Supplementary Materials

Factors affecting tufa degradation in Jiuzhaigou National Nature Reserve, Sichuan, China

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1. The hydrochemistry raw data

Table S1. The major water parameters of the studied sites.

Sites	Time	pH	WT (°C)	EC (μS·cm^{-1})	Ca^{2+} (mg·L^{-1})	Mg^{2+} (mg·L^{-1})	HCO_3^- (mg·L^{-1})	SO_4^{2-} (mg·L^{-1})	NO_3^- (mg·L^{-1})	Na^+ (mg·L^{-1})	K^+ (mg·L^{-1})	F^- (mg·L^{-1})	Cl^- (mg·L^{-1})	DP (mg·L^{-1})
S_{ABL}	Oct 2013	8.48	5.8	422	43.65	12.89	207.16	14.57	0.70	1.02	0.43	0.19	0.45	0.002
	Nov 2013	8.51	3.7	423	42.12	13.52	218.39	14.99	0.75	1.08	0.47	0.21	0.39	0
	Dec 2013	8.09	5.2	402	68.30	12.95	242.32	24.01	1.07	1.01	0.45	0.34	0.57	0
	Jan 2014	8.16	4.0	454	47.73	14.15	289.27	22.09	0.83	1.16	0.51	0.38	0.62	0.009
	Mar 2014	8.20	4.8	463	63.05	14.38	291.70	26.59	0.80	1.27	0.55	0.34	0.68	0.012
	Apr 2014	8.16	10.7	474	76.84	14.98	285.94	27.30	0.75	1.33	0.60	0.38	0.70	0.005
	May 2014	8.24	10.3	446	52.74	13.71	260.68	19.36	0.65	1.13	0.49	0.24	0.54	0.015
	Jun 2014	8.05	8.8	391	63.94	11.70	230.41	21.19	1.11	0.89	0.40	0.36	0.59	0.007
	Jul 2014	8.11	11.3	383	62.12	11.49	218.56	15.53	0.75	0.94	0.40	0.19	0.38	0.001
	Aug 2014	8.03	9.7	396	64.65	12.10	233.08	22.94	1.02	0.99	0.42	0.32	0.59	0.004
	Sep 2014	8.09	8.4	361	60.12	11.23	217.38	21.71	1.23	0.94	0.47	0.30	0.51	0.008
S_{PL}	Oct 2013	8.43	6.3	386	54.31	12.38	208.12	16.68	0.69	0.93	0.42	0.26	0.54	0.001
	Nov 2013	8.57	4.4	371	50.14	12.97	191.24	18.89	0.76	1.01	0.46	0.31	0.50	0
	Dec 2013	8.32	4.3	363	60.54	12.67	216.47	22.05	1.05	1.03	0.44	0.31	0.51	0
	Apr 2014	8.34	9.6	340	51.95	13.08	202.01	22.97	0.32	1.08	0.58	0.31	0.63	0.005
	May 2014	8.37	9.6	336	48.15	13.01	187.37	22.67	0.13	1.10	0.47	0.32	0.62	0.005
	Jun 2014	8.19	9.3	357	56.70	11.86	207.20	21.53	0.91	0.92	0.44	0.35	0.60	0.004
	Jul 2014	8.37	10.5	362	58.12	11.64	211.99	13.94	0.58	0.91	0.42	0.17	0.27	0.001
	Aug 2014	8.28	9.5	357	57.50	11.84	194.79	21.21	0.86	0.94	0.42	0.29	0.57	0.002

