Supplementary Materials

Table S1 a: Site description from the literature review used for this study

Literature label	Sampling time	Depth of sampling (cm)	KP	Site information	Reference	Categorization
UW	2015	0–10	266.4	upstream of the lead–zinc industrial area (West bank)	Li et al, 2019 [1]	4-Smelting in Songbai
UE	2015	0–10	267.6	upstream of the lead–zinc industrial area (East bank)		4-Smelting in Songbai
MW	2015	0–10	272.8	after the estuary of the Chongling River and in the midstream of the Xiangjiang River (West bank)		4-Smelting in Songbai
ME	2015	0–10	272.8	after the estuary of the Chongling River and in the midstream of the Xiangjiang River (East bank)		4-Smelting in Songbai
DW	2015	0–10	277.5	downstream of an industrial area (West bank)		4-Smelting in Songbai
DE	2015	0–10	278	downstream of an industrial area (East bank)		4-Smelting in Songbai
UW	2015	0–40	266.4	upstream of the lead–zinc industrial area (West bank)	Li and Yang et al, 2019 [2]	4-Smelting in Songbai
UE	2015	0–40	267.6	upstream of the lead–zinc industrial area (East bank)		4-Smelting in Songbai
MW	2015	0–40	272.8	after the estuary of the Chongling River and in the midstream of the Xiangjiang River (West bank)		4-Smelting in Songbai
ME	2015	0–40	272.8	after the estuary of the Chongling River and in the midstream of the Xiangjiang River (East bank)		4-Smelting in Songbai
DW	2015	0–40	277.5	downstream of an industrial area (West bank)		4-Smelting in Songbai
DE	2015	0–40	278	downstream of an industrial area (East bank)		4-Smelting in Songbai
LBTB	2014	0–15	0	in Yongzhou	Chai et al, 2017 [3]	9-Xiangjiang River sediments (literature)
LBTN	2014	0–15	41	in Yongzhou		9-Xiangjiang River sediments (literature)
SBSB	2014	0–15	262.2	Shuikoushan in Hengyang		4-Smelting in Songbai
SBSN	2014	0–15	258	Shuikoushan in Hengyang		4-Smelting in Songbai
SBB	2014	0–15	273.6	Shuikoushan in Hengyang		4-Smelting in Songbai
SBN	2014	0–15	276	Shuikoushan in Hengyang		4-Smelting in Songbai
XWD	2014	0–15	516	Xiawan in Zhuzhou		3-Smelting in Zhuzhou
XWZ	2014	0–15	509	Xiawan in Zhuzhou		3-Smelting in Zhuzhou
YJWD	2014	0–15	528	Yijiawan in Xiangtan		3-Smelting in Zhuzhou
SCJD	2014	0–15	594	Sanchaji in Changsha		6-Urban activities

SCJZ	2014	0–15	597	Sanchaji in Changsha		6-Urban activities
SCJX	2014	0–15	595	Sanchaji in Changsha		6-Urban activities
WCX	2014	0–15	610	Wangcheng in Changsha		6-Urban activities
WCZ	2014	0–15	610	Wangcheng in Changsha		6-Urban activities
XYX	2014	0–15	666	Xiangying in Yueyang		1-Agricultural activities
XYD	2014	0–15	663	Xiangying in Yueyang		1-Agricultural activities
Background value used in this reference			/	from China National Environmental Monitoring Center 1990		7-Detrital inputs
YZ-1	2015	0–15	0	upstream of Yongzhou		9-Xiangjiang River sediments (literature)
HY-1	2015	0–15	272.8	areas with mining and smelting factories in Hengyang		4-Smelting in Songbai
HY-2	2015	0–15	258	areas with mining and smelting factories in Hengyang		4-Smelting in Songbai
HY-3	2015	0–15	266.4	areas with mining and smelting factories in Hengyang		4-Smelting in Songbai
HY-4	2015	0–15	276	areas with mining and smelting factories in Hengyang		4-Smelting in Songbai
XT-1	2015	0–15	524	areas with mining and smelting factories in Hengyang	Liu H et al, 2017 [4]	6-Urban activities
XT-2	2015	0–15	543	areas with mining and smelting factories in Hengyang		6-Urban activities
CS-1	2015	0–15	575	in Changsha		6-Urban activities
CS-2	2015	0–15	579.5	in Changsha		6-Urban activities
CS-3	2015	0–15	597	in Changsha		6-Urban activities
CS-4	2015	0–15	610	in Changsha		6-Urban activities
YY-1	2015	0–15	642	at the mouth of the Xiangjiang River at Dongting Lake		1-Agricultural activities
YY-2	2015	0–15	660.5	at the mouth of the Xiangjiang River at Dongting Lake		1-Agricultural activities
XJ-YZ-1	2015	0–15	20	Shiqishi in Yongzhou		9-Xiangjiang River sediments (literature)
XJ-YZ-2	2015	0–15	58	Laobutou in Yongzhou		9-Xiangjiang River sediments (literature)
XJ-YZ-3	2015	0–15	160	Baishuihekou in Yongzhou		9-Xiangjiang River sediments (literature)
XJ-HY-1	2015	0–15	272.8	Songbaizhen in Hengyang	Liu JJ et al, 2017 [5]	4-Smelting in Songbai
XJ-HY-2	2015	0–15	332	Leishuihekou in Hengyang		9-Xiangjiang River sediments (literature)
XJ-HY-3	2015	0–15	390.6	Mishuihekou in Hengyang		9-Xiangjiang River sediments (literature)
XJ-ZZ-1	2015	0–15	500	Jianninggang in Zhuzhou		3-Smelting in Zhuzhou
XJ-ZZ-2	2015	0–15	506	Baishigan in Zhuzhou		3-Smelting in Zhuzhou
XJ-ZZ-3	2015	0–15	511	Xiawangang in Zhuzhou		3-Smelting in Zhuzhou

