Appendix 1.

Basin	Well	Strata	Depth(m)	Composition (%)						$\delta^{13}C$(‰)			Data from
				CH_4	C_2H_6	C_3H_8	iC_4	nC_4	other	CH_4	C_2H_6	C_3H_8	
Sichuan	JIAO13	$T_3x^{2.4}$	2964-3341	94.66	2.35	0.6	0.11	0.1	0.71	-38.9	-27	-25.6	Dai[29]
	JIAO23	T_3x^{2}	3337-3338	93.17	3.24	1.85			1.85	-38.4	-27.2	-24.6	
	JIAO47	T_3x^{6}	2746-2746	89.6	6.22	2.02	0.39	0.97	2.41	-39.5	-25.1	-21.7	
	JIAO48	T_3x^{6}	3383-3395	87.53	6.26	2.65	0.41	0.48	3.06	-40.6	-26.4	-23.6	
	JIAO49	$T_3x^{2.4}$	3394-3455	94.01	3.12	0.72	0.15	0.13	0.87	-37.6	-27.1	-23.7	
	JIAO53	T_3x^{4}	3017-3110	92.95	4.93	1.14	0.2	0.24	1.34	-40.1	-27.4	-24.6	
	MO85	T_3x^{2}	2095-2097	91.37	6.06	1.29	0.31	0.25	1.6	-42.3	-27.9	-24.6	
	SUI8	T_3x^{2}	2265-2284	86.27	7	2.33	0.48	0.43	2.81	-41.4	-27.3	-22.7	
	JIN2	$T_3x^{2.4}$	3074-3390	91.57	5.72	1.6	0.16	0.32	1.76	-38.4	-26.3	-22.9	
	JIN17	T_3x^{2}		92.2	5.88	1.07	0.2	0.2	1.43	-38.9	-25	-23.4	
	GA1	T_3x^{6}		90.14	6.66	1.87	0.36	0.33	2.23	-39.3	-27.3	-25.1	
	GA101	T_3x^{6}		88.63	6.17	1.69	0.34	0.31	2.03	-38.2	-26.2	-25.1	
	GA106	T_3x^{4}	2506-2512	94.16	4.78	0.49	0.09	0.07	0.58	-37.8	-25.7	-24.7	
	GA11	T_3x^{6}		95.86	2.03	0.44	0.1	0.08	0.54	-37.1	-27.4	-22.7	
	GA12	T_3x^{4}		91.04	5.68	1.19	0.26	0.21	1.45	-42.2	-25.7	-22.5	
	GA128	T_3x^{4}	2322-2327	94.31	4.33	0.54	0.2	0.07	0.74	-37.7	-25.2	-23.3	
	GA13	T_3x^{4}		87.79	5.21	1.03	0.21	0.14	1.24	-42.2	-24.5	-21.4	
	GA15	T_3x^{6}		87.57	7.4	2.68	0.48	0.56	3.16	-42.4	-27.8	-25.9	
	GA2	T_3x^{6}		88.02	6.62	1.95	0.39	0.4	2.34	-38.7	-26.6	-25.2	
	GA3	T_3x^{4}		93.31	3.37	0.41	0.07	0.04	0.48	-37.7	-24.2	-22.1	
	GA5	T_3x^{4}		94.07	4.04	0.67	0.14	0.1	0.81	-37.2	-25	-23.7	
	GA7	T_3x^{6}		88.79	6.95	1.86	0.32	0.35	2.18	-42.5	-28	-24.2	
	XI20	T_3x^{4}		90.84	6.06	1.55	0.33	0.38	1.88	-42.2	-28.2	-25.2	
	XI51	T_3x^{4}		90	5.71	1.88			1.88	-40.8	-26.7		
	LS1	T_3x^{2}		91.88	5.92	1.22	0.21	0.22	1.43	-40.5	-27.4	-24.5	
	BM2	T_3x^{2}		95.97	2.45	0.32	0.06	0.04	0.38	-37.6	-21.8	-18.8	
	BM7	T_3x^{4}		87.44	6.9	2.5	0.62	0.77	3.12	-40.5	-24.3	-20	

SH2	T_3x^3		92.38	5.06	0.81	0.19	0.12	1	-38.9	-23.4	-19.4
PL1	T_3x^4		96.77	1.93	0.23	0.05	0.03	0.28	-33.8	-22.7	-22.8
PL10	T_3x	3672	96.78	2.34	0.33	0.13		0.46	-33.7	-21.7	-22.7
