Dolomite of Uppermost Ordovician Wufeng Formation, Southwestern China: Implications for marine sediments of white smoker?

Xiaolong Hu[1,4], Zhiqiang Shi[12*], Qing Chen[3], He Yin[1], Lu Han[1], Inigo Müller[4], Martin Ziegler[4]

1 Institute of Sedimentary Geology, Chengdu University of Technology, Chengdu, 610059, Sichuan, China

2 State Key Laboratory of Oil and Gas Reservoir Geology and Exploration, Chengdu University of Technology, Chengdu 610059, Sichuan, China

3 Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing, 210008, the People's Republic of China

4 Department of Earth Sciences, Utrecht University, Utrecht, Netherlands

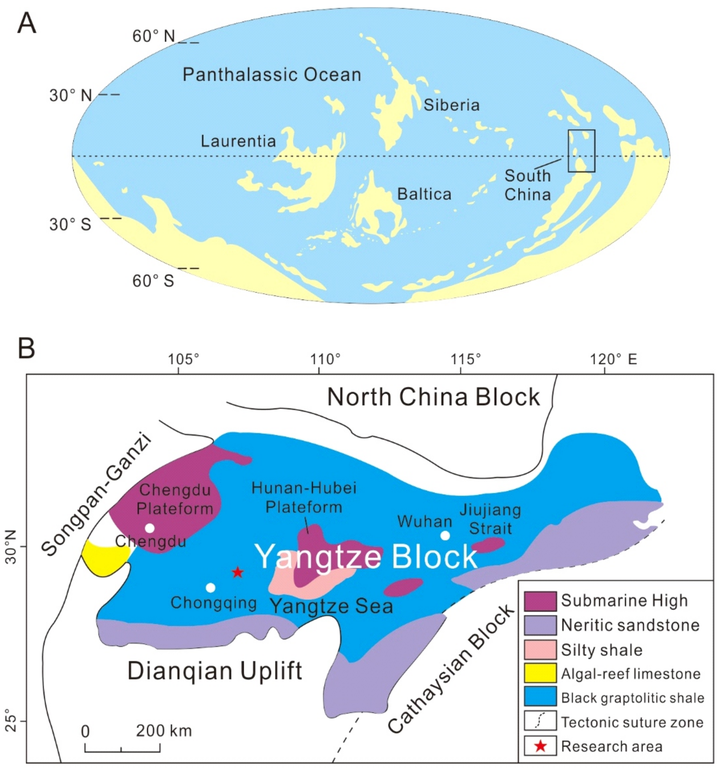
Email: x.hu@uu.nl

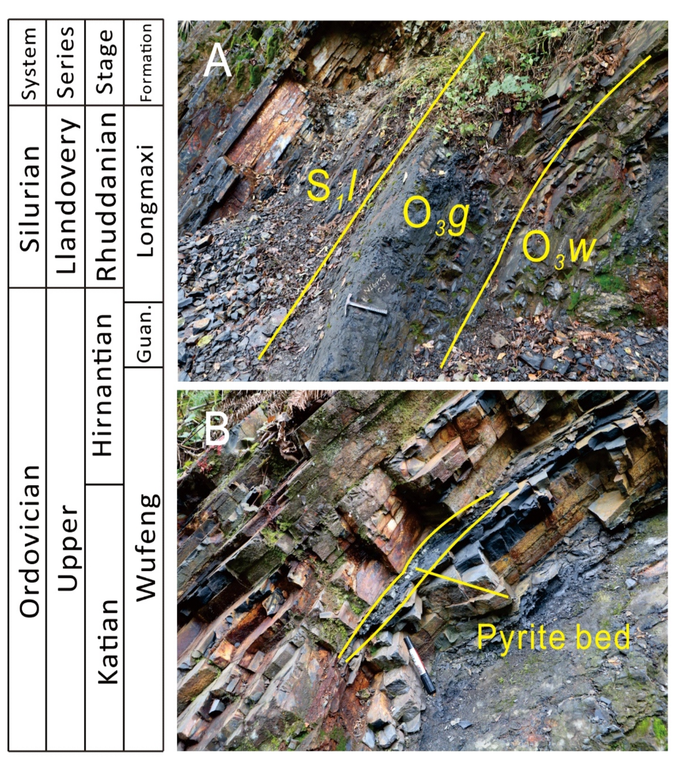
Introduction

The interval from Ordovician to Silurian is a very important period during the whole geological history. The Hirnantian Glaciation, Mass Extinction and Hirnantian isotope curves excursion (HICE) happened during this period.

