Impact of Pleistocene Glaciation on the Hydrodynamics of the Western Canada Sedimentary Basin

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The Western Canada Sedimentary Basin is characterised by two dominant topography-driven flow systems: 1) SW to NE directed flow in the Williston Basin, from recharge areas in central US to discharge in west-central Manitoba, and 2) S to N directed flow in the Alberta Basin, from recharge areas in Montana to discharge in northern Alberta and NWT. Previously, these flow systems were considered to represent long term hydrodynamic conditions of the basin, at least since Eocene time. However, new information suggests that there was an influx of sub-glacial melt water into the northern and eastern portions of the basin during Pleistocene glaciation. Numerical models indicate that due to higher bulk hydraulic conductivities of carbonates, significant underpressures would develop where the Paleozoic rocks abut the shield (i.e. Manitoba and northern Alberta), allowing influx of glacial melt water. In contrast, lower bulk conductivities of the Mesozoic shale that abut the shield through central Saskatchewan would create higher pressures and reduce melt water influx in this portion of the basin. We examine several lines of evidence that support these modeling results.