Geochemical characteristics comparison of artificially expelled and residual oil from Tasmanian oil shale, Australia

Fenting Wu [1,2], Xiaomin Xie [1,2*], Yaohui Xu [1,2], Jingwen Lin [1,2], Lei Zhang [1,2], Jin Xu [3], Zhongliang Ma [3]

1.Hubei Key Laboratory of Petroleum Geochemistry and Environment , School of Resources and Environment, Yangtze University, Wuhan, Hubei 4301002, China
2.Key Laboratory of Exploration Technologies for Oil and Gas Resources,Yangtze University, Ministry of Education, Wuhan, Hubei 4301002, China
3. Wuxi Institute of Petroleum Geology, Sinopec Petroleum Exploration and Development Research Institute, Wuxi, Jiangsu 214100, China
Corresponding author: xiaominxie2019@sina.com

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Introduction

In order to study the geochemical variations of expelled and residual oil, Tasmanian algae rich oil shale (ERo= 0.5%) from Australia had been conducted for artificial maturation experiment. The expelled oil (collected out from the autoclave) and residual oil (extracted from the residual shales in the autoclave) had been separately collected for gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS) studies.

Results and discussion

Extracts from the original oil shale showed distributed in the range n-C_{14}- n-C_{29} with n-C_{16} dominant, and the OEP value = 0.87, did not demonstrate odd-to-even homologues preveilance. The maturity parameters, sedimentary environment and oil-source correlation from GC-MS results showed that: (1) The ratios of Pr/Ph, Ph/C_{18} and Pr/C_{17} in native oil shale and residual oil demonstrated reductive environment, while these parameters in expelled oil showed a mixed source area (Fig.1a); (2) The maturity-related biomarkers (e.g C_{29}20S/(20S+20R), $C_{29}\beta\beta/(\alpha\alpha+\beta\beta)$ and Ts/(Ts+Tm)) indicated that residual and expelled oils were mature at 350°C. The values for maturity-related biomarkers in residual oil have increased with the temperature (To) for T ≤ 350 °C, while the correlation was poor in expelled oil. There was no correlation between the index parameters of residual and expelled oils with the simulation temperature >350 °C. (Fig.1b, c, d, e, f); (3) The distribution patterns of C_{27}, C_{28} and C_{29} steranes were analyzed for oil-source correlation. The results showed that the pattern varied from reverse "L" type at 300~320°C, to slight asymmetric "V" type at 340~375°C, and "L" type at 400 °C (Fig.2). The patterns were similar in residual and expelled oils with the same maturation temperature. To this extend, the sterane distribution pattern could be effectively applied for oil-source correlation analysis with same maturity, while showed differences with different maturity even from the same source rocks. Therefore, maturity needs to be emphasized for molecular compounds analysis (Wu et al., 2021). These results were obtained on the base of an artificial maturation experiment, and could defer from the real geological situation.

Conclusion

The experimental results showed that the influence of maturity on molecular compound parameters needs to be paid attention to in the comparative study of sedimentary environment, maturity and oil source with molecular compounds. Especially after the peak of oil generation, the molecular compound parameter index may be difficult to effectively apply.

