Lacustrine Basin Unconventional Resource Plays: Key Differences

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Abstract

There has been a revival in the interest in hydrocarbon source rock characterization associated with the growing interest in unconventional resources where these fine-grained sediments represent the complete petroleum system. To-date, the primary focus has been on marine unconventional systems. Lacustrine source rocks are, however, geographically important, dominating regions such as China, Indonesia, and Thailand's reserve-base, but have been largely untested for unconventional resources. There are a number of key differences in the nature of these source rock systems that should be considered when assessing if lacustrine systems may represent future unconventional opportunities in areas where the conventional resource-base is dominated by lacustrine-sourced oil.

Among the key differences is the greater sensitivity to climate within lacustrine systems, where changes in the balance between precipitation and evaporation may lead to changes in lake level in excess of 400 meters. These changes are geologically rapid and may occur over periods of thousands of years. Such changes reduce the areal extent of the potentially thick source intervals to only those portions of a basin where a permanent deep lake was present. Thus the core unconventional target may be geographically limited. An examination of the more distal portions of lacustrine systems, where better source rock potential is present, also reveals that there is limited connectivity between source and conventional reservoir. Within these settings, such as the Wind River basin (Waltman Shale), the oil remains trapped within the shales potentially leading to over-pressured systems. This suggests that although areally limited viable unconventional targets may exist.

Finally, the character of the oils produced is different, with lacustrine oils being waxy and displaying different hydrocarbon generation and cracking kinetics. These high wax oils display different flow characteristics and may offer different production challenges than their non-waxy marine equivalents, while their cracking kinetics may indicate that the timing of gas generation may differ significantly as well.