Open File 2010-45
Saskatchewan Ministry of the Economy
Saskatchewan Geological Survey

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Manitoba Innovation, Energy and Mines
Manitoba Geological Survey

Targeted Geoscience Initiative (TGI) II

WILLISTON BASIN ARCHITECTURE AND HYDROCARBON POTENTIAL

Water Driving Force – Newcastle Aquifer

Sheet 53 of 55

by
D. Palombi and B.J. Rostron

The water driving force vector map quantifies the apparent hydraulic gradient and horizontal directions of formation water flow. Direction and magnitude of flow are identified by the density-dependent water driving force vectors (black arrows). Contour lines of freshwater hydraulic head are overlain on the water driving force map to show the direction of flow interpreted from the potentiometric surface alone. The azimuthal difference between the density-dependent water driving force (black arrows) and the hydraulic gradient driving force (gray arrows) vectors are highlighted by the coloured contours ranging from light to dark orange as the angle between the two components increases respectively. To model the density-dependent water driving force, grids of *insitu* brine density, salinity, hydraulic head, formation temperature and aquifer structure were required and calculations were performed using a Visual Basic Code. The equation of state was used to calculate brine density across the aquifer. Grids were generated in Golden Software Inc.'s Surfer Version 8.0 using a kriging interpolation algorithm and the results were contoured and projected using Generic Mapping Tools (GMT) with manual modifications when necessary. Areas in which anomalies may be present may not be accurately portrayed and are likely the result of data control, interpolation, and mapping algorithms.

Although the Saskatchewan Ministry of the Economy has exercised all reasonable care in the compilation, interpretation, and production of this map, it is not possible to ensure total accuracy, and all persons who rely on the information contained herein do so at their own risk. The Saskatchewan Ministry of the Economy and the Government of Saskatchewan do not accept liability for any errors, omissions or inaccuracies that may be included in, or derived from, this product.

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Palombi, D. and Rostron, B.J. (2013): Water Driving Force – Newcastle Aquifer, Williston Basin Architecture and Hydrocarbon Potential, Targeted Geoscience Initiative II; Saskatchewan Ministry of the Economy, Saskatchewan Geological Survey, Open File 2010-45/Manitoba Innovation, Energy and Mines, Manitoba Geological Survey, Open File OF2011-3, sheet 53 of 55, 1:3 000 000-scale map.

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This Open File is available for free download at www.WillistonTGI.com.

Legend

Azimuthal difference between WDF and -▽h Degrees

0 30 60 90 120 150 180

Density-dependent water driving force (vector magnitude shown = 3m/km)

Hydraulic gradient driving force

Equipotential line (contour interval = 40 m)

Edge of Phanerozoic cover

Newcastle-Viking zero edge

Aquifer eroded

Control point

Lake

Transverse Mercator Projection
Central Meridian 101° W

Hydrostratigraphy

RAVENSCRAG
Bearpaw
JUDITH RIVER
Colorado-Lea Park
NEWCASTLE
Joli Fou
MANNVILLE
Masefield-Waskada
JURASSIC
Watrous
POPLAR
RATCLIFFE
MIDALE
FROBISHER
ALIDA
TILSTON
SOURIS VALLEY
BAKKEN
Three Forks
BIRDBEAR
Seward
DUPEROW
Souris River
MANITOBA
Prairie Evaporite
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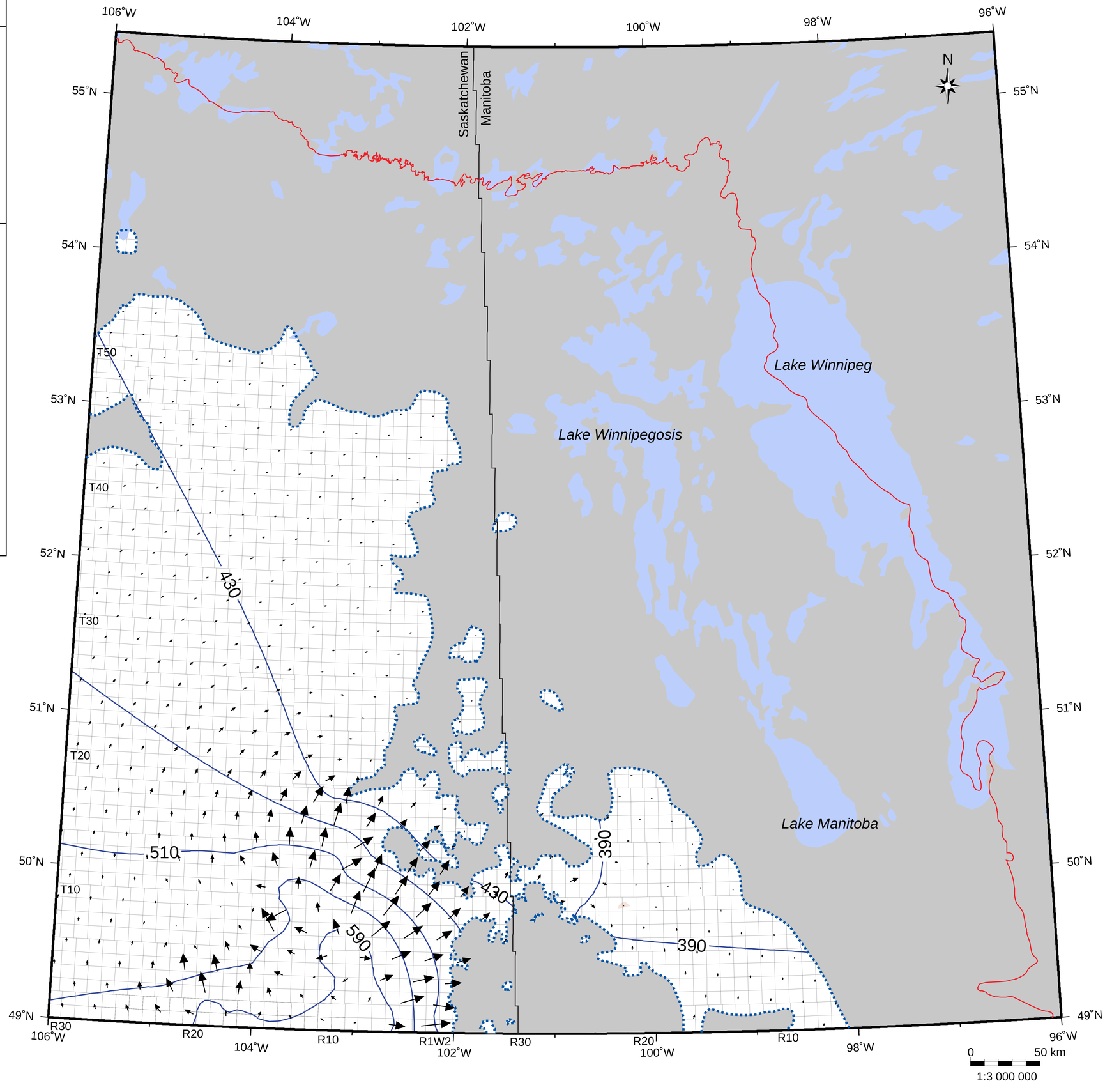
Stony Mountain
RED RIVER
Winnipeg
CAMBRO-ORDOVICIAN
Precambrian

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