LA-ICP-MS U-Pb detrital zircon geochronology of alumina rich gneiss of the Helanshan Group in the northern segment of Helangshan Mountains and its geological significance

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The Helanshan Group exposed in the northern segment of Helangshan Mountains is high-grade metamorphosed rocks which are mainly composed of grey-biotite-sillimanite-cordierite-monzonitic-gneiss, sillimanite-garnet-biotite-plagioclase-gneiss, garnet-biotite-plagioclase-leptynite, sillimanite-garnet-monzonitic-leptite, sillimanite-biotite-plagioclase-leptynite, graphite-marble and hypersthene-plagioclase-gneiss. The gneiss of Helanshan Group belong to khondalite series characterized by rich in Al_2O_3 and similar geochemistry to clay rocks, its protolith rocks assemblages are alumina rich pelite and siltstone, which indicate that these gneiss are a suite of stable continental margin terrigenous clastic rock, the metamorphosed mineral assemblages of gneiss consist of garnet, cordierite, sillimanite, staurolite, hypersthene and so on. Fifty U-Pb data were obtained by LA-ICP-MS method for the detrital zircons in four garnet-sillimanite-biotite-monzonitic-gneiss from the Helanshan Group in this study (Figure 1). The majority of the grains from these four samples are clustered in the 1.80-2.15Ga age, with characteristic age probability peaks at 2.00-2.05Ga. The detrital zircons age of the Helanshan Group similar to Jining complex and Wulashan Group in the western margin of E'erduosi massif that were related to Lüliang movement, we interpret these gneiss as the evolution of mature crust of the North China Craton. Based on distributing age range of detrital zircons of the Helanshan Group, we suggest that the khondalite series of the Helanshan Group formed in the Paleoproterzoic, less to the effect of later period tectonic-thermal events of the North China Craton.

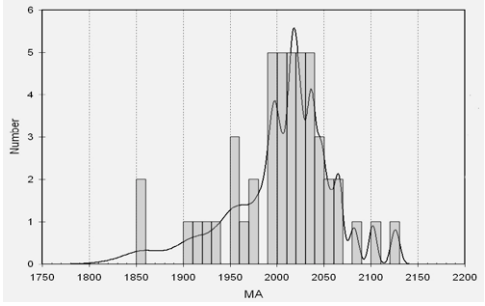

Figure 1: Age frequency diagram of detrital zircons from the Helanshan Group.

Petroleum transformations in reservoirs of Carboniferous oils from the Tz4 Oilfield, Tarim Basin, NW China

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Tz4 Oilfield, one of the most important petroleum production regions in the Tarim Basin, NW China, is a compelling natural laboratory to investigate the processes of petroleum generation, migration and accumulation in an extremely complex tectonic setting. Petroleum transformations in reservoirs involving thermal alteration, gas inclusion, water washing and biodegradation, however, play an important part in determing oil compositions and thus make a big barrier for us to decipher it by using fossils biomarkers [1]. Molecular and stable carbon isotopic compositions of gasoline-range hydrocarbons (GRHs) as well as fossils biomarkers were measured to make an attempt to evaluate the influencing spectrum and levels of various petroleum transformations on Carboniferous oils. Results indicate that thermal alteration, gas inclusion, water washing and biodegradation exert decreasing impacts on Carboniferous oils. *(1) Thermal alteration* From CI, CII to CIII, with burial depth increasing, normal and branched alkanes are increasingly depleted and cycloalkanes and monoaromatics are increasingly rich in C_7 fraction, an increasing enrichment of ^{13}C is also observed on *n*-alkanes and cycloalkanes in GRHs. It is caused mainly by petroleum thermal alteration in the deep-hot Ordovician reservoirs which is supported by nC_7 - nC_{21} CSI and locally geological data. *(2) Gas inclusion* The relative enrichment of toluene and methylcyclohexane in CII and CIII oils implys the occurrence of gas inclusion, it is restricted mainly in CII and CIII as highlighted by K_1 as well as Pr/Ph, MPI3, MDR, and DBT1. *(3) Water washing* The relative depletion of toluene in CI oils indicates water washing has taken place during petroleum secondary migration, it obtains a minor influence on CI oils as suggested by MPI1. *(4) Biodegradation* No biodegradation is revealed by GRHs in Carboniferous oils. GC fingerprints of whole oils from CIII Fm, however, show a UCM curve, suggesting biodegradation occurred in the early-formed Carboniferous reservoirs.

[1] Yang *et al*. (2009) *Science in China Series D (Earth Sciences)* **52**, 12–21.