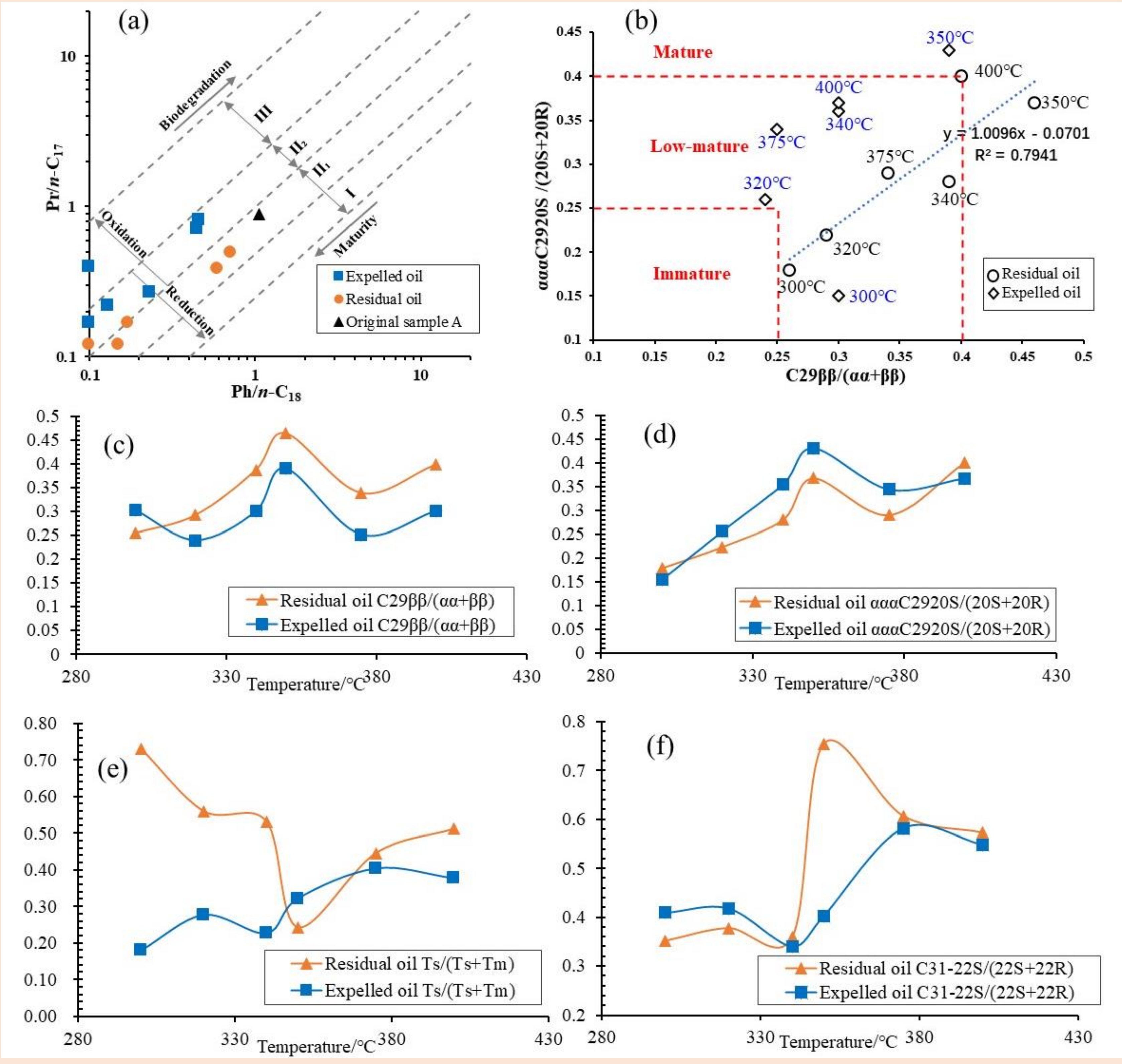

Fig.1 *The relationship between the parameters of the expelled and residual oils with the temperature in the thermal simulation experiment. (a) Sample A and the relationship between expelled and residual oil Ph/C_{18} and Pr/C_{17} (according to Peters et al., 2005) I、II 1-Marine phase, II 2-Mixed phase, III-Continent phase. (b) The relationship between C_{29}-20S/(20S+20R) sterane and C_{29}-ββ/(αα+ββ) sterane in expelled and residual oils. (c) ,(d),(e),(f), The temperature variation diagram of expelled and residual oils αααC_{29}-20S/(20S+20R),C_{29}ββ/(αα+ββ, Ts/(Ts+Tm) and C_{31}-22S/(22S+22R)*

