

Supplementary Materials: Influence of ambient atmospheric environments on the mixing state and source of oxalate-containing particles at coastal and suburban sites in North China

Yunhui Zhao ¹, Yanjing Zhang ¹, Xiaodong Li ¹, Lei Li ^{2,*}, Limin Feng ³, Huan Xie ³, Wenshuai Li ¹, Xiaohuan Liu ³, Yujiao Zhu ⁴, Lifang Sheng ¹, Jianhua Qi ³, Huiwang Gao ³, Zhen Zhou ² and Yang Zhou ^{1,*}

¹ Key Laboratory of Physical Oceanography, College of Oceanic and Atmospheric Sciences, Ocean University of China, Qingdao 266100, China; zhaoyunhui@stu.ouc.edu.cn (Y.Z.); zyj9733@stu.ouc.edu.cn (Y.Z.); lixiaodong1819@126.com (X.L.); lws@stu.ouc.edu.cn (W.L.); shenglf@ouc.edu.cn (L.S.)

² Guangdong Provincial Engineering Research Center for On-Line Source Apportionment System of Air Pollution, Institute of Mass Spectrometry and Atmospheric Environment, Jinan University, Guangzhou 510632, China; zhouzhen@gig.ac.cn

³ Key Lab of Marine Environmental Science and Ecology, Ministry of Education, Ocean University of China, Qingdao 266100, China; flmfenglimin@163.com (L.F.); xh19930517@126.com (H.X.); liuxh1983@ouc.edu.cn (X.L.); qjianhua@ouc.edu.cn (J.Q.); hwgao@ouc.edu.cn (H.G.)

⁴ Environment Research Institute, Shandong University, Qingdao 266237, China; zhuyujiao@sdu.edu.cn

* Correspondence: lileishdx@163.com (L.L.) and yangzhou@ouc.edu.cn (Y.Z.)

Table S1. Classified groups of oxalate particles for marine and continental air mass at LQH and OUC.

Groups	LQH_M ¹		LQH_C ¹		OUC_M ¹		OUC_C ¹	
	Number	Fraction	Number	Fraction	Number	Fraction	Number	Fraction
K-rich	1305	25.4%	12,202	32.9%	4869	22.4%	65,485	34.6%
K-ECOC	1230	23.9%	9848	26.6%	7238	33.3%	53,372	28.2%
K-Na	495	6.6%	4036	10.9%	827	3.8%	20,382	10.8%
EC	191	3.7%	2889	7.8%	2516	11.6%	18,447	9.7%
EC-Na	84	1.6%	1388	3.7%	478	2.2%	10,660	5.6%
ECOC	50	1.0%	1127	3.0%	411	1.9%	2975	1.6%
Fe-rich	971	18.9%	2754	7.4%	2711	12.5%	9272	4.9%
V-rich	154	3.0%	634	1.7%	1384	6.4%	1378	0.7%
Pb-rich	110	2.1%	550	1.5%	294	1.4%	1224	0.6%
Zn-rich	2	0.0%	239	0.6%	13	0.1%	353	0.2%
Cu-rich	31	0.6%	174	0.5%	157	0.7%	1789	0.9%
Other metals	118	2.3%	390	1.1%	233	1.1%	922	0.5%
Undefined	395	7.7%	859	2.3%	591	2.7%	3199	1.7%
Oxalate	5136	1.4%	37,090	12.4%	21,722	7.2%	189,458	13.4%
mass	371,220	100.0%	299,667	100.0%	300,634	100.0%	1,418,144	100.0%

¹ M means under the control of marine air mass and C means under the control of continental air mass.