XJ-XT-1	2015	0–15	516	Majiahe in Xiangtan		6-Urban activities
XJ-XT-2	2015	0–15	528	Yijiawan inXiangtan		6-Urban activities
XJ-XT-3	2015	0–15	534	downstream of a steel company in Xiangtan		6-Urban activities
XJ-XT-4	2015	0–15	546	Zhubugang in Xiangtan		6-Urban activities
XJ-CS-1	2015	0–15	556	east of Muyun in Changsha		6-Urban activities
XJ-CS-2	2015	0–15	562	west of Muyun in Changsha		6-Urban activities
XJ-CS-3	2015	0–15	570	Pingtangzhen in Changsha		6-Urban activities
XJ-CS-4	2015	0–15	601	Xiangluzhou in Changsha		6-Urban activities
XJ-CS-5	2015	0–15	613	Weishuihekou in Changsha		6-Urban activities
XJ-CS-6	2015	0–15	627	Qiaokouzhen in Changsha		1-Agricultural activities
XJ-YY-1	2015	0–15	636	Zhangshugang in Yueyang		1-Agricultural activities
XJ-YY-2	2015	0–15	653	Xiangyin bridge in Yueyang		1-Agricultural activities
XJ-YY-3	2015	0–15	693	Leishixiang in Yueyang		1-Agricultural activities
Background value used in this reference			/	from Zeng et al. (1982) [6]	Liu JJ et al, 2017 [5]	7-Detrital inputs
S1	2015 and 2016	surface sediments	636	at the mouth of the Xiangjiang River at Dongting Lake	Xie et al, 2017 (in Chinese) [7]	1-Agricultural activities
S19	2015 and 2016	surface sediments	666	in the eastern part of Southern Dongting Lake		1-Agricultural activities
XJ-01	2010	3–5	590	in Changsha		6-Urban activities
XJ-03	2010	3–5	583	upstream of XJ-01, upstream of the city center of Changsha		6-Urban activities
XJ-04	2010	3–5	575	upstream of XJ-03		6-Urban activities
XJ-05	2010	3–5	567	upstream of XJ-04		6-Urban activities
XJ-06	2010	3–5	562	upstream of XJ-05		6-Urban activities
XJ-07	2010	3–5	558	upstream of XJ-06		6-Urban activities
XJ-08	2010	3–5	549	upstream of XJ-07		6-Urban activities
XJ-10	2010	3–5	537	in Xiangtan	Mao et al, 2013a, 2013b [8, 9]	6-Urban activities
XJ-11	2010	3–5	524	upstream of XJ-10, upstream of Xiangtan		6-Urban activities
XJ-12	2010	3–5	520	upstream of XJ-11		3-Smelting in Zhuzhou
XJ-13	2010	3–5	516	upstream of XJ-12		3-Smelting in Zhuzhou
XJ-14	2010	3–5	508	upstream of XJ-13		3-Smelting in Zhuzhou
XJ-15	2010	3–5	505	in Zhuzhou		3-Smelting in Zhuzhou
XJ-16	2010	3–5	501	upstream of XJ-15, upstream of Zhuzhou		3-Smelting in Zhuzhou
XJ-17	2010	3–5	596	downstream of Changsha		6-Urban activities
XJ-18	2010	3-5	602	downstream of Changsha		6-Urban activities