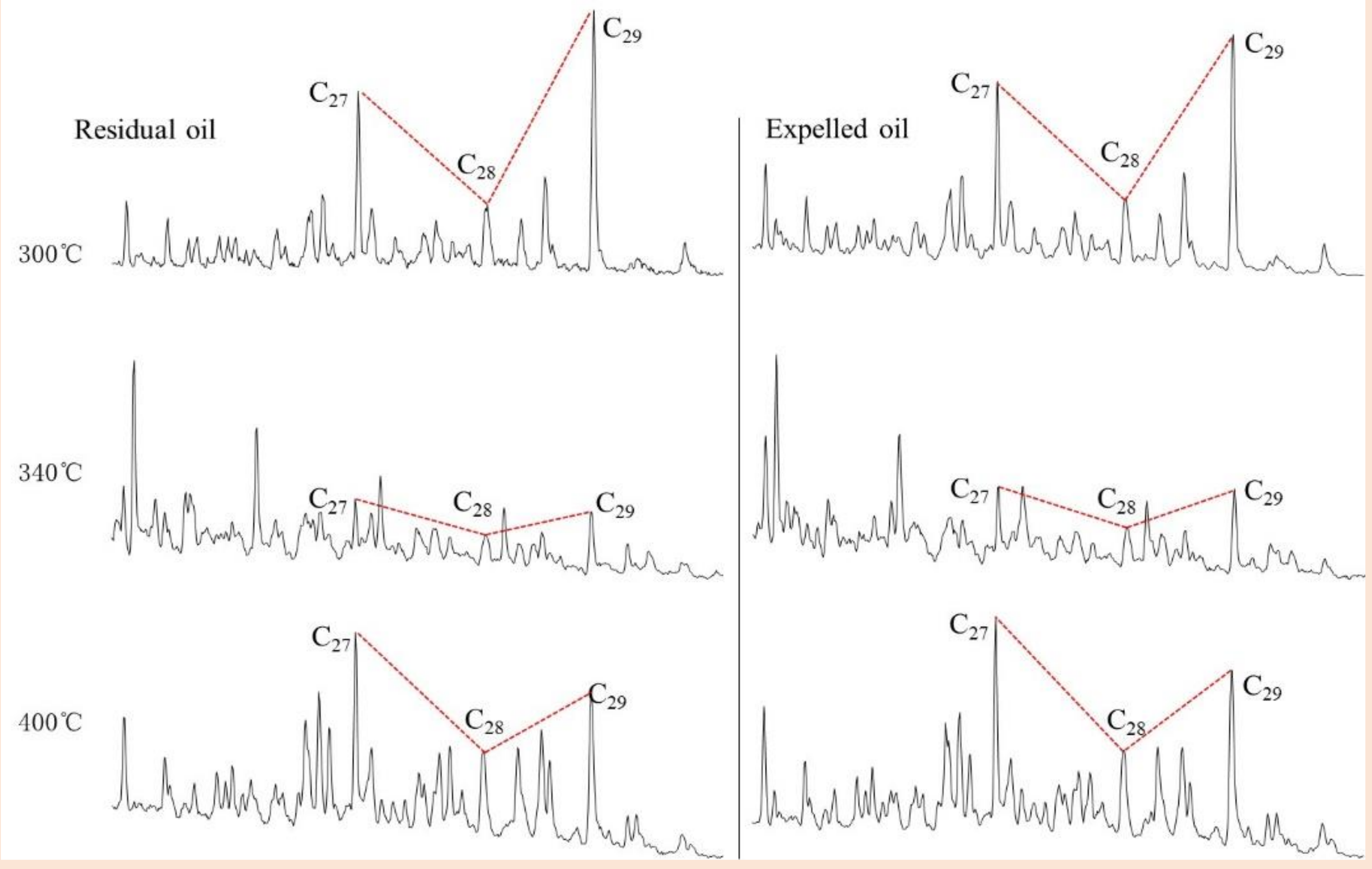

Fig.2 *Expelled and residual oils steranes at 300°C, 340°C, and 400°C*

Acknowledgements

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