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Mapping of glacial landforms and deposits from multi-sensor satellite image processing coupled with geological data in northern Alberta, Canada

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Surficial materials in the Athabasca river and Birch Mountains areas are mostly 25 to 11 ky-old legacies from the Laurentide ice sheet. These form an almost continuous cover over northern Alberta, Canada, where drift prospecting has been motivated by the search for diamond dispersal trails and oil-sand outcrops. The aim of this study was to differentiate fracture patterns from glacial scour features, and map nonglacial and glacial landforms and deposits in order to understand ice flow history and glacial patterns and boundaries. Due to remoteness of the study area and the fine scale needed for detecting glacial features in forested terrain, purpose-designed digital mapping tools were required to access detail and ensure spatial continuity. We analyzed spectral properties of surface features in the visible and near infrared bands with Aster images (15 m) and data from the recently launched Alos satellite. Digital stereophotogrammetry techniques produced a 15 m-ground resolution DEM, and merging of optical (Avnir-2, 10 m) and radar (Palsar, 6.5 m) images served as a basis for geomorphometric processing and landform classification. Prism images (2.5 m) were also used for photo-interpretation, and GIS-compiled overlays extracted from existing literature on regional geology were used as control data. The final output is a 1:50,000 map of surficial sediments including glaciolacustrine and glaciofluvial deposits, landforms such as kettle holes, hummocky moraine, striation marks, as well as postglacial aeolian deposits and alluvial fans. This semi-automated, multi-scale, multi-sensor digital methodology is ideally suited to exploration-stage landform zoning over broad areas in remote terrain, although interpretation of some features will be nonunique and re-

quire additional field and sedimentological work.