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THE LATEST RESULT OF CARBON ISOTOPE ANOMALIES NEAR THE F/F BOUNDARY AT THE XIANGTIAN SECTION, GUANGXI, CHINA

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The F/F section, which is located at Xiangtian, Guangxi, China, is well developed. The top part of the Frasnian stage is represented by the Xiangtian Member (D) which is composed of carbonaceous limestone and calcareous shale, and underlain by the Liujian Formation, composed of siliceous limestone. The lowest part of the Famennian stage is represented by the Wuzhizhan Formation (E-G) composed of thin-bedded grey nodular limestone (H. F. Hou, 1988). Intensive sampling was carried out across the boundary and the results of the isotope analyses are shown in Table 1 and Figure 1. Clearly the $\delta^{13}\text{C}$ values at this F/F boundary section can be classified into three parts.

The lowest part of the carbon isotope curve (Xiangtian Member) shows values from samples D-1b to D-12 which were collected from the Frasnian strata below the boundary. The average $\delta^{13}\text{C}$ values is about 1‰ with subtle changes of about 1.5‰. At the top of the Frasnian Stage, the $\delta^{13}\text{C}$ values suddenly become negative near the boundary within a 3cm thick interval though the lithology does not change. That means that the $\delta^{13}\text{C}$ variation is independent of the lithology.

The middle part of the curve (the base of the Wuzhishan Formation) is represented by samples E-0 to E-6C which were gathered from a 20cm thick marlstone near the boundary belonging to the base of the Famennian Stage. The $\delta^{13}\text{C}$ values are mostly negative, ranging from 0.10‰ to -6.57‰ with an average of -3.0‰, showing a complex peak of negative values consisting of a large negative peak with two secondary ones. This behavior is similar to the curve of oxygen isotopes at the deep-sea drilling hole v28-238 in that a large signal is overprinted with some secondary "noise", reflecting violent changes in the environment. This complex peak is also quite similar to the anomalous peak of carbon isotopes at the P/T boundary in Guangyuan, Sichun, China.

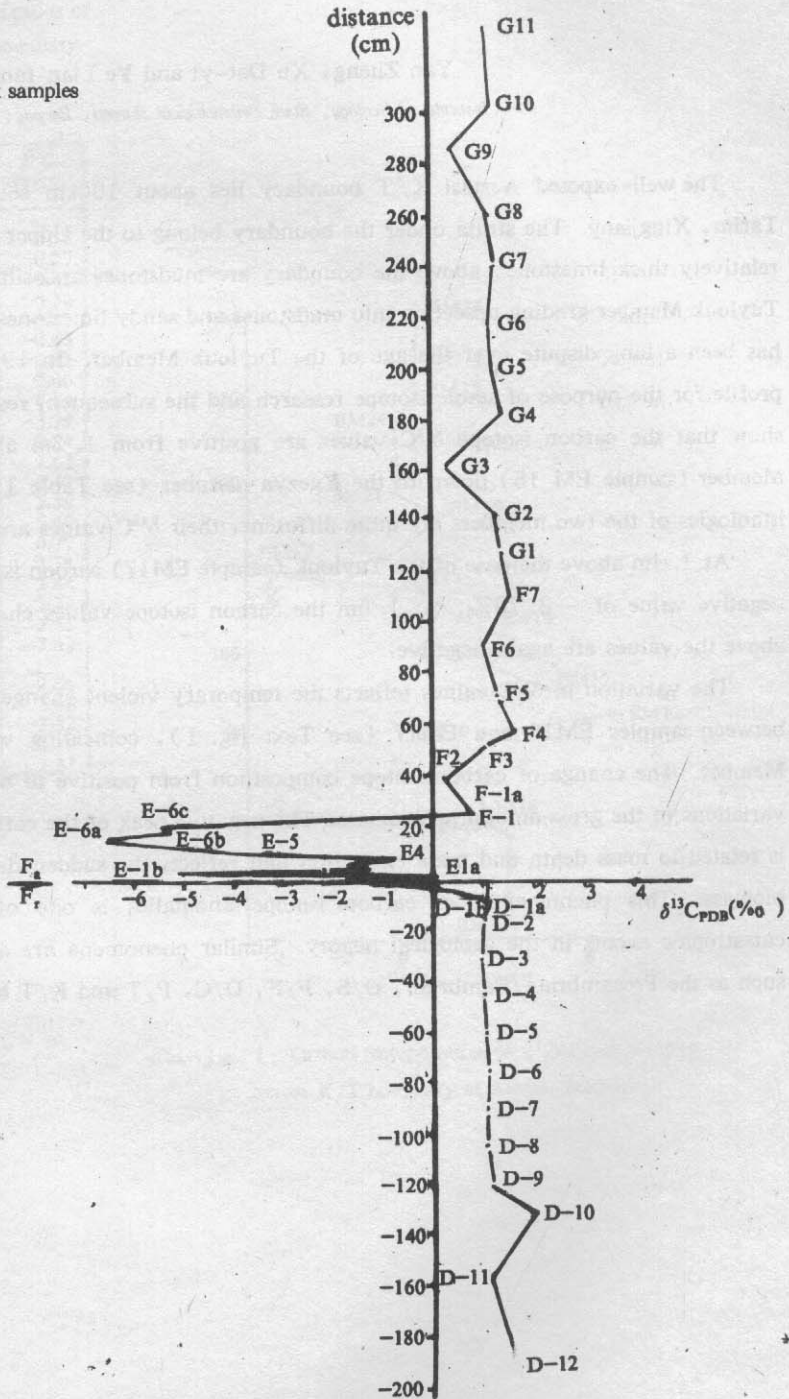
The upper part of the curve shows values of the samples F1 to F7 and sand samples G1 to G11 which come from the F and G members of the Famennian Wuzhishan Formation above the boundary. The sampling covered a 3.5m thick layer consisting of a variety of lithologies ranging from brecciated limestone and nodular limestone to mud limestone in contrast to relatively constant carbon isotope values with an average of about 1‰, which is similar to the $\delta^{13}\text{C}$ values of the Xiangtian Member (D) and the Liujian Formation (C) of Frasnian age below the F/F boundary.

