

THE ORGANIC PETROLOGY OF GRAPTOLITES FROM CHONGQING, CHINA: INSIGHTS FROM REFLECTANCE CROSS-PLOT ANALYSIS

Q. Luo^{1*}, J. Hao¹, N. Zhong¹

¹ China University of Petroleum, Beijing, China.

*) Corresponding author: qingyong.luo@cup.edu.cn.

The organic-rich shales of the Wufeng–Longmaxi Formations (Ordovician–Silurian) are one of the most important hydrocarbon source rocks and shale gas exploration targets in China (Dai et al., 2014; Luo et al., 2016). Graptolites are abundant in these shales, which provide an opportunity for the study of their organic petrology and the thermal maturity of these shales (Chen et al., 2000; 2004; 2005; Luo et al., 2016). Optical microscope was employed to describe the optical characteristics and coalification of the graptolites and the shape of graptolite reflectance indicating surface (GRIS), and to determine the thermal maturity of the Wufeng–Longmaxi formations.

The graptolite fragments show two types of surface morphology: granular and non-granular. Non-granular graptolites was the most common type observed, and the non-granular graptolites display a stronger anisotropy and higher reflectance under polarized reflected light compared to granular graptolites. The strong positive correlation between the maximum reflectance (R_{\max}) and bireflectance of graptolites indicates that the graptolites display stronger anisotropy with maturation (Figure 1). A linear coalification path of graptolite fragments was observed in the studied sediments. A remarkable decrease in the minimum reflectance (R_{\min}) values of graptolites was observed when R_{\max} exceeds 6%. The samples with lower thermal maturity ($R_{\max} < 2\%$) tend to be more biaxial neutral, whereas higher rank samples display biaxial negative characteristics. The GRIS shape will become more oblate with maturation. The shales of the Wufeng–Longmaxi Formations from southeastern Chongqing and Wuxi areas are post mature and in the dry gas zone, whereas samples from Chengkou area are still at the end of the oil window or the onset of the wet gas zone.

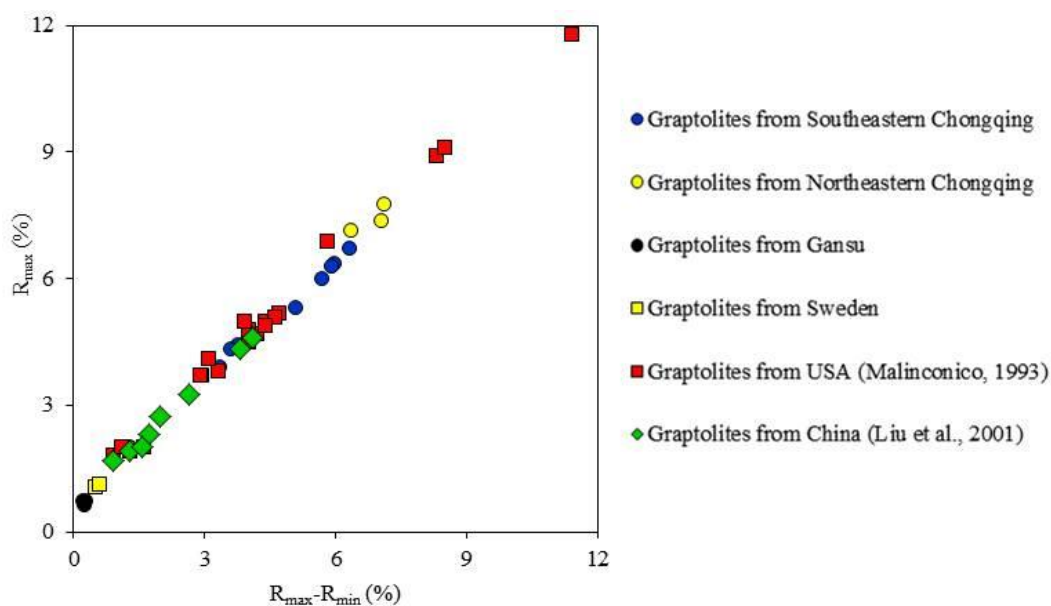


Figure 1 The relationship between the maximum reflectance and bireflectance of the graptolites. Note the strong positive correlation between R_{\max} and $R_{\max} - R_{\min}$.

REFERENCES

- Chen, X., Rong, J., Charles, M., David, H., Fan, J., Zhan, R., Zhang, Y., Li, R., Wang, Y., 2000. Late Ordovician to earliest Silurian graptolite and brachiopod biozonation from the Yangtze region, South China, with a global correlation. *Geological Magazine* 137, 623-650.
- Chen, X., Rong, J., Li, Y., Boucot, A., 2004. Facies patterns and geography of the Yangtze region, South China, through the Ordovician and Silurian transition. *Palaeogeography, Palaeoclimatology, Palaeoecology* 204, 353-372.
- Chen, X., Rong, J., Michael, M., David, S., Charles, M., Fan, J., 2005. Patterns and processes of latest Ordovician graptolite extinction and recovery based on data from South China. *Journal of Paleontology* 79, 824-861.
- Dai, J., Zou, C., Liao, S., Dong, D., Ni, Y., Huang, J., Wu, W., Gong, D., Huang, S., Hu, G., 2014. Geochemistry of the extremely high thermal maturity Longmaxi shale gas, southern Sichuan Basin. *Organic Geochemistry* 74, 3-12.
- Luo, Q., Zhong, N., Dai, N., Zhang, W., 2016. Graptolite-derived organic matter in the Wufeng–Longmaxi Formations (Upper Ordovician–Lower Silurian) of southeastern Chongqing, China: Implications for gas shale evaluation. *International Journal of Coal Geology* 153, 87-98.
- Liu, D., Wang, L., Du, G., Hu, B., 2001. Study of the reflectance cross-plot of optical structure of graptolites in china. *Geoscience*, 15(3): 321-325 (in Chinese with English abstract).
- Malinconico, M.A.L., 1993. Reflectance cross-plot analysis of graptolites from the anchi-metamorphic region of northern Maine, USA. *Organic geochemistry*, 20(2): 197-207.