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"Unconventional" Hydrocarbon Accumulations occur in Conventional Traps

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Unconventional hydrocarbon accumulations – whether oil or gas - occur in previously ignored low-permeability reservoirs presently being developed using drilling and completion techniques. However, the traps and reservoir types being prospected are similar in many respects to conventional reservoirs. For example, tight sands are gradational lithologically into conventional sandstone reservoirs. Even some shale reservoirs are gradational into conventional carbonate reservoirs. Fractured reservoirs and coal are fundamentally different from any conventional reservoirs. However, commercial oil and/or gas in all these reservoir types – sandstone, shale, carbonate, coal, or fractures - are trapped in the same ways as traditional "conventional" accumulations – structural, stratigraphic, or a combination thereof.

"Basin-centre" or "deep-basin" gas in tight sandstone reservoirs probably constituted the first major type of unconventional hydrocarbon to be produced, starting in the 1960s and 1970s. For many years the trapping mechanisms for these large accumulations were debated in both Canada and the U.S. The only factor common to all of them is the presence of updip water and downdip gas (near where it was generated) in the same stratigraphic unit. Downdip water flow was originally invoked that somehow held the gas in the low-permeability reservoirs (along with some high-permeability sweet spots). However, further study using finer-scale stratigraphy and much greater well control has shown that each productive unit has in fact very conventional, if in some cases, very subtle trapping mechanism(s). The two classic "basin-centre" gas producers in western Canada (Falher Member, Cadomin Conglomerate) both show conventional stratigraphic traps that separate gas and water zones. Many of the basin-centre gas accumulations in the United States (Uintah-Piceance, San Juan, SW Wyoming Basins) are trapped in structures within the deeper parts of the basins. Many also have a stratigraphic component of trapping because of the limited lateral extent of fluvial channel sands. Analysis and comparison of all these "basin-centre" gas accumulations shows that their traps are essentially the same as those of "conventional" gas accumulations; there is no magic trapping mechanism because of down-dip water flow.

Basin-centre gas saturation (with no water) has also been questioned. Many wells that have produced large volumes of gas from the downdip gas-saturated zones in several basins have begun to produce water as the pressure declines. The water is believed to have been immobile in the very low permeability reservoirs until the gas pressure was reduced, a situation known as a "permeability jail".

Many unconventional oil reservoirs presently being developed in Canada occur in relatively subtle stratigraphic traps. Some of these are simply the margins of the old conventional fields but the ones that will probably be most successfully developed are separate sand bodies in separate traps. These commonly

have the advantage of not having been subjected to waterfloods during conventional oil recovery. Other unconventional oil reservoirs occur in fractured units, notably the Monterey Formation of California. The fractures were caused by high-pressure fluids generated during diagenesis of opal microfossils. They are not restricted to tight structures; off-structure wells show no significant differences in porosity and permeability. However, commercial oil production is controlled by conventional structures. Unconventional oil production, as much as unconventional gas production, is located in very conventional traps.