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## Supplemental Material

**Table S1.** Typical volcanic ash wells/sections from Late Ordovician–Early Silurian in Yangtze Block.

**Table S2.** Thickness of the thickest Late Ordovician–Early Silurian bentonite layer in the Yangtze Block.

**Table S3.** Global organic carbon content of main shales from Late Ordovician–Early Silurian.

# Supplemental File S1

Table S1. Typical volcanic ash wells/sections from Late Ordovician–Early Silurian in Yangtze Block

Number	Wells/Sections	Abbreviation	Location	Formation	References
1	Nanbazi	NBZ	Yichang, Hubei	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2003</a>
2	Huanghuachang	HHC	Xuancheng, Anhui	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
3	Gaojiabian	GJB	Zhenjiang, Jiangsu	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
4	Jiuxi	JX	Changde, Hunan	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
5	Luojiang	LJ	Chengkou, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
6	Nanbazi	NBZ	Zunyi, Guizhou	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
7	Wangjiawan	WJW	Yichang, Hubei	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
8	Mingzhong1	MZ1	Chengkou, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Ran et al., 2015</a>
9	Maliu	ML	Ankang, Shaanxi	Wufeng–Longmaxi Formation	<a href="#">Xiong et al., 2017</a>
10	Piwo	PW	Dazhou, Sichuan	Wufeng–Longmaxi Formation	<a href="#">Xiong et al., 2017</a>
11	Liangbai	LBP	Hanzhong, Shaanxi	Wufeng–Longmaxi Formation	<a href="#">Ge et al., 2018</a>
12	Shuanghe2	SH2	Yibin, Sichuan	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
13	JY41-5	JY41-5	—	Wufeng–Longmaxi Formation	<a href="#">Wu, 2018</a>
14	PY1	PY1	—	Wufeng–Longmaxi Formation	<a href="#">Wu, 2018</a>
15	Qiliao2	QL2	Shizhu, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2019</a>
16	Lunshan	LS	Nanjing, Jiangsu	Wufeng–Longmaxi Formation	<a href="#">Yang et al., 2019</a>
17	LY1	LY1	—	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2019</a>
18	Liziping	LZP	Shiyan, Hubei	Wufeng–Longmaxi Formation	<a href="#">Xiong et al., 2019</a>
19	Yanzi	YZ	Wuxi, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Xiong et al., 2019</a>
20	Laolin	LL	Tongren, Guizhou	Wufeng–Longmaxi Formation	<a href="#">Zhang, 2019</a>
21	Tuochuanya	TCY	Tongren, Guizhou	Wufeng–Longmaxi Formation	<a href="#">Zhang, 2019</a>
22	Tiekeng	TK	Tongren Guizhou	Wufeng–Longmaxi Formation	<a href="#">Zhang, 2019</a>
23	Jiaoye-1	JY1	—	Wufeng–Longmaxi Formation	<a href="#">Liu et al., 2019</a>
24	Gantianzui	GTZ	Zunyi Guizhou	Wufeng–Longmaxi Formation	<a href="#">Du et al., 2020</a>
25	Muchanggou	MCG	—	Wufeng–Longmaxi Formation	<a href="#">Du et al., 2020</a>
26	Wangjiawan North	WJWN	Yichang, Hubei	Wufeng–Longmaxi Formation	<a href="#">Du et al., 2020</a>
27	XY5	XY5	—	Wufeng–Longmaxi Formation	<a href="#">Hu et al., 2020</a>
28	Honghuayuan	HHY	Yichang, Hubei	Wufeng–Longmaxi Formation	<a href="#">Hu et al., 2020</a>
29	Wuxing	WX	Hanzhong, Shaanxi	Wufeng–Longmaxi Formation	<a href="#">Liu et al., 2020</a>
30	Chongqing- Guizhou boundary	CQGZ	—	Wufeng–Longmaxi Formation	<a href="#">Liu et al., 2020</a>
31	Anji	AJ	Huzhou, Zhejiang	Wufeng–Longmaxi Formation	<a href="#">Liu et al., 2020</a>
31	Songmutang	SMT	Yiyang, Hunan	Wufeng–Longmaxi Formation	<a href="#">Liu et al., 2020</a>
32	EHD1	EHD1	—	Wufeng–Longmaxi Formation	<a href="#">Lu et al., 2020</a>
33	N211	N211	—	Wufeng–Longmaxi Formation	<a href="#">Lu et al., 2020</a>
34	Huangying	HYXP	Wulong, Chongqing	Wufeng–Guanyinqiao bed	<a href="#">Men et al., 2020</a>
35	Nanzheng	NFP	Hanzhong, Shaanxi	Wufeng–Guanyinqiao bed	<a href="#">Men et al., 2020</a>
36	Shuanghui	SHP	Guangyuan, Sichuan	Wufeng–Guanyinqiao bed	<a href="#">Men et al., 2020</a>
37	YY1	YY1	—	Wufeng–Longmaxi Formation	<a href="#">Tang et al., 2020</a>