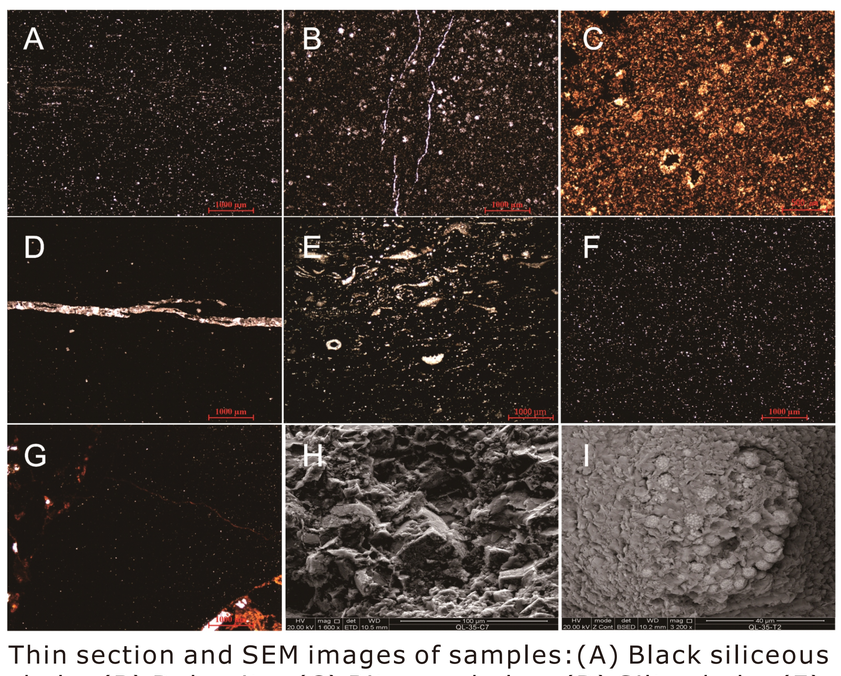
The strata deposited across the glaciation corresponding to the upper Ordovician Wufeng Formation and lower Silurian Longmaxi Formation are widely developed in south China upper-middle Yangtze Platform. A stratum of shelly limestone at the upper most of Wufeng Formation, which contains a lot of Hirnantia-Dalmanitina Fauna named Guanyinqiao Member was deposited during Hirnantian (445.2~443.8 Ma)(Nie et al., 2017). The lithology of sedimentary rocks vary from black shales (Wufeng Formation) to shelly limestone (Guanyinqiao Member).

Some researchers found the special dolomite occurred in the shelly limestone and studied the geochemistry feature of it in Canada (Ahm et al., 2017). However, the dolomites in this stratum are unusual in China and few scholars noticed that which have special significance. In this research, we are trying to unravel the origin of dolomite, reconstruct paleoclimate and biochemical processes and try to discuss the relationships with the mass extinction by studying the Guanyinqiao Member dolomite.





Results



Thin section and SEM images of samples:(A) Black siliceous shale. (B) Dolomite. (C) Bitumen holes. (D) Silty shale. (E) Hirnantia Fauna debris. (F) Black siliceous shale. (G) Irony slaggy bed. (H) Dolomites. (I) Strawberry-like pyrite.

1-Micritic to powder crystallized dolomites and the holes filled with asphalt can be seen in dolostone. 2-Dolomite formed in different diagenetic stages due to the different size of dolomite crystals. 3-The Hirnantian $\delta^{13}C_{carb}$ isotopic curve shows strongly positive excursion in Guanyinqiao Member (~12‰) and decrease at the end of Hirnantian stage. The $\delta^{13}C_{org}$ isotopic values of dolostone indicate slightly positive shift and strongly shifted (~2‰) under the dolostone.

Preliminary results of clumped isotope mesurements

Sample Series	$\delta^{13}C$ (VPDB)	$\delta^{18}O$ (VPDB)	Δ47-T (°C)	$\delta^{18}O$(VSMOW)-fluid source
QL-6	-3.04	-11.06	68	-4.4
QL-7	-3.12	-10.90	159	5.8
QL-8	-2.50	-11.26	68	-4.6

