Influence of water on D/H ratios of *n*-alkanes from hydrous pyrolysis of source rocks with kerogen types I, II, IIS and III

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Compound-specific D/H ratios of *n*-alkanes in soils and immature source rocks can be used to help constrain paleoenvironmental and paleoclimatic conditions. With increasing thermal maturity, however, the isotopic composition of primary biogenic *n*-alkanes can be altered both by isotopic exchange and the production of thermogenic *n*-alkanes via cracking of sedimentary organic matter. To investigate these effects, hydrous pyrolysis and supercritical heating experiments exposed four different immature source rocks with kerogen types I, II, IIS, and III to waters with differing D/H ratios at temperatures from 310 to 381°C for 12 to 144 hours. *n*-Alkanes from the artificially generated oils and waxes were extracted, purified, and measured to evaluate (i) the hydrogen isotopic influence of water hydrogen during cracking, and (ii) limits to the utility of *n*-alkane D/H ratios in petroleums and mature source rocks for paleoenvironmental studies. The use of differing D/H ratio waters helps us to distinguish between effects related to isotopic exchange versus those due to production of new *n*-alkanes.

The isotopic influence of water hydrogen on *n*-alkanes after heating source rocks to 330°C for 72 h decreased in the order of kerogen types IIS>II>III≈I, similar to earlier findings on D/H of kerogens and bulk oils from the same source rocks. In general, longer-chain *n*-alkanes were more D-enriched than shorter-chain *n*-alkanes, but the relationship was not linear and featured many exceptions. With all other hydrous pyrolysis conditions being constant, longer heating resulted in increased *n*-alkane production and enhanced isotopic influence of water hydrogen. Similar effects were observed when reaction temperatures were raised from 310 to 381°C.

LA-ICP-MS U-Pb zircon geochronology and geochemistry of Hongliugou granite in the north Altyn Fault and its geological significance, China

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Hongliugou granite pluton is located in the western segment of Hongliuguo-Lapeiquan subduction collision complex zone in northern Altyn Tagh Mountains. The Hongliugou granite body is main made up of granite belonging to high-Na and calc-alkaline with SiO_2 = 72.88% ~ 74.36%, Al_2O_3 = 12.71% ~ 14.34%, TiO_2 = 0.20% ~ 0.25%, Na_2O = 4.46% ~ 5.12%, K_2O = 0.40% ~ 1.18%, CaO = 2.50% ~ 3.99% and A/CNK = 0.81-1.07. The LA-ICP-MS U-Pb age of zircons from granite is 512.2 ± 1.5Ma (MSWD = 0.77), which is the intrusive age of granitic magma (Figure 1). The characteristics of the granite are low contents of REE, strongly enriched and high-fractionated LREE (La/Smcn = 5.19 ~ 6.44), relatively low-fractionated HREE (Gd/Ybcn = 1.12 ~ 1.30), slightly Eu negative anomalies, and Nb, Ta, P and Ti negative anomalies and Th, U and Yb positive anomalies. Furthermore, the granite samples are located at volcanic arc granite area (VAG) in trace discrimination diagram. All above indicate that the Hongliugou intrusions were formed in island arcs settings on the subduction zone, implying that the ocean-continent subduction took place in the area of Hongliuguo-Lapeiquan during the middle Cambrian.

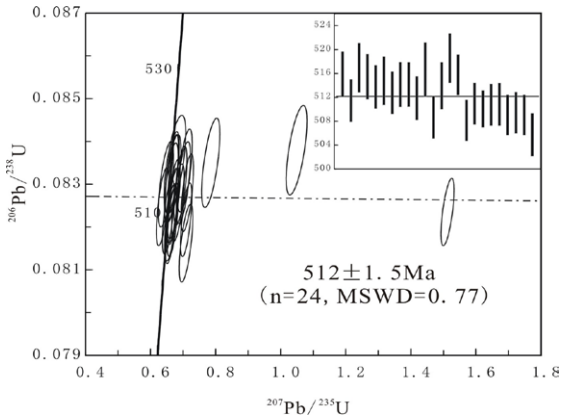

Figure 1: U-Pb concordia diagram of zircons of Hongliugou granite

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