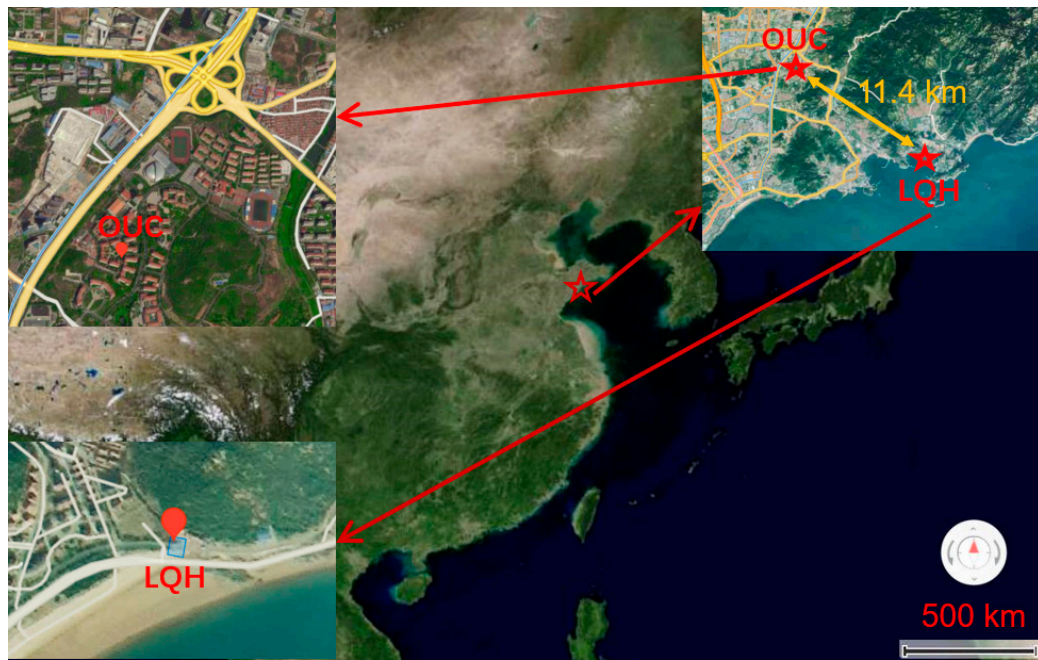


Figure S1. The location of the two observation sites.