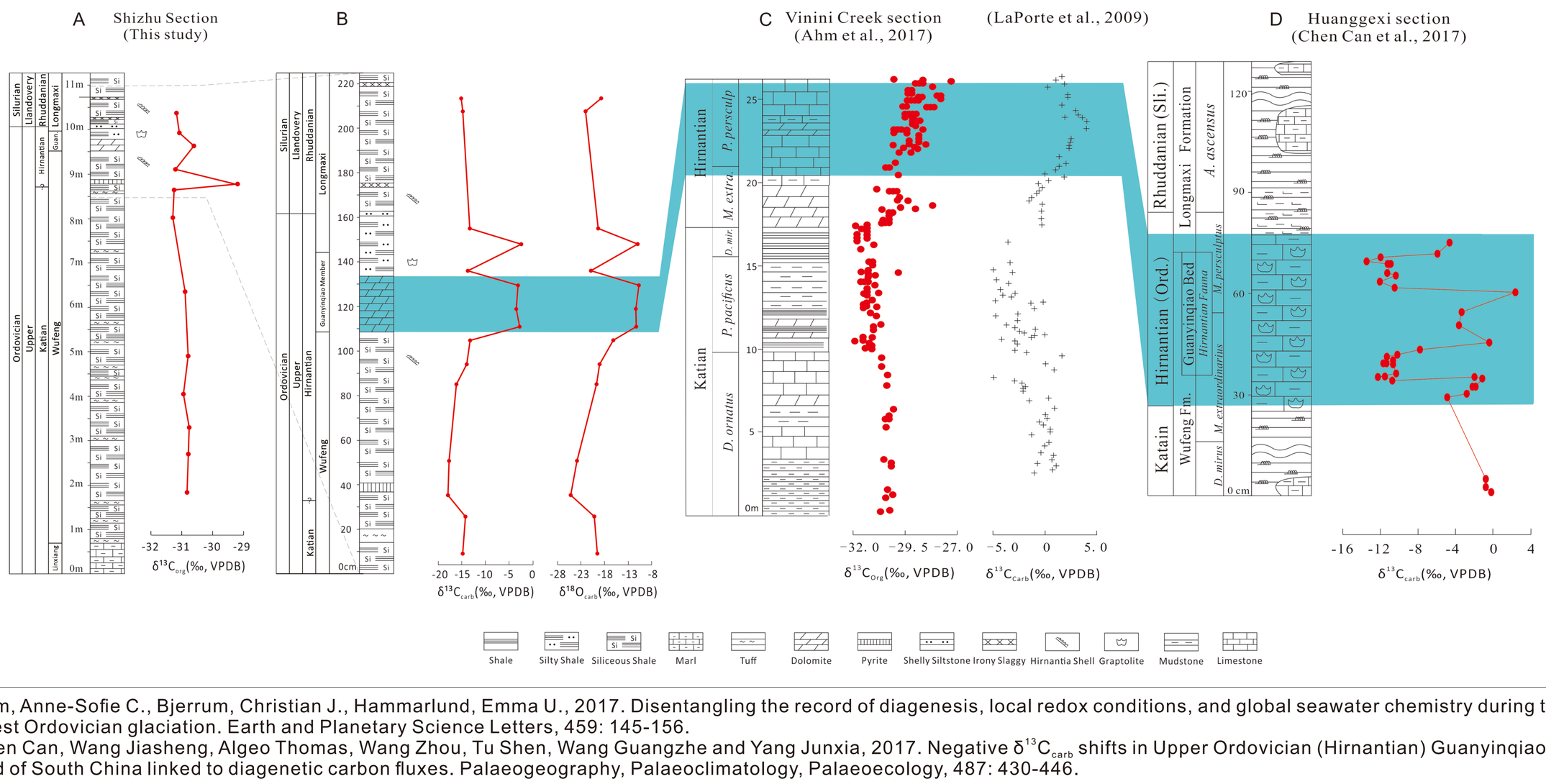
Analyzed dolomite samples formed from a rather hot fluid source with meteoric oxygen isotope composition. However, as we analyzed only few replicates the preliminary results come with a big uncertainty, especially the hot T estimates of QL-7. More replicates are required.

Acknowledgements

This study was supported by National Natural Science Foundation of China (No. 41572085). Professor Xu Jinyong and Lecturer Feng Mingshi are also thankful for their help during experimenting.

Anticipated outcomes

1-Micritic to powder crystallized dolomites are developed in the uppermost Ordovician Guanyinqiao Member. 2-The $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$ isotopes of the dolostone in Guanyinqiao Member show positive excursion and are coincide with the corresponding strata in North America (Ahm et al., 2017) and Middle Yangtze Region (Chen et al., 2017). 3-The dolomite correspond to a diagenetic phase that formed later during burial.



Ahm, Anne-Sofie C., Bjerrum, Christian J., Hammarlund, Emma U., 2017. Disentangling the record of diagenesis, local redox conditions, and global seawater chemistry during the latest Ordovician glaciation. Earth and Planetary Science Letters, 459: 145-156.

Chen Can, Wang Jiasheng, Algeo Thomas, Wang Zhou, Tu Shen, Wang Guangzhe and Yang Junxia, 2017. Negative $\delta^{13}C_{carb}$ shifts in Upper Ordovician (Hirnantian) Guanyinqiao Bed of South China linked to diagenetic carbon fluxes. Palaeogeography, Palaeoclimatology, Palaeoecology, 487: 430-446.