Re-Os oil/gas geochronology of the Tarim Basin and Yangtze Block systems, China

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During the past decade the Re-Os geochronometer has been successfully applied to petroleum systems to yield the timing of hydrocarbon generation, hydrocarbon possesses (e.g., TSR), and utilised as a oil-source fingerprinter.

The Tarim Basin and Yangtze Block host collectively ~100 Bbbls of oil and ~180 tcf of gas. However, the temporal understanding of oil and gas formation in these petroleum systems are either poorly defined or debated. New Re-Os geochronology on hydrocarbons from the Halahatang, Majiang-Wanshan, and Micang Shan reservoirs yield the absolute timing of both oil and gas generation.

The Re-Os isotope data of oil from the Halahatang reservoir in the Tarim Basin yield a Re-Os age of ~285 Ma, which is in agreement with both fluid incluson and basin models and is ~5 – 55 myr older than the illite K-Ar dates, which constrain the timing of oil migration/accummulation. In the Yangtze Block, the Majiang-Wanshan reservoir, western Xuefeng Uplift, the Re-Os data record both the timing of oil (bitumen) and gas (pyrobitumen) generation. The Re-Os bitumen date (~430 Ma) is consistent with the timing of oil generation determined via basin modeling and a bitumen Rb-Sr date. In contrast, Re-Os isotope data of pyrobitumen yield a date (~80 Ma) that is in agreement with the timing of gas generation based on basin burial, fluid inclusion and oil composition numerical model. Pyrobitumen is widely distributed in the Neoproterozoic strata in the Sichuan Basin. The Re-Os pyrobitumen data yield a ~185 Re-Os date in the Micang Shan area, of the northermost Sichuan Basin. This Re-Os date coincides with the basin burial modelling, and high gas fluid inclusion Th (>180ºC), suggesting gas generation occurred during the Early Jurassic.

In summary, through comprehensive Re-Os analysis of different types of hydrocarbons (oil, bitumen, pyrobitumen) the determined Re-Os dates yield the timing of a distinct stage of petroleum evolution, e.g., oil or gas generation. This study further illustrates that oil/bitumen and pyrobitumen Re-Os dating can yield the timing of hydrocarbon generation, with oil/bitumen defining the time of oil generation, and with pyrobitumen constraining the age of dry gas formation.