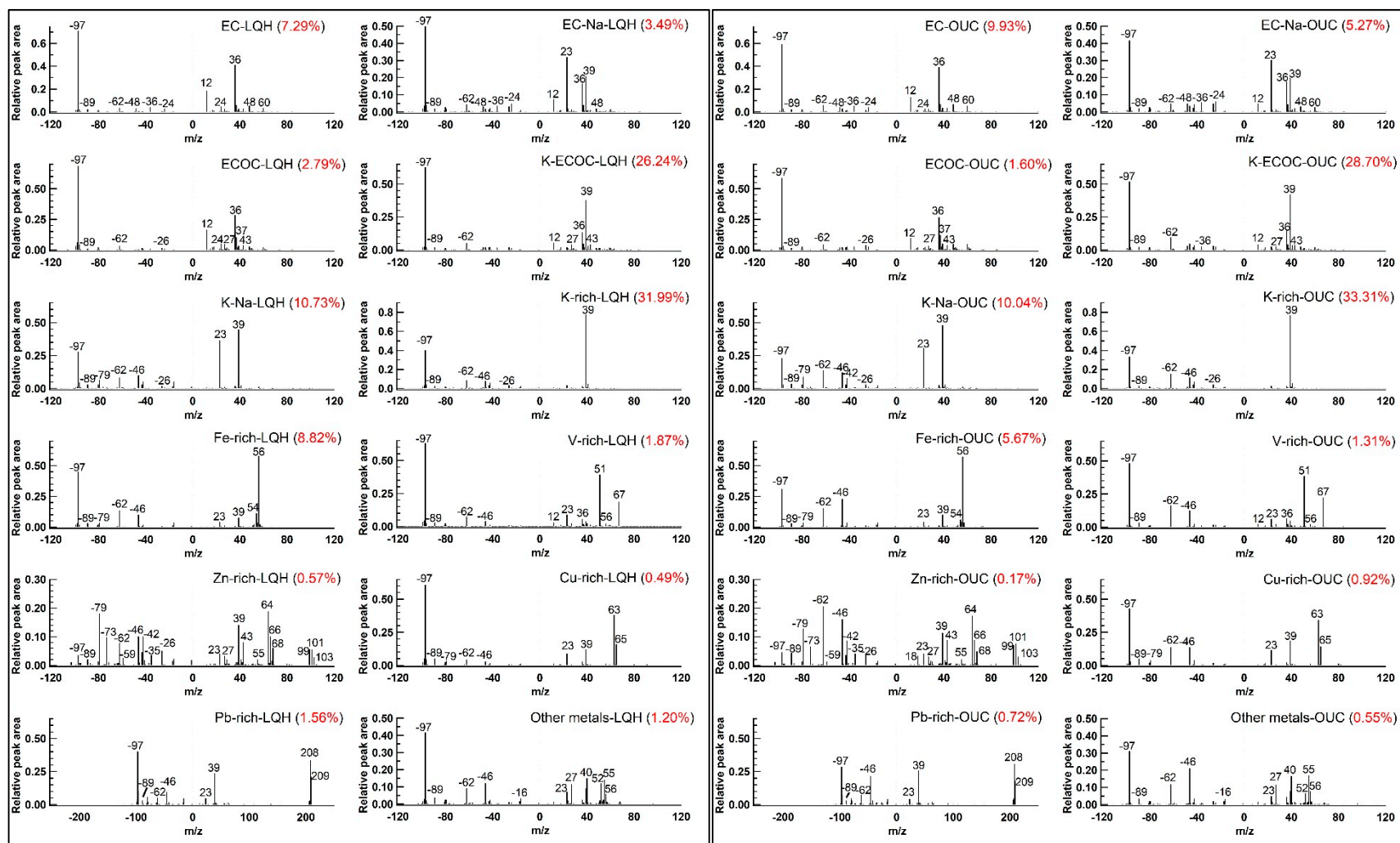


Figure S2. Average mass spectra of 12 major oxalate-containing particle types classified using the Art-2a clustering algorithm.

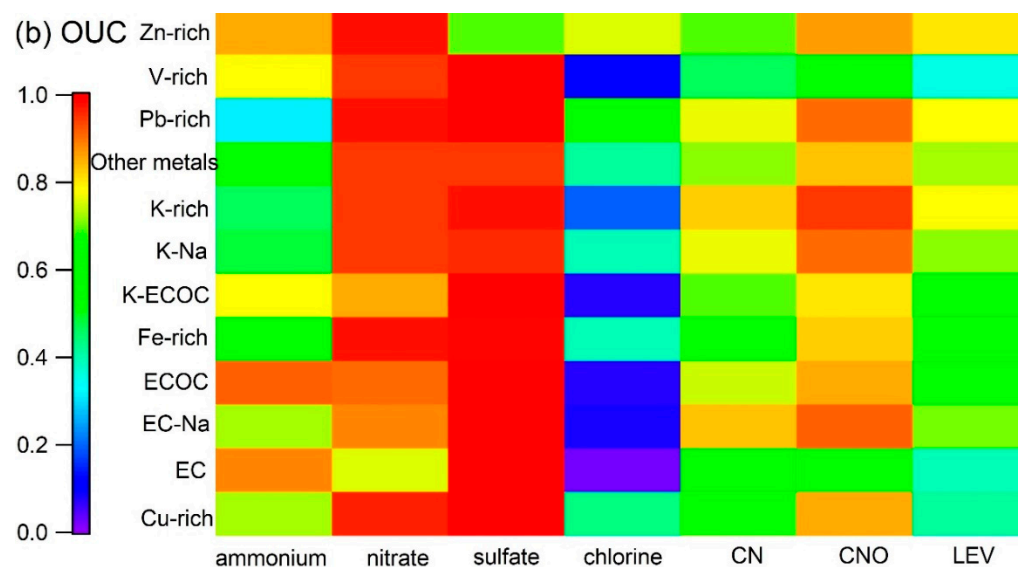


Figure S4. Number fraction of selected ion markers associated with single particle types at (a) LQH and (b) OUC.