It can be seen that the carbon isotope anomalies across the F/F boundary at the Xiangtian Section in Guangxi are similar to anomalies across other boundaries such as the K/T, P/T, D/C, O/S and

Precambrian/Cambrian implying violent changes of the geological environment and of the sea water which deviated from original "normal" sea water, thus leading to mass extinctions. This conclusion is based on the carbon isotope record which reflects variations in the geological environment and in the amount of biomass regardless of lithologic facies.

Tab. I Carbon isotope ratios of rock samples near F/F boundary at Xiangtian

		distance (cm)	samples (No.)	$\delta^{13}C$ (PDB)
Famennian Stage	Wuzhishan Formation	357	G 11	1.03
		312	G 10	1.20
		287	G 9	0.40
		262	G 8	1.18
		242	G 7	1.25
		217	G 6	1.14
		202	G 5	1.20
		182	G 4	1.39
		162	G 3	0.27
		142	G 2	1.28
	127	G 1	1.38	
	112	F 7	1.56	
	92	F 6	1.07	
	72	F 5	1.33	
	57	F 4	1.63	
	52	F 3	1.04	
	40	F 2	0.27	
	30	F 1a	0.67	
	25	F 1	0.91	
	20	E 6c	-5.35	
18	E 6b	-5.34		
16	E 6a	-6.57		
10	E 5	-3.33		
8	E 4	-0.78		
6	E 3	-1.73		
5	E 2	-1.33		
4	E 1c	-2.20		
3	E 1b	-5.07		
1	E 1a	0.10		
0	E 0	-2.09		
Frasnian Stage	Xiangtian Member	-3	D 1b	0.43
		-7	D 1a	1.14
		-15	D 2	1.08
		-30	D 3	0.95
		-45	D 4	0.98
		-60	D 5	1.04
		-75	D 6	1.11
		-90	D 7	1.06
		-105	D 8	1.09
		-120	D 9	1.15
		-132	D 10	2.05
		-157	D 11	1.15
-189	D 12	1.69		



Text-fig. 1 Carbon isotope ratios of whole rock samples across F/F boundary at Xiangtian Section