1
C8s	46.74119	7.49132	0.80	1254	780	21.6	23.2	40.9	29.9	5.4	2.3
G1	46.73314	7.474846	3.23	1435	2519	19.2	9.2	33.9	26.8	4.7	2.2
G2	46.739704	7.481027	0.26	1221	1784	19.4	50.7	32.4	12.2	4.7	1.7
G3	46.742879	7.481919	0.60	1326	1618	21.5	22.1	36.9	27.5	5.3	2.3
G4	46.747332	7.501382	1.23	1082		21.2	75.6	33.4	20.9	5.3	2.7
G5	46.743069	7.499663	8.11	1274		20.0	26.1	40.5	37.7	4.9	2.2

Table S1: Catchment characteristics calculated for the quartz corrected catchments.

Sample	Latitude [°]	Longitude [°]	Alt. [m. a.s.l.]	Diss. Qtz [g]	^{9}Be spike [mg]	^{10}Be/^{9}Be [10^{-14}]	^{10}Be concentration [10^{4} at/g]
C1s	46.73025	7.46171	1359	37.9383	0.2007	24.91 ± 0.67	8.67 ± 0.48
C3s	46.72989	7.47103	1214.1	37.4855	0.2021	13.74 ± 0.39	4.81 ± 0.29
C4s	46.7431	7.4998	765.6	44.9421	0.2003	11.25 ± 0.34	3.23 ± 0.21
C5s	46.74296	7.49982	765.6	45.616	0.2007	12.69 ± 0.37	3.61 ± 0.23
C6s	46.73607	7.4804	1022.1	44.979	0.2016	10.13 ± 0.32	2.92 ± 0.20
C7s	46.73847	7.48562	927.2	39.5544	0.2019	7.72 ± 0.27	2.50 ± 0.20
C8s	46.74119	7.49132	842.8	40.4166	0.2018	10.01 ± 0.29	3.21 ± 0.21
G1	46.73314	7.474846	1126.3	49.313	0.1699	15.09 ± 0.73	3.42 ± 0.34
G2	46.739704	7.481027	1042.3	49.9758	0.1716	14.17 ± 0.61	3.20 ± 0.28
G3	46.742879	7.481919	1025.1	43.7295	0.1741	12.04 ± 0.58	3.14 ± 0.31
G4	46.747332	7.501382	724.3	49.7005	0.1745	9.55 ± 0.53	2.19 ± 0.25
G5	46.743069	7.499663	766.2	51.6378	0.1728	14.86 ± 0.70	3.27 ± 0.31

Table S2: Measured ^{10}Be/^{9}Be ratios and ^{10}Be concentrations for all samples. ^{10}Be concentrations were adjusted using measured in batch blank ratios of 3.92 x 10-15 for the samples C1s to C8s and 2.26 x 10-15 for the samples G1 - G5. Alt. = Altitude; values are provided refering to the Swiss Reference System (CH1903+ LV95 EPSG 4150). Diss. Qtz = amount of dissolved quartz.

Sample	Latitude [°]	Longitude [°]	Alt. [m. a.s.l.]	Diss. Qtz [g]	^{26}Al/^{27}Al [10^{-14}]	^{26}Al concentration [10^{5} at/g]
C1s	46.73025	7.46171	1359	37.9383	20.91 ± 0.79	6.42 ± 0.49
C3s	46.72989	7.47103	1214.1	37.4855	10.15 ± 0.36	3.48 ± 0.25
C4s	46.7431	7.4998	765.6	44.9421	7.81 ± 0.45	2.41 ± 0.28
C5s	46.74296	7.49982	765.6	45.616	7.43 ± 0.36	2.26 ± 0.22
C6s	46.73607	7.4804	1022.1	44.979	7.82 ± 0.50	2.57 ± 0.33
C7s	46.73847	7.48562	927.2	39.5544	5.90 ± 0.33	1.94 ± 0.22
C8s	46.74119	7.49132	842.8	40.4166	10.88 ± 0.56	3.06 ± 0.32

Table S3: Measured ^{26}Al/^{27}Al ratios and ^{26}Al concentrations for all samples.

