Organic and elemental sulfur impact on the gases and carbon isotopic composition of heavy oil-cracking

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The sealed gold tube-high pressure autoclave system was applied for the pyrolysis study of the organic sulfur and elemental impacts on the gases and carbon isotopic composition of heavy oil cracking. A sulfur-free heavy oil sample from Lungu area of Tarim Basin was chosen for this study. Four series of experiments were carried out, i.e. the heavy oil only, the crude oil with 1% and 5% elemental sulfur and with 5.62% n-propanethiol, respectively. The comparison of the gases yields and the carbon isotopic compositions from the four series pyrolysis experiments suggest that the addition of both organic sulfur compound and elemental sulfur has slightly depressed the generation of the hydrocarbon gases, in particular methane, but promoted the generation of the non-hydrocarbon gases (such as hydrogen and carbon dioxide). The added organic sulfur compound and elemental sulfur could significantly affect the carbon isotopic composition of methane by causing a maximum positive excursion of 7‰ at the lower temperature pyrolysis range, while has little affection on the carbon isotopic composition of ethane and propane gases. Furthermore, the differences of organic sulfur compound and elemental sulfur on the heavy oil cracking products implies that the sulfur's role is largely depending on its chemical forms.

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Lower crustal xenoliths from Junan, Shandong province and their bearing on the nature of the lower crust beneath the North China Craton

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Geochronological, petrological and geochemical studies were performed on the granulite xenoliths from a Late Cretaceous basaltic breccia dike in Junan, Shandong province, eastern China. These xenoliths show close similarities to the Nushan granulite xenoliths from the southern margin of the North China Craton (NCC) and the Archean granulite terrains in terms of mineralogy and bulk rock compositions, but are quite different from the Hanuoba mafic granulite xenoliths from the northern NCC. *In situ* zircon U-Pb age analyses, together with geochemical data reveal that the protolith of these xenoliths was formed around 2.3 Ga ago, through assimilation-fractional crystallization of a mafic magma. P-T conditions of these xenoliths suggest that the lower crust beneath the Junan region reaches to a depth of 35 km, which agree well with the result deduced from various geophysical methods. The consistent petrological and seismic Moho depths, the observed velocity structure and calculated velocity for these xenoliths imply the absence of underplating-induced crust-mantle transition zone, which was well developed in the northern NCC. The lower crust beneath Junan region extended to a much thinner depth in Late Cretaceous than in Early Jurassic, suggesting that the lower crust of NCC was significantly thinned during Late Mesozoic.