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Petroleum System: from Conventional to Unconventional

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The work of the traditional petroleum system (PS) study is largely concerned with the process of petroleum from source to trap and its focus is primarily on conventional accumulation. However, as more and more unconventional accumulations have been discovered, reconsideration of the connotation, study guidelines and exploration strategy of petroleum system becomes necessary. The objective of this article is to demonstrate that both conventional and unconventional accumulations can result from a same source kitchen and frequently three significant types of petroleum systems are formed therein. (1) Conventional PS. In such a petroleum system, hydrocarbon accumulation occurs in conventional reservoirs and all of the elements and processes such as source kitchen, reservoir, seal, trap, migration and preservation are indispensable to hydrocarbon accumulation; migration includes primary and secondary ones, and secondary migration can be in long distance and is mainly driven by buoyant force; the accumulations are geographically discrete and thus can be termed as discontinuous accumulation; hydrocarbon distribution is complex and controlled by multiple factors. (2) Tight PS. For this type, source kitchen, reservoir and seal are key factors affecting hydrocarbon accumulation, while migration is predominated by primary migration and short distance secondary migration driven principally by non-buoyant forces; the accumulation is quasi-continuous characterized by that hydrocarbon distribution is extensive with no defined boundaries and an accumulation is composed of numerous small-medium reservoirs not connected to each other [1-3]; accumulation is not restrained by structural traps but by subtle traps such as lithologic traps; hydrocarbon distribution is highly controlled by effective source rocks, "sweet spot" of reservoirs and seals as well. (3) Source rock PS. Two typical representatives of such a petroleum system are shale oil/gas system and coalbed methane system; as source rocks also act as reservoirs, this kind of petroleum system is self-sourced and self-reservoired; accumulation is continuous distinguished by that hydrocarbon distribution is extensive and consecutive with no defined boundaries within the scope of source kitchen; traps have no effect on the accumulation and migration is also unnecessary or inconsequential; oil/gas accumulation and occurrence is governed by the quality of source rocks, "sweet spots", sealing conditions, and hydrogeological dynamics.

It has been revealed that among the above 3 petroleum systems resulted from a common source kitchen, close relationship and unique laws governing hydrocarbon distribution must exist, and their richness of hydrocarbon resources is assumed to be negatively proportional to each other. As a result, they ought to be taken into consideration as a closely related entirety in the study and exploration of petroleum systems to enhance the successful rate.

References:
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