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Sites	Time	pH	WT (℃)	EC (μS·cm^{-1})	Ca^{2+} (mg·L^{-1})	Mg^{2+} (mg·L^{-1})	HCO_3^- (mg·L^{-1})	SO_4^{2-} (mg·L^{-1})	NO_3^- (mg·L^{-1})	Na^+ (mg·L^{-1})	K^+ (mg·L^{-1})	F^- (mg·L^{-1})	Cl^- (mg·L^{-1})	DP (mg·L^{-1})
S_{PS1}	Sep 2014	8.29	9.6	350	58.05	11.29	209.02	22.25	1.20	0.89	0.44	0.27	0.46	0.006
	Oct 2013	8.41	7.4	390	50.14	13.96	212.25	21.56	1.08	1.09	0.41	0.34	0.58	0.002
	Nov 2013	8.46	7.0	368	48.87	13.74	209.75	21.04	1.03	1.17	0.46	0.37	0.60	0
	Dec 2013	8.18	6.4	372	60.26	13.40	213.24	22.00	1.25	1.16	0.43	0.33	0.56	0
	Jan 2014	8.13	6.9	391	43.18	14.39	242.61	23.00	1.00	1.23	0.46	0.36	0.58	0.003
	Mar 2014	8.18	6.2	391	62.14	14.67	234.72	24.42	1.12	1.31	0.47	0.30	0.62	0.004
	Apr 2014	8.24	8.7	420	62.91	14.67	243.26	25.15	1.08	1.35	0.65	0.38	0.87	0.007
	May 2014	8.30	9.1	401	54.25	13.86	228.10	23.77	1.01	1.29	0.52	0.36	0.69	0.001
	Jun 2014	8.21	9.5	378	60.54	13.33	222.12	21.61	1.14	1.09	0.48	0.32	0.59	0.004
	Jul 2014	8.21	10.3	379	56.84	12.47	220.20	18.08	0.88	1.02	0.46	0.24	0.46	0.001
	Aug 2014	8.19	10.6	377	60.57	13.21	221.42	22.88	1.16	1.16	0.56	0.33	0.65	0.002
	Sep 2014	8.19	10.3	362	58.19	12.52	214.04	21.79	1.24	1.04	0.45	0.30	0.58	0.004
S_{PS2}	Oct 2013	8.48	7.7	378	49.25	12.84	205.24	19.22	0.99	1.12	0.39	0.33	0.55	0.001
	Nov 2013	8.55	6.4	365	45.38	13.79	199.88	20.91	1.01	1.17	0.46	0.35	0.59	0
	Dec 2013	8.31	6.1	369	60.53	13.36	216.47	21.82	1.24	1.12	0.46	0.32	0.52	0
	Jan 2014	8.28	6.0	386	46.94	13.90	237.28	23.12	1.10	1.22	0.45	0.27	0.56	0.006
	Mar 2014	8.35	7.4	381	61.22	14.70	230.65	24.66	1.12	1.31	0.47	0.32	0.62	0.002
	Apr 2014	8.34	9.3	394	60.12	14.26	241.84	24.70	1.05	1.27	0.48	0.37	0.74	0.008
	May 2014	8.38	8.8	388	52.23	14.71	224.84	20.42	0.80	1.30	0.56	0.25	0.61	0.006
	Jun 2014	8.32	9.3	375	58.08	13.29	222.12	21.61	1.24	1.10	0.50	0.37	0.64	0.006
	Jul 2014	8.39	10.0	376	58.68	12.85	230.06	15.16	0.80	1.11	0.47	0.20	0.26	0.005
	Aug 2014	8.34	10.7	374	56.60	12.36	218.09	22.30	1.17	1.08	0.49	0.36	0.63	0.002

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Sites	Time	pH	WT (°C)	EC (μS·cm^{-1})	Ca^{2+} (mg·L^{-1})	Mg^{2+} (mg·L^{-1})	HCO_3^- (mg·L^{-1})	SO_4^{2-} (mg·L^{-1})	NO_3^- (mg·L^{-1})	Na^+ (mg·L^{-1})	K^+ (mg·L^{-1})	F^- (mg·L^{-1})	Cl^- (mg·L^{-1})	DP (mg·L^{-1})
S_{PS3}	Sep 2014	8.27	10.4	358	56.22	12.09	214.04	23.01	1.26	1.00	0.44	0.30	0.51	0.004
	Oct 2013	8.56	8.7	376	44.07	11.91	208.62	21.88	1.03	0.94	0.46	0.38	0.46	0.002
	Nov 2013	8.44	7.4	369	46.52	13.70	203.58	18.73	1.01	1.17	0.46	0.22	0.46	0
	Dec 2013	8.19	7.2	368	59.18	13.57	215.66	21.82	1.23	1.13	0.45	0.31	0.51	0
	Jan 2014	8.13	7.2	383	48.85	14.06	231.95	22.07	1.03	1.23	0.47	0.30	0.58	0.013
	Mar 2014	8.23	7.3	383	59.72	14.40	223.87	24.21	1.06	1.33	0.46	0.31	0.61	0.002
	Apr 2014	8.24	9.0	405	62.50	14.64	236.86	24.85	1.01	1.36	0.62	0.31	0.82	0.001
	May 2014	8.29	9.5	405	57.03	14.54	226.47	24.76	1.03	1.31	0.50	0.38	0.71	0.002
	Jun 2014	8.27	9.8	375	58.15	13.57	221.29	21.29	1.14	1.13	0.51	0.31	0.58	0.004
	Jul 2014	8.26	10.7	375	59.51	13.03	221.03	15.58	0.83	1.10	0.47	0.21	0.33	0.003
	Aug 2014	8.24	10.8	375	59.83	13.05	218.93	22.79	1.24	1.12	0.58	0.34	0.68	0.004
	Sep 2014	8.19	10.3	360	57.94	12.46	212.36	22.61	1.25	1.08	0.46	0.31	0.59	0.003
S_{SZL}	Oct 2013	8.40	9.0	362	48.36	13.22	187.23	20.12	1.02	1.02	0.44	0.33	0.50	0.002
	Nov 2013	8.41	8.5	356	49.33	13.57	181.37	20.59	1.07	1.12	0.47	0.30	0.53	0
	Dec 2013	8.31	6.6	334	50.20	13.62	195.47	22.87	1.48	1.13	0.47	0.32	0.52	0
	Jan 2014	8.23	5.9	342	46.34	13.97	186.63	21.12	1.11	1.17	0.46	0.34	0.53	0.015
	Mar 2014	8.26	6.3	348	50.23	13.92	196.73	25.22	1.11	1.24	0.48	0.31	0.55	0.003
	Apr 2014	8.23	10.0	350	51.76	14.35	165.02	24.84	0.96	1.29	0.51	0.33	0.56	0.009
	May 2014	8.23	11.2	351	52.34	14.37	190.63	25.63	1.01	1.32	0.56	0.35	0.67	0.003
	Jun 2014	8.27	11.2	351	49.72	14.36	202.23	22.05	0.84	1.22	0.49	0.31	0.60	0.003
	Jul 2014	8.29	12.8	341	50.91	13.46	193.91	17.52	0.88	1.17	0.49	0.23	0.44	0.004
	Aug 2014	8.23	12.3	338	49.17	12.94	191.46	24.11	1.26	1.12	0.48	0.36	0.62	0.010