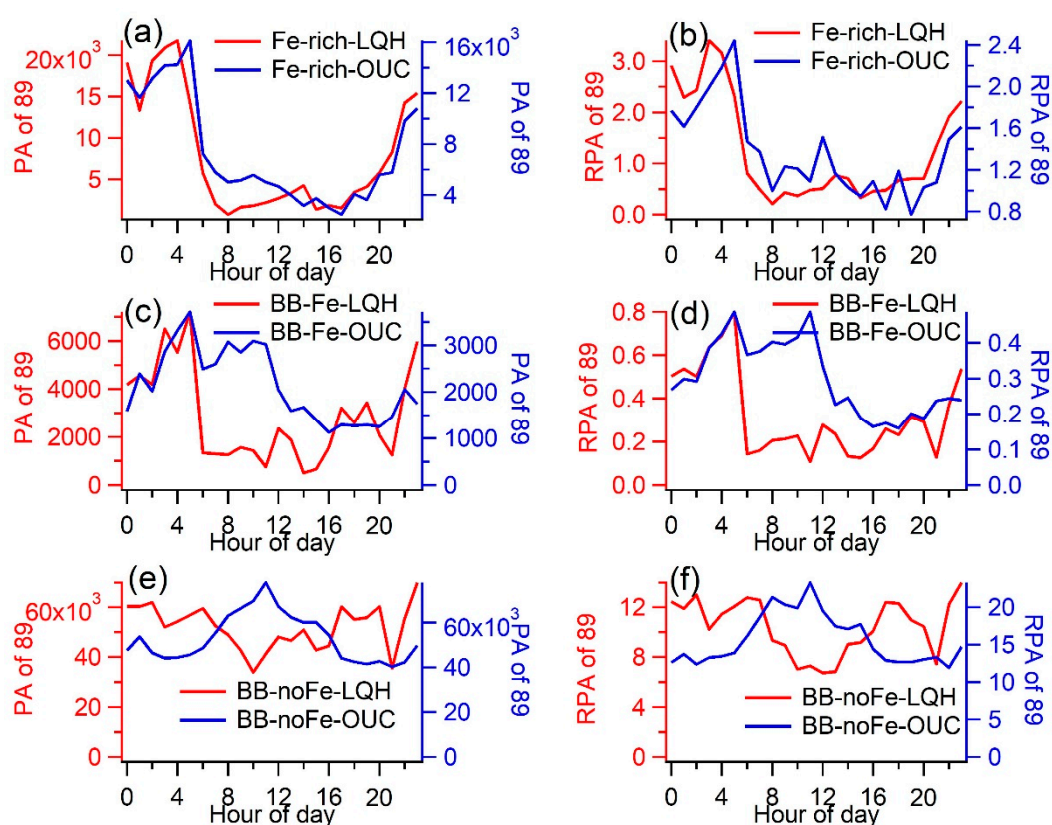


Figure S5. Diurnal variations of oxalate (m/z -89) PA (a), and RPA (b) in Fe-rich particles and oxalate (m/z -89) PA (c), and RPA (d) in BB-Fe particles and oxalate (m/z -89) PA (e), and RPA (f) in BB-noFe particles.