PL12	T_3x^2		96.87	1.81	0.33	0.05	0.03	0.38	-33.5	-21.9	-21.1
PL1-2	T_3x	3465	96.62	2.24	0.21	0.06		0.27	-34.3	-22.7	-22.8
PL1-3	T_3x	3513	96.62	2.24	0.21	0.06		0.27	-33.8	-22.4	-22
PL3	T_3x	3710	97.14	1.98	0.24	0.08		0.32	-33.3	-21.7	-21.2
PL6	T_3x	3650	96.81	2.37	0.31	0.11		0.42	-33.5	-21.7	-22.6
PL6-1	T_3x	3764	97.15	2.23	0.23	0.07		0.3	-33.6	-22	-22.6
PL8	T_3x	3594	97.16	2.01	0.24	0.09		0.33	-33.6	-21.6	-21.6
PL9	T_3x^4		96.32	2.51	0.41	0.07	0.03	0.48	-34.8	-22	-20.8
DX5	T_3x	3292	97.31	2.19	0.28	0.08		0.36	-32.7	-20.7	-21.6
CH127	T_3x^2	4566	98.58	0.5	0.05	0.01		0.06	-31	-23.6	
CG561	T_3x^4		93.89	4.08	0.57	0.13	0.08	0.7	-39.4	-22	-19.3
CG561	T_3x^2		97.13	0.99	0.1	0.01	0.01	0.11	-31.6	-28.1	-31.5
CH127	T_3x^2		96.9	0.78	0.08	0.01	0.01	0.09	-31.2	-25.9	-26
CH137	T_3x^2		96.74	0.84	0.1	0.02	0.02	0.12	-31.2	-24.4	-26.2
CH138	T_3x^2		94.13	3.69	0.79	0.16	0.13	0.95	-31.1	-27.1	
CH148	T_3x^2		97.41	1.13	0.26	0.01	0.01	0.27	-39.4	-22	-19.3
CX96	T_3x^5	2625-2630	95.36	2.95	0.74	0.6	0.23	1.34	-35.9	-22.9	-26.6
CX94	T_3x^4	3412	93.19	5.99	0.47	0.18		0.65	-35.3	-24.6	
CX96	T_3x^5	628	97.26	1.81	0.45	0.12		0.57	-36.8	-26.9	
CHUAN35	T_3x^4	3970	91.89	6.36	0.51			0.51	-38.9	-24.3	-21.2
CHUAN93	T_3x^4	2625-2630	88.75	4.02	1.31	0.15	0.22	1.46	-35	-24.4	-21.6
CHUAN96	T_3x^5	3356	90.32	7.45	1.2	0.16	0.22	1.36	-38.9	-26	-22.3
CX37	T_3x^4		93.34	3.77	0.69	0.22	0.18	0.91	-36.1	-23	-25.5
CX93	T_3x^4		94.75	3.13	0.61	0.11	0.12	0.72	-33.2	-23.7	-21.2
CX94	T_3x^4		87.22	6.4	2.36	0.17	0.39	2.53	-35.3	-24.6	
CX560	T_3x^4		97.24	2	0.21	0.03	0.02	0.24	-33.7	-20.8	-20.6
LIAN116	T_3x^4		95.99	2.44	0.31	0.06	0.05	0.37	-33.3	-21.5	-21.8
LIAN150	T_3x^2		96.95	0.74	0.08	0.01	0.01	0.09	-31	-28.1	-27.3

	XIN11	T_3x^2		97.26	1.32	0.13	0.03	0.02	0.16	-32.2	-23.4	-19.5	
	XIN2	T_3x^2		97.37	0.91	0.08	0.01	0.01	0.09	-31.3	-27.8	-28	
	XIN202	T_3x^2		96.69	0.77	0.07	0.01	0.01	0.08	-31.7	-28.1		
	XIN3	T_3x^2		97.31	0.96	0.09	0.01	0.01	0.1	-31.2	-28.1	-25.1	
	XIN851	T_3x^2		97.37	0.83	0.09	0.01	0.01	0.1	-30.3	-27.1		
	XIN853	T_3x^2		97.07	0.79	0.08	0.01	0.01	0.09	-31.8	-26.9	-25.7	
	XIN856	T_3x^2		97.19	0.86	0.07	0.01	0.01	0.08	-30.8	-27	-26.5	