38	YY6	YY6	—	Wufeng–Longmaxi Formation	<a href="#">Tang et al., 2020</a>
39	YY7	YY7	—	Wufeng–Longmaxi Formation	<a href="#">Tang et al., 2020</a>
40	Lu-A	Lu-A	—	Wufeng–Longmaxi Formation	<a href="#">Tang et al., 2020</a>
41	SY-1	SY-1	—	Wufeng–Longmaxi Formation	<a href="#">Yang et al., 2020</a>
42	Xujiaba	XJ	Wuxi, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Zan et al., 2020</a>
43	Mingzhong2	MZ2	Chengkou, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Zan et al., 2020</a>
44	Huadi 1	HD1	Guang 'an, Sichuan	Wufeng–Longmaxi Formation	<a href="#">Ge, 2020</a>
45	Fenghuang	FH	Youyang, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Ge, 2020</a>
46	Xiema	XM	Xiangyang, Hubei	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2020</a>
47	J11-4	JY11-4	—	Wufeng–Longmaxi Formation	<a href="#">Du et al., 2021</a>
48	XD2	XD2	—	Wufeng–Longmaxi Formation	<a href="#">Ge et al., 2021</a>
49	YT3	YT3	—	Wufeng–Longmaxi Formation	<a href="#">Shen et al., 2021</a>
50	XY-1	XY-1	—	Wufeng–Longmaxi Formation	<a href="#">Zan et al., 2021</a>
51	Jienietuo	JNT	Liangshan, Sichuan	Wufeng–Longmaxi Formation	<a href="#">Zhang et al., 2021</a>
52	Lvcongpo	LCP	Enshi, Hubei	Wufeng–Longmaxi Formation	<a href="#">Zhang et al., 2021</a>
53	JY143-5	JY143	—	Wufeng–Longmaxi Formation	<a href="#">Zhao et al., 2021</a>
54	Tianlin	TL	Luzhou, Sichuan	Wufeng–Longmaxi Formation	<a href="#">Dong et al., 2022</a>
55	JY11	JY11	Fuling, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Lu et al., 2022a</a>
56	YY2	YY2	Enshi, Hubei	Wufeng–Longmaxi Formation	<a href="#">Lu et al., 2022b</a>
57	Wangjiawan(GSSP)	WJW(GSSP)	Yichang, Hubei	Wufeng–Longmaxi Formation	<a href="#">Lu et al., 2022b</a>
58	XD No.2	XD No.2	—	Wufeng–Longmaxi Formation	<a href="#">Men et al., 2022</a>
59	Qiliao1	QL1	—	Wufeng–Longmaxi Formation	<a href="#">Qiu et al., 2022</a>
60	Shaunghe1	SH1	Yibin, Sichuan	Wufeng–Longmaxi Formation	<a href="#">Qiu et al., 2022</a>
61	Tianba	TB	Ankang, Shaanxi	Wufeng–Longmaxi Formation	<a href="#">Qiu et al., 2022</a>
62	Chengkou	CK	Chengkou, Chongqing	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2022</a>
63	W213	W213	—	Wufeng–Longmaxi Formation	<a href="#">This study</a>
64	W214	W214	—	Wufeng–Longmaxi Formation	<a href="#">This study</a>
65	L204	L204	—	Wufeng–Longmaxi Formation	<a href="#">This study</a>
66	L205	L205	—	Wufeng–Longmaxi Formation	<a href="#">This study</a>
67	N222	N222	—	Wufeng–Longmaxi Formation	<a href="#">This study</a>

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Table S2. Thickness of the thickest Late Ordovician-Early Silurian bentonite layer in the Yangtze Block