Background value used in this reference			/	background values of soil in Hunan Province	Mao et al, 2013a, 2013b [8, 9]	7-Detrital inputs
X	2010	0–10	/	Xiawangang in Zhuzhou	Zhu et al, 2013 [10]	3-Smelting in Zhuzhou
H	2010	0–10	/	Xiawangang in Zhuzhou		3-Smelting in Zhuzhou
S	2010	0–10	504.9	6 km upriver of F site in the Xiangjiang River		3-Smelting in Zhuzhou
F	2010	0–10	510.9	at the confluence of the Xiangjiang River and Xiawangang in Zhuzhou		3-Smelting in Zhuzhou
W1	2007	0–2	638	Wanhe village, downstream of Changsha	Peng et al, 2011 [11]	1-Agricultural activities
X39	2007	0–2	649	Wanhe village, downstream of Changsha		1-Agricultural activities
Q1	2007	0–2	673	Quyuan village, downstream of Changsha		1-Agricultural activities
Background value used in this reference			/	background value of metals in the river sediments (Li et al. 1986) [12]		7-Detrital inputs
S1	2004	1–5	667	in Dongting lake	Qian et al, 2005 [13]	6-Urban activities
Background value used in this reference			/	background value of soil in China		7-Detrital inputs
B	before 2016	0–10	/	100 m away from the sewage outlet of Xiawangang in Zhuzhou	Jie et al, 2016 [14]	3-Smelting in Zhuzhou
C	before 2016	0–10	/	200 m away from the sewage outlet of Xiawangang in Zhuzhou		3-Smelting in Zhuzhou
Background value used in this reference			/	according to the Environment Quality Report of Hunan Province (2011)	Liang et al, 2015 [15]	7-Detrital inputs
Background value used in this reference			/	background of Hunan Province	Jiang et al, 2013 [16]	7-Detrital inputs
Background value used in this reference			/	in Dongting lake	Li et al, 2013 [17]	7-Detrital inputs
LDR3	2009	0–2	/	west of Loudi	Zhang et al, 2011 [18]	2-Smelting in Loudi
LDR11	2009	0–2	/	near the wastewater treatment plant in Loudi		2-Smelting in Loudi
LDR14	2009	0–2	/	east of Loudi		2-Smelting in Loudi
LDR18	2009	0–2	/	east of Loudi		2-Smelting in Loudi

The sampling sites from Jie et al (2016), Liang et al (2015), Jiang et al (2013), Li et al (2013) and Zhang et al (2011) are not shown on the map (Fig. 1).

Table S1 b: Site description from the 2015–2017 survey (this study)

Label	Sampling time	Depth of sampling (cm)	KP	Site information	Categorization
Mainstream of the Xiangjiang River					
XIA-1	2016	0–10	326	upstream of Hengyang	8-Xiangjiang river sediments (this study)
XIA-2	2016	0–10	388	downstream of Hengyang	8-Xiangjiang river sediments (this study)
XIA-3	2016	0–10	483	upstream of Zhuzhou	8-Xiangjiang river sediments (this study)