	XIN882	T_3x^4		95.58	2.76	0.61	0.15	0.15	0.76	-33.4	-22.1	-20.6	
	XIN884	T_3x^4		95.65	2.73	0.52	0.13	0.11	0.65	-33.6	-22.1	-21.4	
	XC22	T_3x^4		95.73	2.93	0.32	0.05	0.04	0.37	-33.4	-21.2	-20.6	
	CF125	T_3x^4		95.98	2.38	0.54	0.16	0.11	0.7	-33.8	-21.6	-20.3	
	CF125	T_3x^4		94.99	3.49	0.66	0.21	0.14	0.87	-35	-24	-20.9	
	CF563	T_3x^4		95.6	2.28	0.33	0.06	0.05	0.39	-35.2	-21.5	-19.8	
	FG1	T_3x^4		91.98	5.39	1.39	0.12	0.08	1.51	-38.4	-25.3	-21.4	
	ZHONG29	T_3x^4	2269-2361	87.86	6.53	2.1	0.6	0.83	2.7	-34.8	-24.8	-23.7	
	ZHONG31	T_3x^2	2522-2590	91.74	5.44	1.45	0.35	0.67	1.8	-36.4	-25.6	-24	
	ZHONG34	T_3x^2	2373-2409	90.71	5.53	1.65	0.31	0.36	1.96	-36.1	-26	-23.4	
	ZHONG37	T_3x^2		90.44	5.83	1.62	0.37	0.33	1.99	-38	-24.4	-25.9	
	ZHONG39	T_3x^2	2423-2461	87.82	6.36	2.7	0.93	1.38	3.63	-36.9	-25.6	-23.2	
	ZHONG9	T_3x^2		90.3	5.94	1.67	0.91		2.58	-36.3	-26.2	-24.1	
	WEN16	T_3x^2	4487-4575	97.08	2.11	0.24	0.62	0.01	0.86	-35.3	-24.2		
	WEN4	T_3x^3	3792-3697	92.64	5.24	0.95	0.2	0.13	1.15	-37	-24.1	-19.9	
	WEN9	T_3x^2	4496-4258	94.06	3.69	0.69	0.17	0.11	0.86	-34.8	-23.8	-19.2	
	WC1	T_3x^4		95.96	3.14	0.25			0.25	-33.9	-21.4	-21	
	TONG1	T_3x^2	2314-2428	82.34	10.1	4.03	0.82	0.83	4.85	-41.3	-27	-24.2	
	TA2	T_3x^2	4331-4489	93.51	4.49	0.84	0.16	0.05	1	-37.5	-25.2		
	SH2	T_3x^3		92.38	5.06	0.81	0.19	0.12	1.08	-38.9	-23.4	-19.4	
Ordos	SHAN16	P_1s	2936-2940	85.84	0.99	0.11	0.01	0.01	10.95	-33.5	-25.3	-25.8	Dai[29]
	SHAN19	P_2x	3171-3176	94.91	1.41	0.14	0.02	0.02	3.2	-33.5	-24.9	-24.5	
	SHAN41	P_1s	3100-3104	95.02	3.06	0.45	0.05	0.05	1.16	-33.5	-24.6	-25	
	SHAN46	P_1s	3214-3218	85.8	7.67	2.07	0.49	0.38	2.53	-33.5	-22.7	-21.3	

SHAN65	P_2x	3149-3154	95.74	2.54	0.29	0.03	0.04	1.26	-33.5	-23.5	-25.5
SHAN67	P_1s	3618-3623	94.36	3.39	0.47	0.09	0.07	1.59	-33.5	-22.2	-21.9
SHAN68	P_1s	3535-3540	90.97	5.91	1.11	0.25	0.16	4.17	-33.6	-29.3	-27.8
SHAN83	P_1s	2939-2945	93.32	3.39	0.45	0.17	0.07	6.64	-33.6	-20.8	-19.6
SHAN118	P_1s^2	2857-2864	94.04	3.41	0.54	0.08	0.09	1.83	-33.2	-25.8	-24.4
SHAN141	P_1s^2	2797-2828	94.12	3.4	0.5	0.06	0.07	1.85	-33.7	-26.3	-24.3
SHAN142	P_1s^2	2800-2814	94.24	3.37	0.49	0.06	0.07	1.76	-32.4	-26.1	-24.9
