

Deciphering Hydrocarbon Accumulation Processes for the Oil Pools in Superimposed Petroliferous Basins within Mass Fractions

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Petroleum systems in superimposed petroliferous basins are usually characterized by multiple source kitchens, multiple phase filling histories, and severely secondary in-reservoir alterations, resulting in difficulties to assess the processes involved in hydrocarbon generation, migration, accumulation and destruction. Because the representative of biomarkers that normally have an amount of <0.1% in crude oils is being questionable, caution must be taken for the use of biomarker approach to decipher hydrocarbon accumulation processes in superimposed petroliferous basins. For example, if multiple end members have drastically different absolute concentrations for certain compound class, biomarker distribution in crude oils may be severely biased towards one of the end members in which their concentrations are significantly high. It will be easily for a misleading on regional exploration strategy-making. As main compound classes in crude oils with normal API gravities, n-alkanes, isoprenoids, naphthalenes, biphenyls and phenanthrenes reaches up to an amount of 70-90%(wt) in crude oil. Therefore, if genetic types of these compound classes can be defined, processes involved in the formation of oil reservoir can be clearly identified. In this communication, the distribution, absolute concentration, and stable carbon isotopic composition of these main compound classes in crude oils, together with biomarker assemblages and specific source and/or environmental-dependent compounds within geological context are used to characterize source contribution, filling history, and secondary alteration of petroleum system in superimposed petroliferous basins. A case study from the Carboniferous oil pool of the Tazhong 4 region in Paleozoic petroleum system, Tarim Basin, NW China, was presented. The results suggested that three pays in reservoir profile (CI, CII, and CIII) experienced different filling history and secondary alteration. The CI reservoir characterized by single source and one time filling without post-alteration, whereas the CIII reservoir showed multiple periods of oil generation, migration, accumulation and destruction, indicating a co-contribution from Upper to Middle Ordovician dysoxic marls and Middle to Lower Cambrian euxinic source rocks. The CII reservoir has a closely relationship with CIII reservoir, and partly from adjust and reconstruction of the CIII reservoir.