

Overview of regional 3D modelling projects by the Saskatchewan Geological Survey

Sean A. Bosman

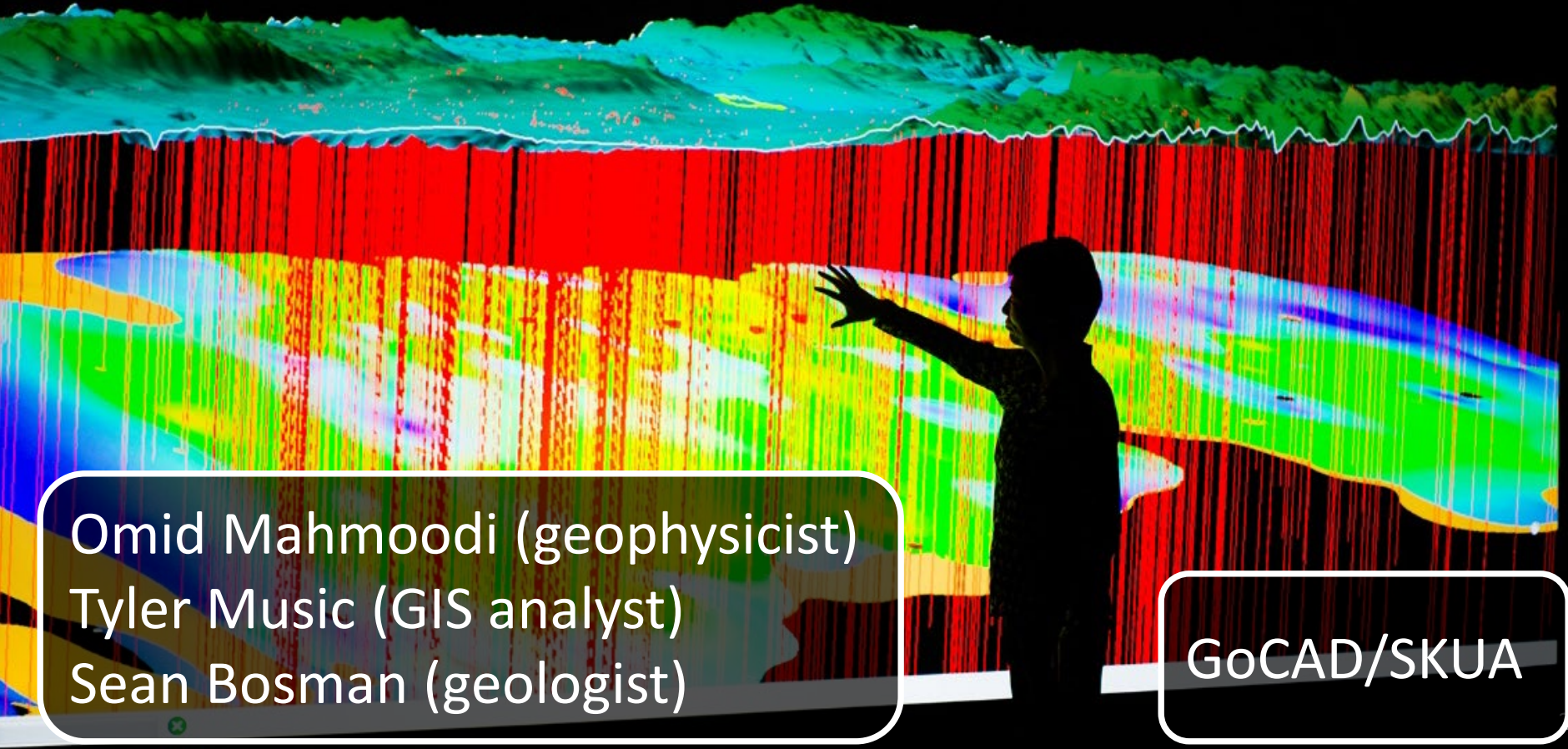
Canada 3D Presentation – Virtual Meeting – June 17, 2020

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Government
— of —
Saskatchewan

Our 3D modelling team



Omid Mahmoodi (geophysicist)