Sample	sample vol.	sample wight	weight HNO5 1%	Aluminium (Al)	
	mL	g	g	mg/L	mg/kg Solution
C1s	0.25	0.277	2.259	527 ± 47	483 ± 43
C3s	0.25	0.276	2.259	582 ± 52	535 ± 48
C4s	0.25	0.273	2.258	624 ± 56	579 ± 52
C5s	0.25	0.277	2.261	625 ± 56	573 ± 52
C6s	0.25	0.275	2.262	665 ± 60	614 ± 55
C7s	0.25	0.278	2.257	594 ± 53	542 ± 49
C8s	0.25	0.276	2.261	515 ± 46	473 ± 43

Table S4: total Al concentrations measured with ICP-MS

Sample	AMS ID	sample mass [g]	Fraction modern $F^{14}C_{corr.}$	$\delta^{13}C$ ‰	$^{14}C/^{12}C_{total}$ [10^{-13}]	^{14}C Concentration [10^{4} at/g]
C1S	ETH-148098.1.1	3.249	0.29 ± 0.004	-14.4	3.453 ± 0.049	11.50 ± 0.46
C3S	ETH-147114.1.1	2.4352	0.11 ± 0.002	-10.3	1.354 ± 0.026	6.88 ± 0.58
C4S	ETH-144164.1.1	3.248	0.15 ± 0.003	-17.2	1.777 ± 0.030	7.07 ± 0.28
C5S	ETH-145788.1.1	2.343	0.06 ± 0.002	-20.0	0.642 ± 0.020	5.10 ± 0.41
C6S	ETH-144165.1.1	3.019	0.17 ± 0.003	-16.9	1.981 ± 0.033	7.27 ± 0.29
C7S	ETH-145789.1.1	3.526	0.10 ± 0.002	-11.0	1.174 ± 0.026	3.47 ± 0.21

Table S5: In situ ^{14}C data.

Sample	catchment centre point		Mean Alt.	snow shielding	*topographic shielidng*	Denudation rate			min exp. Age		
	Longitude	Latitude				^{10}Be	^{26}Al	^{14}C	^{10}Be	^{26}Al	^{14}C
	[°]	[°]	[m a.s.l.]			[mm/yr]	[mm/yr]	[mm/yr]	yr	yr	yr
C1s	46.72909	7.44991	1523	0.92	*0.98*	0.10 ± 0.009	0.10 ± 0.011	0.211 ± 0.015	5939 ± 498	6291 ± 698	2785 ± 179
C3s	46.72449	7.46013	1392	0.93	*0.97*	0.17 ± 0.015	0.17 ± 0.019	0.48 ± 0.036	3121 ± 264	3226 ± 355	1467 ± 105
C4s	46.73429	7.46998	1274	0.94	*0.97*	0.24 ± 0.021	0.23 ± 0.027	0.394 ± 0.025	2449 ± 210	2603 ± 311	1775 ± 107
C5s	46.73429	7.46998	1274	0.94	*0.97*	0.21 ± 0.018	0.24 ± 0.028	0.617 ± 0.045	2737 ± 233	2448 ± 281	1241 ± 86
C6s	46.73699	7.46876	1317	0.94	*0.96*	0.27 ± 0.023	0.22 ± 0.027	0.353 ± 0.023	2341 ± 202	2948 ± 361	1951 ± 118
C7s	46.7402	7.46885	1315	0.94	*0.97*	0.32 ± 0.028	0.29 ± 0.034	0.956 ± 0.060	2008 ± 178	2225 ± 263	876 ± 54
C8s	46.7448	7.47315	1257	0.94	*0.97*	0.24 ± 0.020	0.18 ± 0.021		2709 ± 231	3693 ± 430	
G1	46.72829	7.45742	1435	0.93	*0.97*	0.25 ± 0.023			2286 ± 213		
G2	46.7415	7.47324	1222	0.94	*0.98*	0.23 ± 0.021			2771 ± 251		
G3	46.7453	7.46935	1343	0.93	*0.97*	0.26 ± 0.024			2505 ± 234		
G4	46.7491	7.48285	1054	0.95	*0.97*	0.31 ± 0.030			2115 ± 206		
G5	46.73429	7.46998	1274	0.94	*0.97*	0.24 ± 0.022			2477 ± 229		

Table S6: Denudation rates calculated with the online calculator of Balco et al. (2008); corrections have been made for the snow cover and quartz content (adjusted catchment area); Mean Alt. = Average catchment altitude (without quartzfree area); min exp. Age = minimu exposure age calculated with the online calculator of Balco et al. (2008) with zero erosion.