SHAN143	P_1s^2	2795-2812	93.91	3.65	0.58	0.1	0.11	1.61	-33.6	-26	-24.4
SHAN165	P_2x	3103-3134	93.17	3.46	0.6	0.1	0.09	2.58	-33	-24	-24.5
SHAN167	P_2x	3118-3126	92.33	4.21	0.74	0.13	0.12	2.45	-33.8	-23.5	-23.4
SHAN178	P_2x	2991-2997	92.37	4.32	0.78	0.13	0.12	2.28	-34.2	-23.7	-23.7
SHAN209	P_1s^2	2939-2942	93.61	3.82	0.62	0.09	0.09	1.76	-33.1	-24.2	-23.1
SHAN211	P_1s^2	2903-2928	94.07	3.16	0.49	0.09	0.09	2.05	-32.4	-25.8	-23.8
SHAN215	P_1s^2	2738-2744	93.6	3.79	0.55	0.08	0.08	2.2	-32.9	-26	-24
SHAN217	P_1s^2	2779-2789	94.9	2.65	0.35	0.05	0.05	2	-31.6	-26	-24.1
SHAN231	P_2x	3127-3147	93.55	4	0.72	0.13	0.16	1.36	-33.3	-24.4	-25.4
SHAN240	P_2x	3158-3161	92.56	4	0.69	0.11	0.1	2.54	-33.3	-24.3	-24.6
SHAN241	P_2x	3153-3196	92.7	3.99	0.68	0.11	0.11	2.41	-33.3	-24.1	-24.2
SHAN243	P_1s	3042-3080	90.85	5.46	1.03	0.18	0.17	2.31	-33.3	-24	-23.6
YU24-13	P_1s^2	2859-2873	94.24	3.27	0.49	0.07	0.07	1.87	-33.3	-26.3	-24.7
YU26-12	P_1s^2	2822-2862	94.25	3.31	0.49	0.06	0.07	1.82	-32.9	-26.7	-24.6
YU27-11	P_1s^2	2871-2892	94.15	3.27	0.53	0.08	0.08	1.89	-33.4	-26.8	-26.5
YU28-12	P_1s^2	2818-2872	94.25	3.25	0.47	0.06	0.07	1.89	-32.4	-27	-24.8
YU35-8	P_1s	2932-2936	95.32	2.67	0.34	0.07	0.06	1.52	-32.6	-24.9	-23.7
YU36-9	P_1s^2	2917-2938	93.85	3.64	0.57	0.1	0.11	1.72	-32.9	-26.3	-24.2
YU37	P_1s^2	2881-2891	94.66	2.93	0.42	0.06	0.06	1.87	-31.8	-26.1	-24.6
YU42-3	P_1s^2	2931.0-2950.2	95.21	2.47	0.34	0.04	0.04	1.91	-31.2	-26.1	-24.4
YU43	P_1s^2	2681-2684	97.47	1.72	0.17			0.64	-34	-30.9	
YU43-5	P_1s^2	2921-2937	95.04	2.9	0.33	0.03	0.02	1.67	-32.8	-26.4	-23.8
YU43-6	P_1s^2	2836-2869	94.55	3.12	0.4	0.05	0.05	1.83	-32.2	-25.8	-24
YU43-7	P_1s^2	2818-2831	95.02	3	0.42	0.06	0.06	1.71	-32.9	-23.6	-23.1

YU43-8	P_1s^2	2792-2827	95.02	2.65	0.36	0.05	0.05	1.89	-32.7	-25.6	-24.6	
YU43-10	P_1s^2	2781-2798	94.94	2.7	0.35	0.05	0.05	1.92	-31.9	-26.4	-23.2	
YU44-7	P_1s^2	2784-2792	95.65	2.65	0.32	0.04	0.04	1.32	-32.8	-25.5	-23.8	
YU44-9	P_1s^2	2756-2762	94.73	2.98	0.4	0.05	0.05	1.79	-33.1	-24.9	-23.7	
YU45-10	P_1s^2	2727-2736	94.26	3.39	0.51	0.07	0.08	1.7	-30.2	-26.1	-23.8	
YU47	P_1s^2	2694-2697	95.37	3.03	0.47	0.07	0.07	0	-32.3	-26		
YU54	P_1s^{2-3}	2617-2620	94.84	3.31	0.58			0	-33.3	-27.8		
