

## **$^3\text{He}/^4\text{He}$ distributions near the Tancheng-Lujiang faults zones, at Liaoning, NE China**

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Chemical and isotopic compositions have been measured for natural gases near the NNE trending Tancheng-Lujiang Fault Zones (TLFZ) at Liaoning Province, NE China, including hydrocarbon-rich natural gases from Liaohe basin (121°E-124°E, 40.5°N-42°N) and nitrogen-rich geothermal gases from the eastern Liaoning Mountains. Observed  $^3\text{He}/^4\text{He}$  ratios show two orders of magnitude variability from 0.04 RA to 3.5 RA where RA is atmospheric  $^3\text{He}/^4\text{He}$  ratio  $1.4 \times 10^{-6}$ . The following geochemical observations are noted: (1) at Liaohe basin and the adjacent geothermal fields,  $^3\text{He}/^4\text{He}$  ratios show positive correlations with He contents; (2) in Liaohe basin, the  $^3\text{He}/^4\text{He}$  ratios are largely variable (0.04-3.5 RA), generally high in the eastern depress and low in the western depress; (3) in the eastern Liaoning mountains, geothermal  $^3\text{He}/^4\text{He}$  ratios are generally low (0.2-0.7 RA) but have closed relationship with distribution of seismic activity and heat flow; and (4) overall there is a spatial distribution pattern that  $^3\text{He}/^4\text{He}$  ratios gradually decrease from the TLFZ eastwards and westwards. Such a  $^3\text{He}/^4\text{He}$  distribution feature shows strong evidence that the TLFZ played an important role on mantle-derived helium transform from mantle upwards and groundwater circulation along the deep major faults.

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