

## Detrital Zircon Provenance of the McMurray Formation, Alberta, Canada

Benyon, Christine, University of Calgary  
Leier, Andrew, University of Calgary  
Leckie, Dale A., Nexen Inc.  
Webb, Andrew, Nexen Inc.  
Hubbard, Steve, University of Calgary  
Gehrels, George, University of Arizona

The Lower Cretaceous (Aptian) McMurray Formation is the largest source of in situ bitumen in the Athabasca Oil Sands of northeastern Alberta. Despite the importance of the deposit, the provenance and transport history of the sediment within the McMurray Formation remains understudied. Petrographic evidence suggests much of the sand in the McMurray Formation was derived from the Canadian Shield east of the study area, whereas early paleogeographic reconstructions imply the sand was derived from a large, continental-scale south-to-north drainage network that traversed western North America. Resolving these issues with detrital zircon geochronology can help improve our understanding of the complex depositional history and better predict reservoir characteristics.

Nine sandstone samples were collected from three cored wells and were analyzed using detrital zircon U-Pb geochronology. Preliminary results and Kolmogorov-Smirnov (K-S) statistics define three distinct detrital zircon signatures, forming the basis of three chronofacies. The first chronofacies (*i*) is characterized by zircons of Archean (ca. 2800-2600 Ma) and Early Proterozoic age (ca. 1900-1800 Ma), which are interpreted as indicating a provenance associated with the Canadian Shield. The second chronofacies (*ii*) is characterized by zircons of Grenville (ca. 1250-950 Ma) and early Paleozoic age (ca. 600-350 Ma), which suggests a Grenville and Appalachian source, respectively. However, the zircons may be multi-cyclic; originally transported from eastern North America, deposited in southern Canada or the northern U.S., and subsequently transported to the study area in the Early Cretaceous. The third chronofacies (*iii*) is dominated by relatively young zircons (<250 Ma) with a lesser population of Early Proterozoic ages (ca. 1900-1800 Ma), which are interpreted to have been derived from the Cordillera of western North America. These three signatures suggest a complex provenance history that evolved throughout McMurray deposition. Regional mapping of the McMurray sub basin, based on fluvial channel dimensions and deposits, provides important constraints on the location and extent of the paleo-watershed. Ongoing analyses will aid reconstructions of Early Cretaceous paleogeography in North America and provide a more refined depositional history.