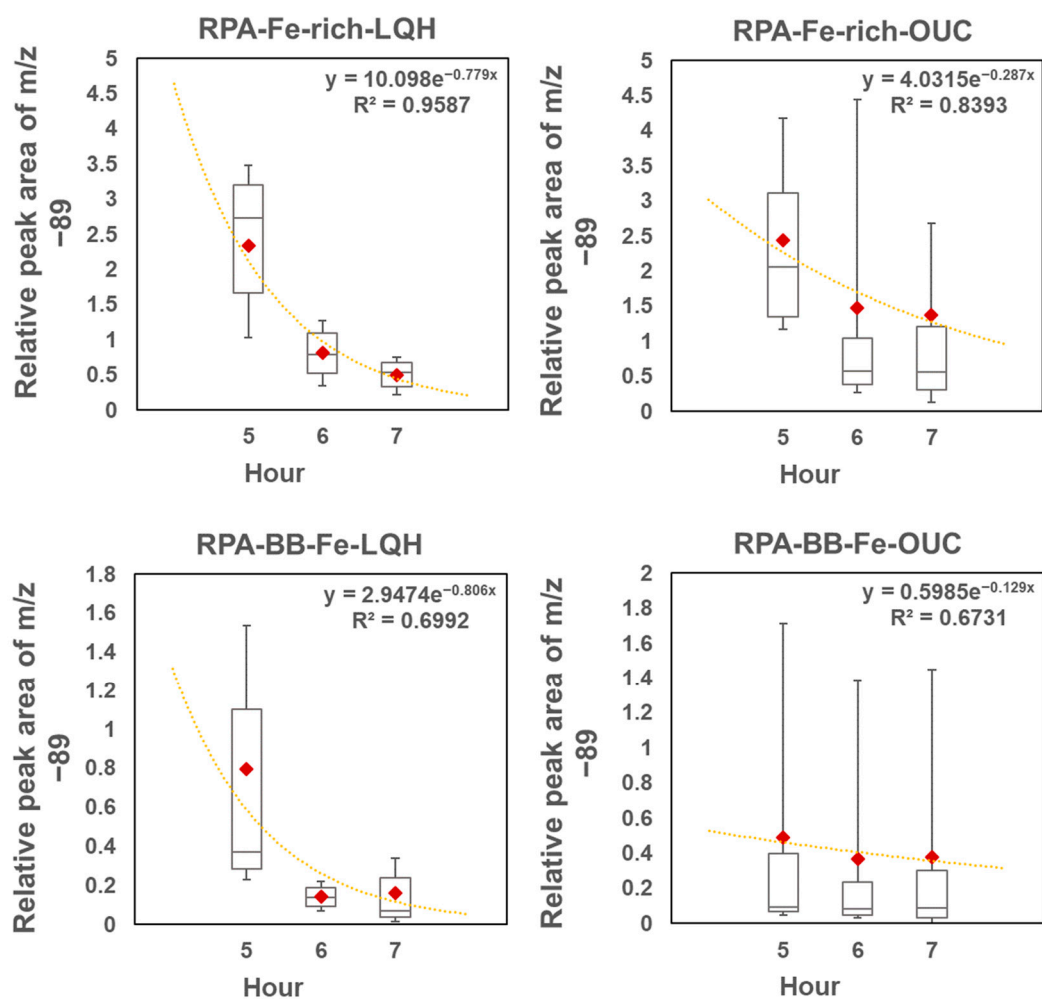


Figure S6. Average decay estimation of oxalate intensity in different oxalate-Fe complexes. (Plotted by particle RPA of m/z -89; box and error bars represent the 10th, 25th, 50th, 75th, and 90th percentiles; and the red diamond represents the mean).

