

## **Derald Smith and Inclined Heterolithic Stratification (IHS): Examples of his influence on the present and future of thermal oil recovery in Canada**

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Derald G. Smith was the pioneering researcher whose work forms the basis of today's understanding of the formation of inclined heterolithic stratification (IHS) within modern fluvial-estuarine deposits. The application of his work on IHS to reservoir evaluations of Canadian Cretaceous bitumen and heavy oil reservoirs has led to an enhanced understanding of how non-random reservoir heterogeneities interact with steam chambers with the ultimate end result being the petroleum industry now has greater confidence in determining the performance of reservoirs possessing varying amounts of inclined mudstone interbeds.

The application of the IHS model to McMurray Formation steam-assisted gravity drainage (SAGD) reservoirs was materially debated, prior to any commercial SAGD developments, during the substantive (and contentious) gas-over-bitumen hearings convened by the Energy Resources Conservation Board beginning in 1999 and running several years thereafter. Key items assessed and debated in those hearings included the initial reservoir responses associated with the vertical rise of steam in IHS found within early McMurray SAGD pilot reservoirs along with various perspectives as to what constitutes a commercial SAGD reservoir possessing various amount of IHS.

Concomitant with, and subsequent to, the ERCB hearings several commercial SAGD projects were initiated by operators with a wide view of what constituted an appropriate commercial McMurray Formation SAGD reservoir. Historical performance results now in hand reveal the substantial influence IHS (and its absence) has had on vertical steam rise along with production rates, steam-oil ratios and, ultimately, the commercial success or failure of SAGD developments.

A perhaps less-appreciated aspect of Derald Smith's work on IHS is that it has directly led to some companies avoiding the pursuit of greenfield McMurray projects in order to attempt developments within other types of reservoirs where reservoir properties in some zones are superior, in many important regards, to those found within McMurray zones possessing substantial amounts of IHS.

Derald Smith's work on IHS is a profound example of the latent economic value found within basic research applied to one of Canada's most important petroleum resources.