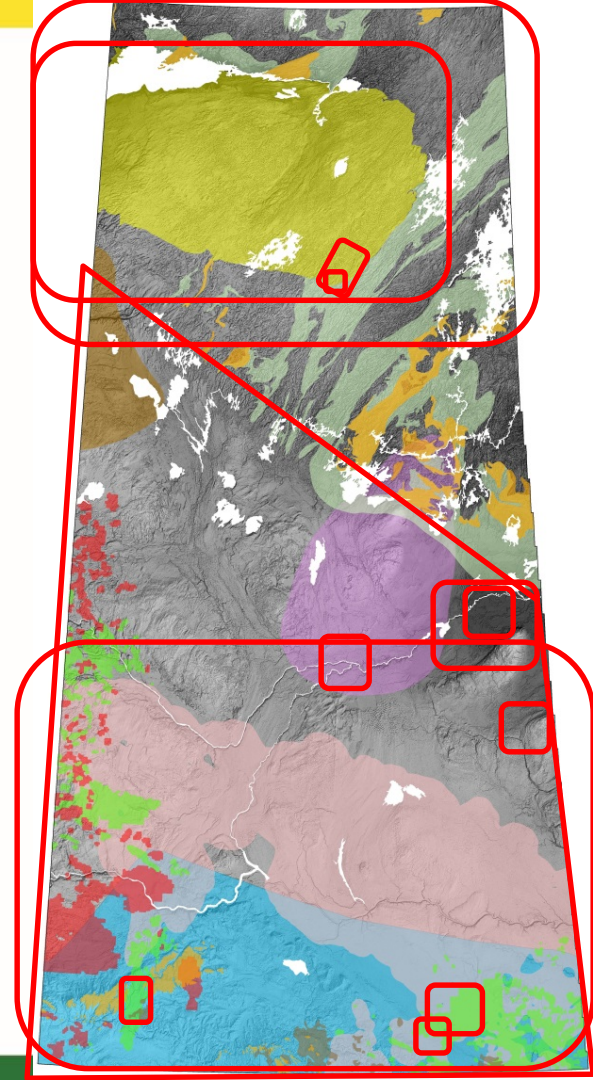
Tyler Music (GIS analyst)

Sean Bosman (geologist)

GoCAD/SKUA

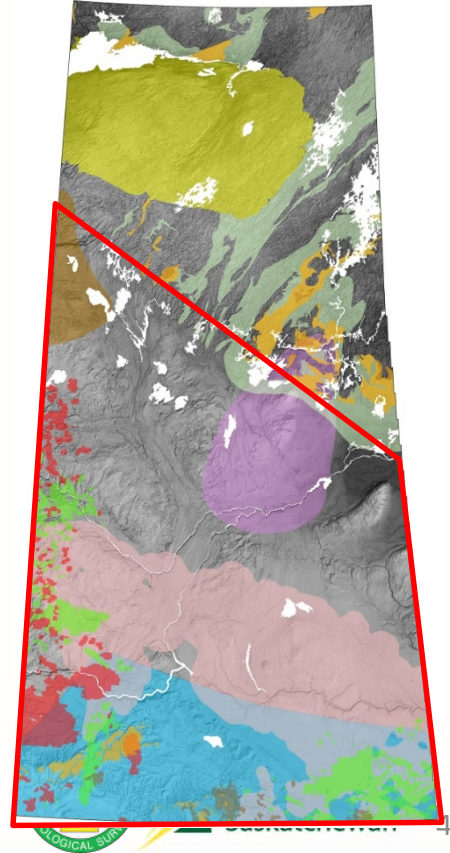
Past and current 3D projects

- Key Lake Sue C pit (2002)
- Fort à la Corne Diamonds (2004)
- Weyburn project (2004)
- Athabasca Basin (2007-2010)
- Hudson Bay Coal (2009-2012)
- Prairie Evaporite (2011-2016)
- Sub-Phanerozoic (2011-2015)
- Bakken Oil Pool (2011-2014)
- Southwest Athabasca Basin (2014-2016)
- Western Canada Sedimentary Basin (2017-present)
- Athabasca Region (2019-present)
- Project Sphalerite (2019-present) – NGSC project
- Shaunavon Oil Pool (2019-2020)



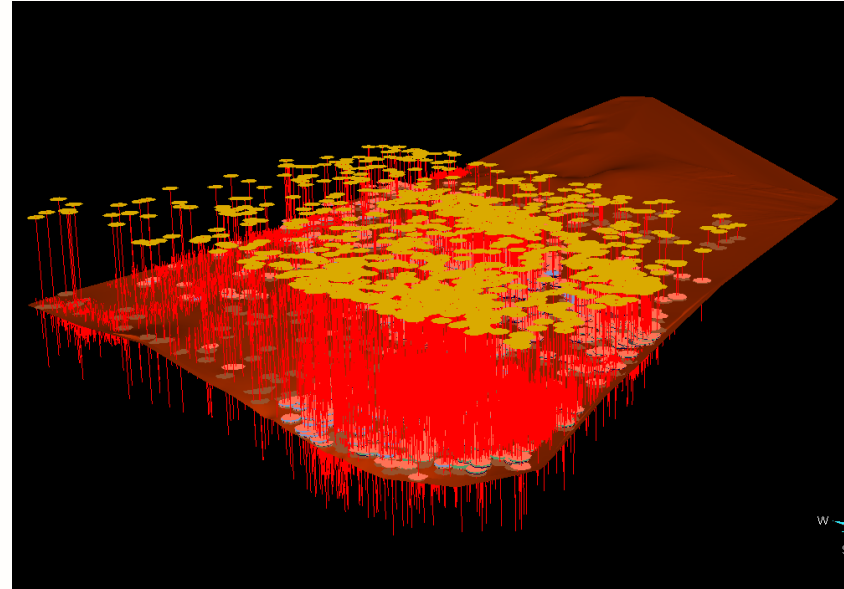
Western Canada Sedimentary Basin

- Based on Sask. Phanerozoic Fluids and Petroleum Systems Project (Marsh and Love, 2014)
- To provide regional framework for future pool-scale reservoir characterization