TAI6		2538	96.03	3.09	0.41			0	-36.8	-26.9		
ZHAO4	P_2x	3979-3018	90.7	5.46	1.09	0.21	0.21	2.05	-33.3	-23.7	-23	
WU19-5	P_2x	3248-3266	92.79	3.9	0.64	0.1	0.09	2.48	-33.4	-23.7	-24.7	
WU19-8	P_2x	3108-3162	92.18	3.96	0.68	0.13	0.13	2.91	-33.4	-24	-25.2	
WU22-7	P_2x	3120-3142	92.51	4.1	0.69	0.11	0.11	2.48	-33.4	-23.7	-24.2	
WU24-5	P_1s	3206-3210	92.77	4.21	0.63	0.09	0.09	2.21	-33.4	-23.5	-24.9	
G01-9	P_2x	3038-3053	93.46	3.92	0.54	0.07	0.07	1.94	-33.4	-23.1	-24.8	
G03-10	P_2x	3028-3035	93.03	3.97	0.6	0.09	0.09	2.22	-33.4	-23.2	-24.5	
SU1井	P_2x	3350-3354	92.24	4.16	0.81	0.18	0.14	2.35	-34.2	-22.2	-22.1	
SU6井	P_2x	3320-3329	95.17	1.87	0.4	0.07	0.07	2.42	-33.5	-24	-24.7	
SU14井	P_2x	3503-3506	96.37	1.66	0.4	0.13	0.09	1.35	-32.5	-23.2	-23.8	
SU20井	P_2x	3442-3472	92.42	4.82	0.87	0.15	0.16	1.52	-33	-24.4	-24.7	
SU33-18	P_2x	3290-3296	93.83	4.09	0.84	0.13	0.15	0.91	-32.3	-25.2	-23.8	
SU36-13	P_2x	3312-3352	90.89	5.26	1.11	0.18	0.2	2.15	-33.4	-24.7	-24.4	
SU38-14	P_2x	3322-3373	89.96	5.9	1.32	0.21	0.23	2.23	-33.8	-24.4	-25	
SU39-17	P_2x	3291-3335	90.72	5.47	1.07	0.18	0.2	2.24	-33.7	-24.5	-25	
SU40-14	P_2x	3322-3336	90.65	5.57	1.12	0.18	0.18	2.17	-34.1	-24	-24.5	
SU40-16	P_2x	3276-3295	90.31	5.29	1.17	0.21	0.25	2.67	-32.6	-24.9	-25.2	
TAO5	P_2x	3272-3275	91	4.81	0.92	0.16	0.15	2.61	-33.1	-23.6	-23.7	
TAP6	P_2x	3362-3368	93.4	2.76	0.36	0.04	0.46	2.86	-29	-25	-27	
SHUANG10	C_3t	2388-2392	91.67	4.97	0.99	0.17	0.16	2.13	-37.5	-24.6	-22.6	
FU5	C_3t	2123-2126	84.93	1.45	0.75	0.12	0.11	12.61	-33.5	-32.1	-27.7	
SHI2	P_2s		96.68	0.73	0.09	0.02	0.06	2.48	-29.2	-30.7	-31.9	Feng et al,[13]
SHI6	P_2x		96.32	0.76	0.07	0.01	0.01	2.83	-28.1	-30.5	-30.4	

SHI36	P_2x	93.9	0.43	0.02	5.65	-29.2	-35.4	
SHI37	C_2b	96.6	0.42	0.03	2.76	-30.8	-37.1	-37.3
SHI38	P_2x	95.91	0.42	0.03	3.64	-28.2	-36.1	
SHI48	C_2b	94.89	0.52	0.04	4.54	-29.9	-36.5	
SHI209	P_2x	89.9	0.42	0.02	9.65	-28.9	-34.7	
SHI210	P_2x	93.39	0.43	0.03	5.89	-29.7	-34.9	-34.5
SHI212	P_2x	93.24	0.41	0.02	6.32	-29.7	-35.1	-34.5
SHI217	P_2s	96.3	0.62	0.05	3.03	-27.6	-34.9	
SHI225	P_2x	93.87	0.43	0.03	5.68	-28.8	-34.1	
SHI231	P_2x	93.14	0.4	0.02	6.43	-29.4	-34.4	-34
YAN127	P_2x	93.45	0.43	0.03	6.09	-29.3	-33.7	-30.7