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Supporting Information for

**Correlations between tectonic degassing and seismogenesis inferred from a Y-shaped active fault system in the eastern Tibetan Plateau**

Wei Liu1, Maoliang Zhang1,2,\*, Biying Chen1, Yi Liu1, Lufeng Guan1, Chunhui Cao3, Wang Xu4, Guodong Zheng5,3, Xiaocheng Zhou6, Yun-Chao Lang1, Yuji Sano7,2, and Sheng Xu1,\*

1Institute of Surface-Earth System Science, School of Earth System Science, Tianjin University, Tianjin 300072, China

2Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Chiba 277-8564, Japan

3Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences, Lanzhou 730000, China

4College of Energy Resources, Chengdu University of Technology, Chengdu 610059, China

5School of Environmental Studies, China University of Geosciences, Wuhan 430074, China

6Institute of Earthquake Forecasting, China Earthquake Administration, Beijing 100036, China

7Center for Advanced Marine Core Research, Kochi University, Kochi 783-8502, Japan

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**Introduction**

This Supporting Information file contains two figures (Figures S1-S2) supporting the findings of this study; five tables (Tables S1-S5) providing sample information, relevant geochemical compositions, mantle fluid flux data, slip rate along the fault, He isotope composition in literatures and references.

**Figures**



**Figure S1.** Triangular CO2-CH4-N2 (a) and CO2-O2-N2 (b)plot of gas samples along the Y-shaped fault system. The blue line represents a mixing between air and pure CO2 end-member. Filled and open symbols represent data in this study and literature data, respectively. The reported data are listed in Table S1. GYXFS: Yushu-Ganzi-Xianhuihe fault system; YGXFS (bend): bending segment of Yushu-Ganzi-Xianshuihe fault; ANFS: Anninghe fault system; LMFS: Longmenshan fault system. Literature data are from Xu et al. (2022) and Zhou et al. (2017).



**Figure S2.** Variation with latitude of the CO2/3He (a), 3He/4He (b) and δ13CCO2 (c) ratios of hydrothermal gas from Y-shaped fault system in the ETP. The yellow and blue shading represent the range of crustal 3He/4He ratios (Ballentine et al., 2002) and carbon isotopic compositions for carbonates (Sano and Marty, 1995), respectively. The pink and purple shading represent the range of carbon isotopic compositions and CO2/3He for MORB (Marty and Jambon, 1987; Sano and Marty, 1995). Data source and symbols are as in Figure S1.

**Tables**

**Table S1** Chemical composition of hydrothermal gas along the Y-shaped fault system in the ETP. Shown in Supporting Tables (Files uploaded separately).

**Table S2** Isotopic composition of hydrothermal gas along the Y-shaped fault system in the ETP. Shown in Supporting Tables (Files uploaded separately).

**Table S3** Calculation of the mantle fluid flux and using reference parameters in hydrothermal gases along the YGXFS and ANFS. Shown in Supporting Tables (Files uploaded separately).

**Table S4** The compiled He-isotope data for geothermal fluids and distance along different strike-slip faults fault in the world. Shown in Supporting Tables (Files uploaded separately).

**Table S5** He isotope of fluids and slip rate along the YGF, XSF and ANF.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fault | Number of measurements | Mean Rc/Ra | ± 1σ | Mean slip-rate (mm/yr) | ± 1σ |
| Yushu-Ganzi faut  (YGF) | 24 | 0.139a | 0.113 | 7.0d | 1 |
| Xianshuihe fault, Nonthwestern  (XSF-NW) | 21 | 0.282a,b,c | 0.150 | 8.4d | 0.7 |
| Xianshuihe fault, Southeastern  (XSF-SE) | 6 | 1.236a,b | 0.381 | 10.0d | 2 |
| Xianshuihe fault, Kangding-Moxi  (XSF-KM) | 32 | 1.400a,c | 0.566 | 11.5d | 1.9 |
| Anninghe fault (ANF) | 14 | 0.078a,b | 0.031 | 6.5e | 1 |

The air-corrected He isotope ratio (Rc/Ra) are from: this study and a Zhang et al. (2021); bTian et al. (2021); cZhou et al. (2015). Slip rates along the YGF, XSF and ANF are from dBai et al. (2021) and reference therein; eZhu et al. (2016) and reference therein.

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