Sample	LOI	SiO2	Al2O3	Fe2O3(T)	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	Total
	GRAV	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP
C1s	11.26	58.95	12.16	4.89	0.072	1.4	8.04	0.75	2.23	0.607	0.09	100.4
C2s	14.26	52.09	9.97	4.13	0.06	2.01	12.65	0.77	1.8	0.521	0.1	98.35
C3s	25.58	33.19	5.57	2.53	0.054	4.07	27.65	0.38	1.14	0.26	0.07	100.5
C4s	22.52	37.72	5.59	3.02	0.08	2.3	26.97	0.64	0.95	0.268	0.07	100.1
C4ss	16.12	49.43	8.55	3.83	0.068	2.29	17.39	0.91	1.52	0.405	0.09	100.6
C4.1s	19.39	43.93	6.86	3.48	0.071	2.38	21.81	0.77	1.19	0.359	0.09	100.3
C5s	24.06	35.88	5	2.84	0.081	2.34	28.71	0.61	0.82	0.246	0.08	100.7
C6s	15.58	50.27	9.57	4.32	0.071	1.64	15.89	0.79	1.75	0.434	0.09	100.4
C7s	18.39	43.44	9.74	4.44	0.087	1.83	18.92	0.83	1.69	0.447	0.09	99.9
C8s	19.12	41.8	9.16	4.3	0.1	1.91	20.56	0.83	1.61	0.407	0.09	99.88

Table S7a: content of oxides (%)

Sample	Ba	Sr	Y	Sc	Zr	Be	V	Ag	Cd	Cu	Ni	Pb
	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	FUS-ICP	TD-ICP	TD-ICP	TD-ICP	TD-ICP	TD-ICP
C1s	262	325	19	10	169	2	100	< 0.3	< 0.5	29	41	16
C2s	310	391	22	9	220	2	81	0.4	< 0.5	32	36	13
C3s	140	581	13	5	90	< 1	47	0.5	< 0.5	21	22	8
C4s	172	664	17	6	121	< 1	44	< 0.3	< 0.5	16	27	7
C4ss	273	488	19	7	156	1	68	< 0.3	< 0.5	25	38	9
C4.1s	223	589	19	6	181	1	53	0.3	< 0.5	21	34	13
C5s	165	717	17	5	111	< 1	39	< 0.3	< 0.5	14	25	8
C6s	194	428	21	8	147	2	80	0.4	< 0.5	30	45	15
C7s	200	500	22	9	130	2	81	< 0.3	< 0.5	36	47	12
C8s	206	558	22	9	119	2	77	0.4	< 0.5	26	47	9

Table S7b: Content of trace elements (ppm)

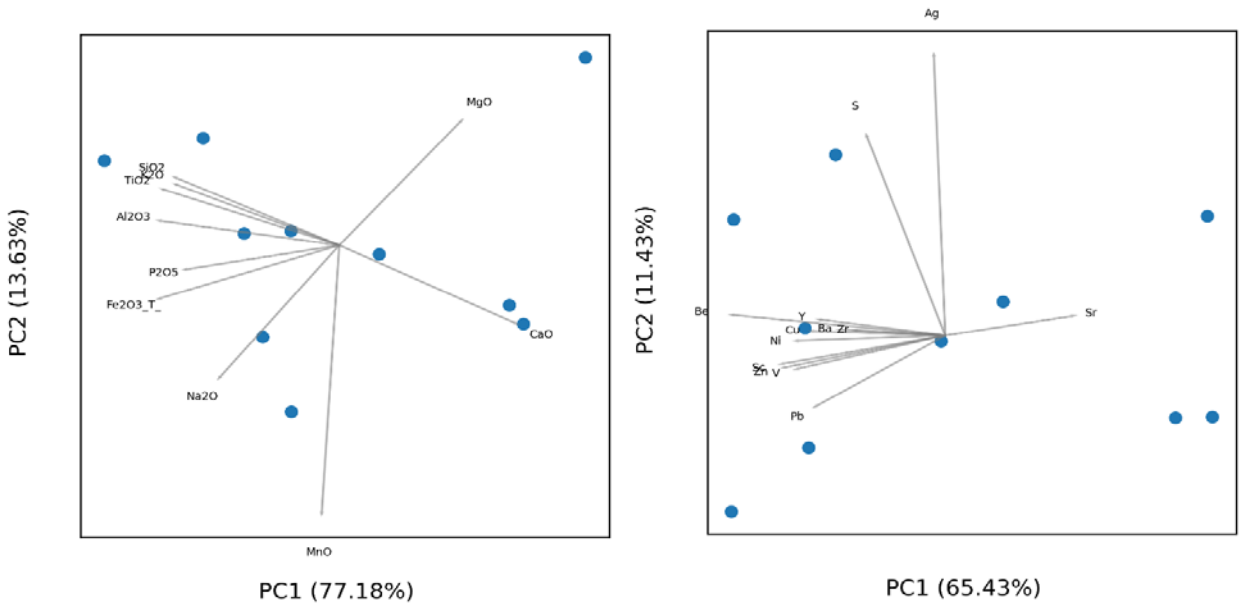

Figure S1: PCA of oxides (left) and trace elements (right)