XIA-4	2016	0–10	527	downstream of Zhuzhou	8-Xiangjiang river sediments (this study)
XIA-5	2016	0–10	534	downstream of Xiangtan	8-Xiangjiang river sediments (this study)
XIA-6	2016	0–10	586	in Changsha, left bank	8-Xiangjiang river sediments (this study)
Tributaries of the Xiangjiang River at the confluence					
Zheng river	2016	0–10	330	close to the inlet of the Zheng river, near Hengyang	10-Tributary sediments (this study)
Lei river	2016	0–10	335	close to the inlet of the Lei river, near Hengyang	10-Tributary sediments (this study)
Mi river	2016	0–10	385	close to the inlet of the Mi river	10-Tributary sediments (this study)
Lu river	2016	0–10	487	close to the inlet of the Lu river, near Zhuzhou	10-Tributary sediments (this study)
Juan river	2016	0–10	530	close to the inlet of the Juan river, upstream of Xiangtan	10-Tributary sediments (this study)
Lian river	2016	0–10	532	close to the inlet of the Lian river	10-Tributary sediments (this study)
Specific sites, representative of specific inputs					
X1	2015	0–10	/	just downstream of Loudi city	10-Tributary sediments (this study)
X2	2015	0–10	/	downstream of Shuifumiao reservoir and the inlet of the Ce river	10-Tributary sediments (this study)
X3	2016	0–10	/	downstream of Xiangxiang Refractory Clay Ore	10-Tributary sediments (this study)
X4	2016	0–10	/	downstream of Xiangjiang Aluminum plant, near Hunan ferroalloy plant	10-Tributary sediments (this study)
X5	2016	0–10	/	downstream of Hunan ferroalloy plant	10-Tributary sediments (this study)
X6	2016	0–10	/	close to the Lian river	10-Tributary sediments (this study)
X7	2015	0–10	/	downstream of a coal mining district on the Ce river	10-Tributary sediments (this study)
X8	2015	0–10	/	Downstream of a coal mining district on the Ce river	10-Tributary sediments (this study)
X9	2015	0–10	/	downstream of a coal mining district on the Ce river	10-Tributary sediments (this study)
X10	2015	0–10	/	downstream on the Ce river	10-Tributary sediments (this study)
X11	2015	0–10	/	downstream of a gypsum mining district on the Ce river	10-Tributary sediments (this study)
X12	2015	0–10	/	near a Pb-Zn mining district on the Ce river	10-Tributary sediments (this study)
X13	2015	0–10	/	near a Pb-Zn mining district on the Ce river	7-Mining activities (this study)
X14	2016	0–10	/	downstream of the Ce river	10-Tributary sediments (this study)
X15	2016	0–10	/	In the Pb/Zn mining district	7-Mining activities (this study)
X16	2017	0–10	/	upstream of the Lei river	10-Tributary sediments (this study)
X17	2017	0–10	/	on the Lei river	10-Tributary sediments (this study)

X18	2017	0–10	/	on the Lei river	10-Tributary sediments (this study)
X19	2017	0–10	/	on the Lei river	10-Tributary sediments (this study)
X20	2017	0–10	/	on the Lei river	10-Tributary sediments (this study)
X21	2017	0–10	/	tributary of the Lei river, downstream of Chenzhou	10-Tributary sediments (this study)
X22	2017	0–10	/	tributary of the Lei river, upstream of X21	10-Tributary sediments (this study)
X23	2017	0–10	/	tributary of the Lei river, upstream of X18	10-Tributary sediments (this study)
X24	2017	0–10	/	tributary of the Lei river, upstream of X19	10-Tributary sediments (this study)
X25	2017	0–10	/	tributary of the Lei river, downstream of X20	10-Tributary sediments (this study)

Table S2: I_{geo} classes in surface sediments of the Xiangjiang River and its tributaries for the 2015–2016 period (this study). According to Igeo scale, moderate pollution is for Igeo [1–3], heavily pollution for Igeo [3–5] and extreme pollution for Igeo > 5

Site	KP	As	Cd	Co	Cr	Cu	Hg	Ni	Pb	Sb	U	V	Zn
Mainstream of the Xiangjiang River (n = 6)													
XIA-1	326	3	5	1	1	2	3	1	2	2	1	0	3
XIA-2	388	4	4	0	1	2	3	1	2	3	0	0	2
XIA-3	483	3	4	1	1	2	2	1	2	2	1	0	2
XIA-4	527	2	4	1	1	2	2	1	2	2	1	0	2
XIA-5	534	3	5	1	1	2	3	1	2	2	1	0	3
XIA-6	586	2	4	0	1	2	4	1	2	2	0	0	3
Tributaries of the Xiangjiang River at the confluence													
Zheng river	330	1	3	1	1	2	3	1	1	1	0	0	2
Lei river	335	3	5	1	1	2	3	1	3	2	0	0	3
Mi river	385	0	2	0	0	1	1	0	1	0	0	0	0
Lu river	487	1	3	1	1	1	2	1	1	1	0	0	2
Juan river	530	0	3	1	1	1	2	1	1	0	1	0	2
Lian river	532	0	1	0	2	1	5	0	1	0	2	0	1

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