Stratigraphic Architecture of an Isolated Prodeltaic Sandstone Body at the Fernie–Nikanassin Transition, Knopcik Field, Northwestern Alberta

Holly C. A. Rose*, Brett D. Miles, Ross B. Kukulski, and Stephen M. Hubbard
Center for Applied Basin Studies (CABS)
Department of Geoscience, University of Calgary, Calgary, AB
* holly.ca.rose@gmail.com

An isolated sandstone deposit is present at the transition between the Fernie and Nikanassin groups in the area of the Knopcik tight gas field, northwestern Alberta (T73- and 74-10W6; Fig. 1A). This relatively thin deposit has proven capable of producing an appreciable volume of natural gas. Facies and stratal relationships suggest a genetic linkage between the isolated sandstone body and overlying deltaic units of the Monteith Formation (lowermost Nikanassin Group). The objectives of this study are to map the distribution and architecture of the isolated sandstone deposit, demonstrate its stratigraphic position and relationship to overlying units, and characterize associated facies in order to develop an understanding of its depositional origin.

The sandstone deposit is up to 5.5 m thick and 30 by 20 km in areal extent; the trend of highest net sandstone is oriented roughly north-south along a 10 km belt (Fig. 1A). A blocky gamma radiation log signature characterizes the sandstone, with local evidence for significant internal stratigraphic divisions (Fig. 1B). The dominantly fine-grained sandstone is comprised of massive, normally graded, or ungraded beds dominated by planar laminations (up to 1 m thick). Evidence for waves, including oscillatory bedforms, are locally important. The sandstone is encased in fine-grained strata characterized by thin normally-graded beds (typically siltstone to mudstone), which record deposition from dilute gravity flows. A similar siltstone-dominated facies has recently been attributed to hyperpycnal flows in prodelta strata of the overlying Monteith Formation (Miles et al. 2009). The occurrence of this prodelta facies above and below the isolated sandstone body suggests a genetic association with the overlying delta front deposits of the Lower Monteith Formation.

Regional-scale mapping of sandstone in the lowermost stratigraphic unit of the Monteith Formation demonstrates its northward pinch-out, just south of the Knopcik Field (Fig. 1A). The sandstone termination is interpreted to represent the depositional edge of the sandstone-dominated delta front in this stratigraphic interval (Miles and Hubbard, 2009). The isolated sandstone body sits immediately north of this stratigraphic pinch-out (Fig. 1A), 12-16 m below the base of Lower Monteith delta front sandstone (Fig. 1B). Based on its stratigraphic position and facies characteristics, the isolated sandstone body is interpreted to have been generated from gravity flows and locally modified by waves at the toe of the prodelta slope (Fig. 1B).

Beyond a depositional model generated for the Knopcik Field, this study provides paleogeographic and reservoir delineation insight into the relatively understudied Fernie–Nikanassin interval in the subsurface of northwestern Alberta.

References

Miles, B.D., Hubbard, S.M., Raines, M.K., Kukulski, R.B., Fisher, R.M., and Zonneveld, J.P., 2009. A stratigraphic framework for the Jurassic–Cretaceous Nikanassin Group, northwestern Alberta, Canada: CSPG–CSEG–CWLS Annual Convention, Core Conference Extended Abstracts, p. 32-39.

Miles, B.D., and Hubbard, S.M., 2009. Storm-influenced deltaic deposits, Jurassic, NW Alberta: Insight into the paleogeographic development of the Western Interior Seaway: AAPG Search and Discovery, Article 90090.