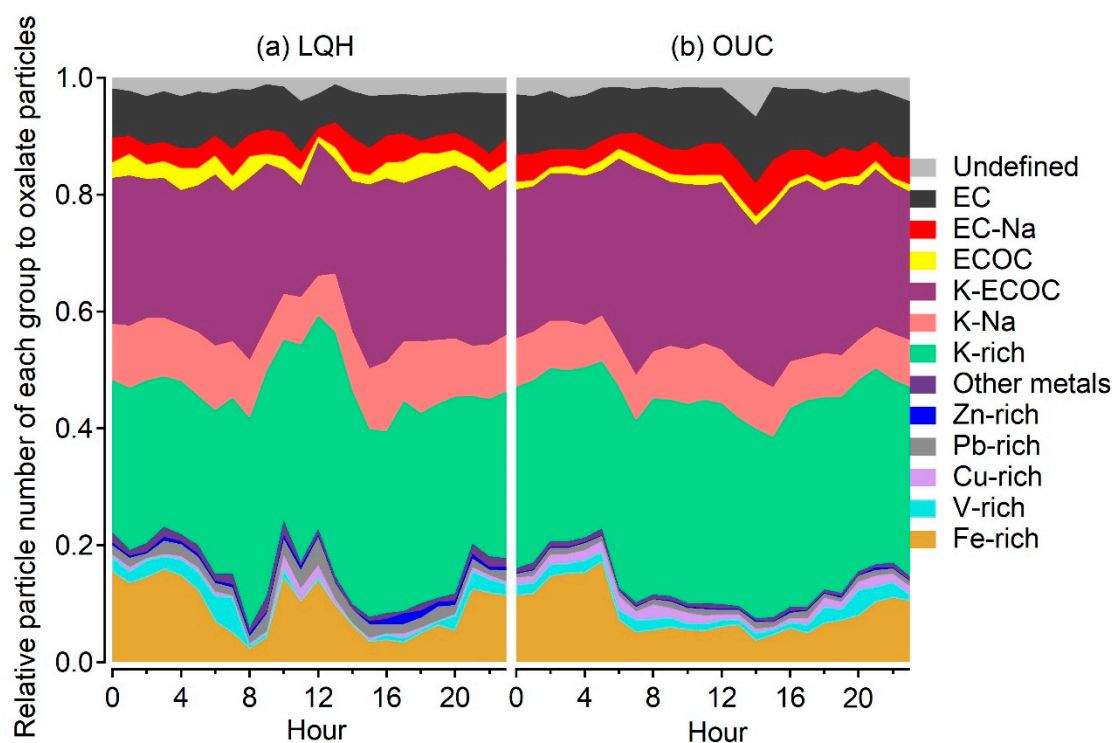


Figure S7. Average diurnal variation in classified oxalate groups (contribution of relative particle number from each classified group to that of the total oxalate particles) at (a) LQH and (b) OUC.

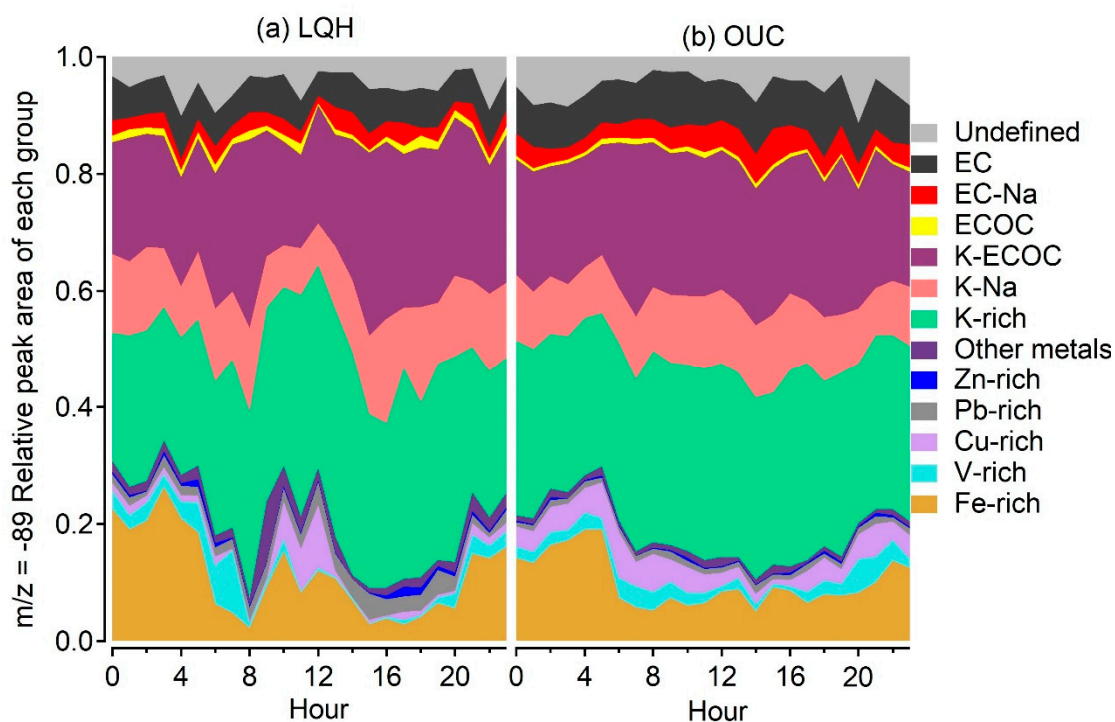


Figure S8. Average diurnal variation in classified oxalate groups (contribution of m/z -89 RPA from each classified group to that of the total oxalate particles) at (a) LQH and (b) OUC.