Number	Wells/Sections	Abbreviation	Thickness of Thickest Bentonite/cm	Formation	References
1	Nanbazi	NBZ	2	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2003</a>
2	Huanghuachang	HHC	2	Wufeng–Longmaxi Formation	<a href="#">Su et al., 2009</a>
3	Anji	AJ	10	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2015</a>
4	Qiliao	QL2	10	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
5	Gaolu	GL	5	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
6	Datianba	DTB	10	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
7	Hongyanxi	HYX	12	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
8	Xintian	XT	12	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
9	Guanwu	GW	10	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
10	Bailu	BL	10	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
11	Xiema	XM	15	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
12	Guanyinqiao	GYQ	8	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
13	Shuanghe	SH	40	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2018</a>
14	Maoba	MB	2	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2019</a>
15	Bayu	BY	1	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2019</a>
16	Huangcao	HC	0.2	Wufeng–Longmaxi Formation	<a href="#">Wang et al., 2019</a>
17	Xingwen	XW	10	Wufeng–Longmaxi Formation	<a href="#">Li et al., 2019</a>
18	Liziping	LZP	8	Wufeng–Longmaxi Formation	<a href="#">Xiong et al., 2019</a>
19	Yanzi	YZ	3	Wufeng–Longmaxi Formation	<a href="#">Xiong et al., 2019</a>
20	Liangbai	LBP	2	Wufeng–Longmaxi Formation	<a href="#">Ge et al, 2019</a>
21	Wuxing	WX	10	Wufeng–Longmaxi Formation	<a href="#">Ge et al, 2019</a>
22	Lunshan	LS	11	Wufeng–Longmaxi Formation	<a href="#">Yang et al, 2019</a>
23	Songmutang	SMT	1	Wufeng–Longmaxi Formation	<a href="#">Liu et al, 2020</a>
24	PY-1	PY1	2	Wufeng–Longmaxi Formation	<a href="#">Liu et al, 2020</a>
25	JY-1	JY1	2	Wufeng–Longmaxi Formation	<a href="#">Liu et al, 2020</a>
26	Gaojiabian	GJB	139.5	Wufeng–Longmaxi Formation	<a href="#">Tang et al, 2020</a>
27	Jiuxi	JX	71.1	Wufeng–Longmaxi Formation	<a href="#">Tang et al, 2020</a>
28	XY-1	XY-1	9.6	Wufeng–Longmaxi Formation	<a href="#">Zan et al, 2021</a>
29	YT3	YT3	5	Wufeng–Longmaxi Formation	<a href="#">Shen et al, 2021</a>
30	JY11	JY11	2	Wufeng–Longmaxi Formation	<a href="#">Lu et al, 2022a</a>
31	Chengkou	CK	11	Wufeng–Longmaxi Formation	<a href="#">Wang et al, 2022</a>
32	W213	W213	2	Wufeng–Longmaxi Formation	<a href="#">This study</a>
33	W214	W214	0.8	Wufeng–Longmaxi Formation	<a href="#">This study</a>
34	L204	L204	2	Wufeng–Longmaxi Formation	<a href="#">This study</a>
35	L205	L205	1	Wufeng–Longmaxi Formation	<a href="#">This study</a>
36	N222	N222	2	Wufeng–Longmaxi Formation	<a href="#">This study</a>

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Table S3. Global organic carbon content of main shales from Late Ordovician–Early Silurian

Number	Region	Geologic period	Formation	Original carbon seal stock/t	References
1	Murzuq Basin, Libya	Early Silurian	Tanezzuft Fm.	23537070067.50	<a href="#">Fello et al., 2006</a>
2	Tarim basin	Late Ordovician	Yingan-Saergan Fm.	211833481179.38	<a href="#">Qiao et al., 2016</a>
3	Yangtze region	Early Silurian	Longmaxi Fm.	4504064735770.90	<a href="#">Zou et al., 2019</a>
4	Yangtze region	Late Ordovician	Wufwng Fm.	78428595963.30	<a href="#">Zou et al., 2019</a>
5	Ghadames Basin in the Libya, Algeria and Tunisia region	Early Silurian– Middle Silurian	Tanezzuft Fm.	3129540853972.50	<a href="#">Albriki et al., 2022</a>
6	Southern Iran and the Arabian Plate	Early Silurian	Tanf-Mudawwara-Akka-Qusaiba- Dadas-Sarchahan-Sahmah Fm.	8183729932939.28	<a href="#">Rahmani et al., 2022</a>
SUM				16131134669892.90	

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