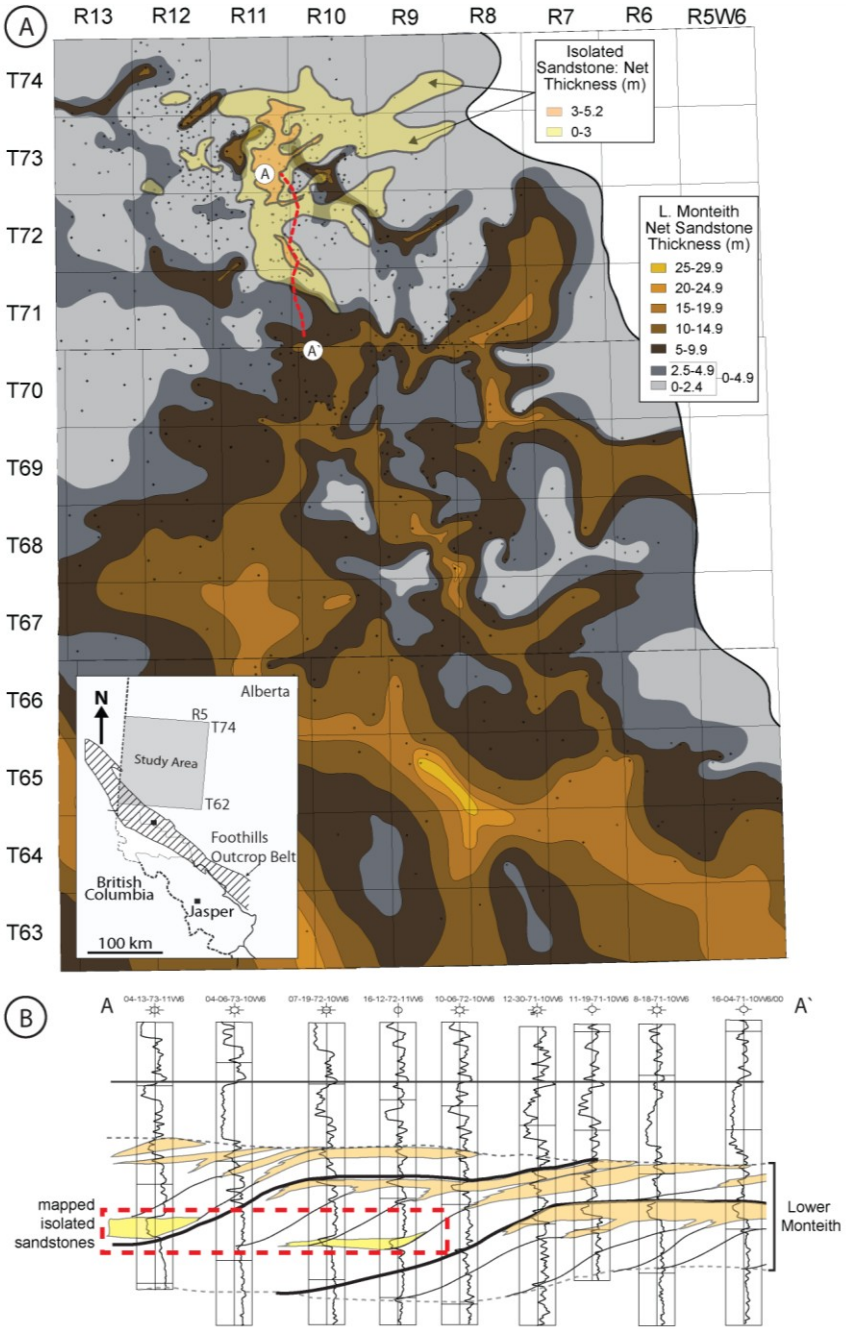

Figure 1. Distribution of isolated sandstone body at the Fernie–Nikanassin transition. (A) Net sandstone map showing distribution of delta front sandstone in the Lower Montieth Allomember (from Miles et al. 2009). The northern depositional edge is closely associated with the mapped position of the isolated sandstone body, towards the upper portion of the map area. (B) Stratigraphic cross-section oriented along depositional dip showing the genetic link between progradational deltaic deposits of the Lower Montieth Formation and the isolated sandstone studied at the toe of the prodelta slope.