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Sites	Time	pH	WT (°C)	EC (μS·cm^{-1})	Ca^{2+} (mg·L^{-1})	Mg^{2+} (mg·L^{-1})	HCO_3^- (mg·L^{-1})	SO_4^{2-} (mg·L^{-1})	NO_3^- (mg·L^{-1})	Na^+ (mg·L^{-1})	K^+ (mg·L^{-1})	F^- (mg·L^{-1})	Cl^- (mg·L^{-1})	DP (mg·L^{-1})
S_{SZL}	Sep 2014	8.29	11.6	334	48.35	12.41	192.30	23.39	1.34	1.03	0.47	0.31	0.55	0.006

Abbreviations: WT, Water temperature; EC, electric conductivity; DP, dissolved phosphorus.

The values are expressed as mean. The unit is mg L^{-1}, except for pH, WT (°C) and EC (μS·cm^{-1}). The stream from Panda Lake to Five-Color Lake disappeared completely from January to March 2014, and the water flow in Pearl Shoal (including $S_{PS}1$, $S_{PS}2$ and $S_{PS}3$) ceased in February 2014, so there were no relevant hydrochemistry data at S_{PL} site from January to March 2014 and no sampling in February 2014 at all selected sampling sites.

2. The mineralogical characteristics and chemical composition analysis of tufa samples

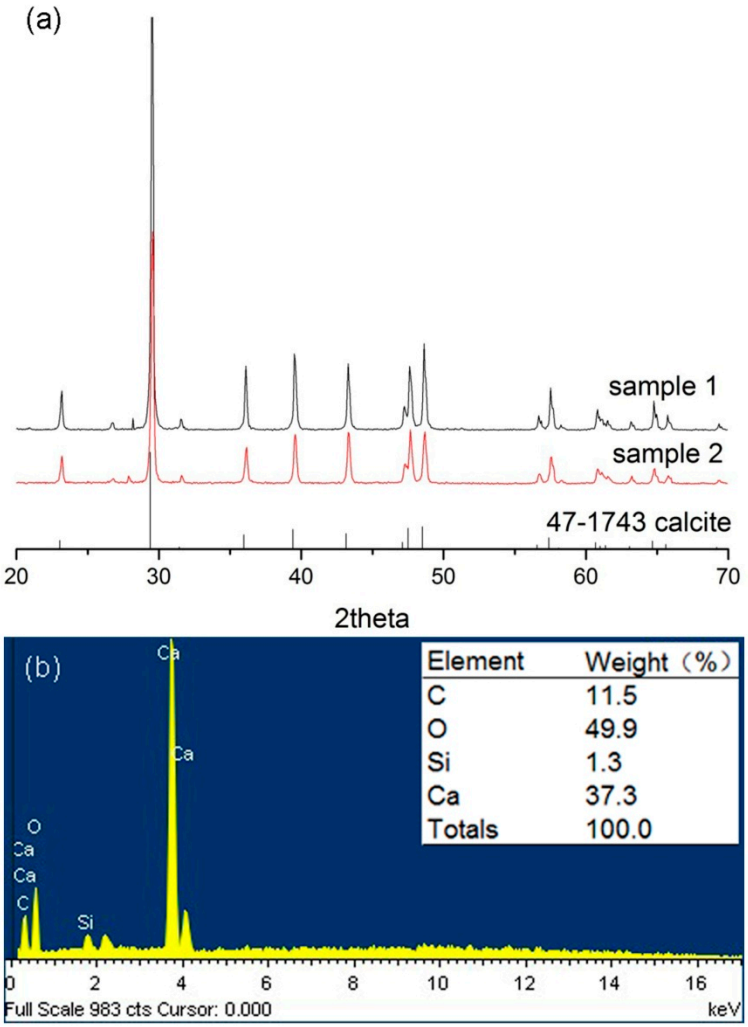

Fig. S1. (**a**) X-ray diffraction (XRD) spectrogram and (**b**) Energy dispersive spectrum (EDS) diagram of tufa samples.