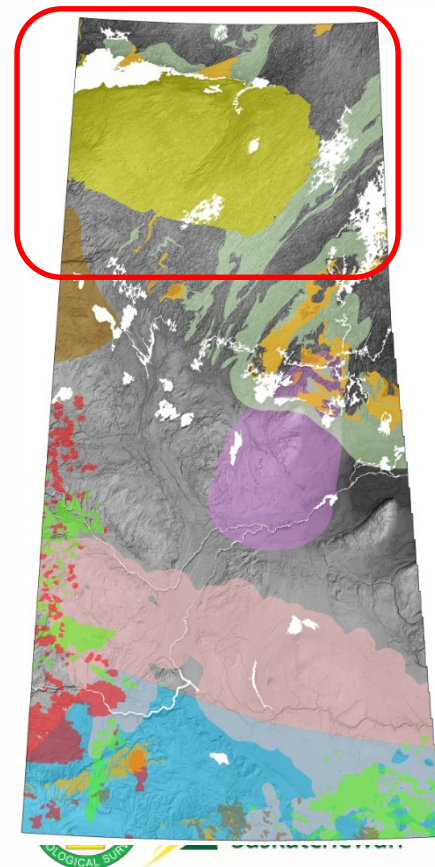
Data sources and outputs

- 1 arc-second DEM
- ~20 K boreholes
- 156 grid files, with 2 km spacing (~244 K points)
- 85 structural surfaces (14 built so far)
- Hydrogeological data – Jenson *et al.* 2015 (not yet used)



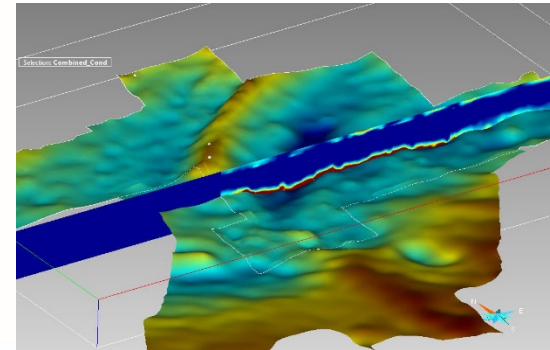
Athabasca Basin region

- Focused on the Athabasca Basin (includes Alberta portion)
- Improve on previous model and incorporate new data to advance our understanding of the geology
- Provide industry a regional platform so they can incorporate their property-scale models



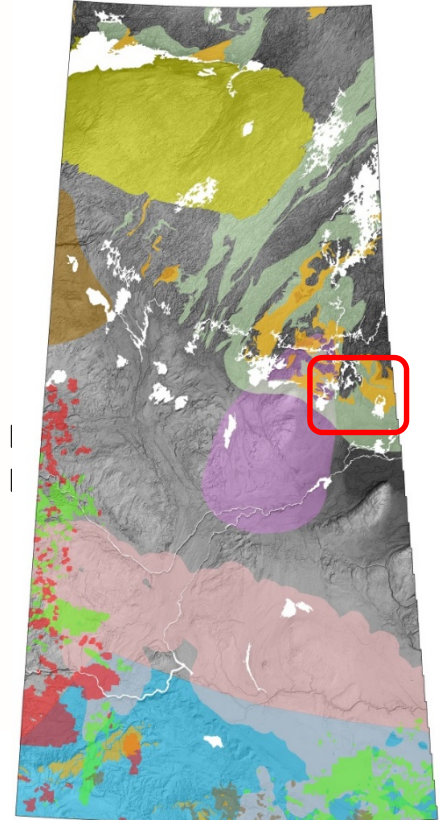
Model Inputs

- Use updated stratigraphic nomenclature (Bosman and Ramaekers, 2015) - 25 horizons (previously 8)
- 600 ddh with complete stratigraphic information (previous model used 120)
- Additional 20 000 DDH with partial stratigraphic information (previous model used ~ 8000 DDH)
- Lithological parameters (over 100 000 records)
- Bathymetric, seismic and lake sediment depths (>100 K data points)
- Outcrop information from across the basin region
- Geochemical and hyperspectral datasets
- Previously generated fault network
- Modern geophysical datasets (from assessment files)



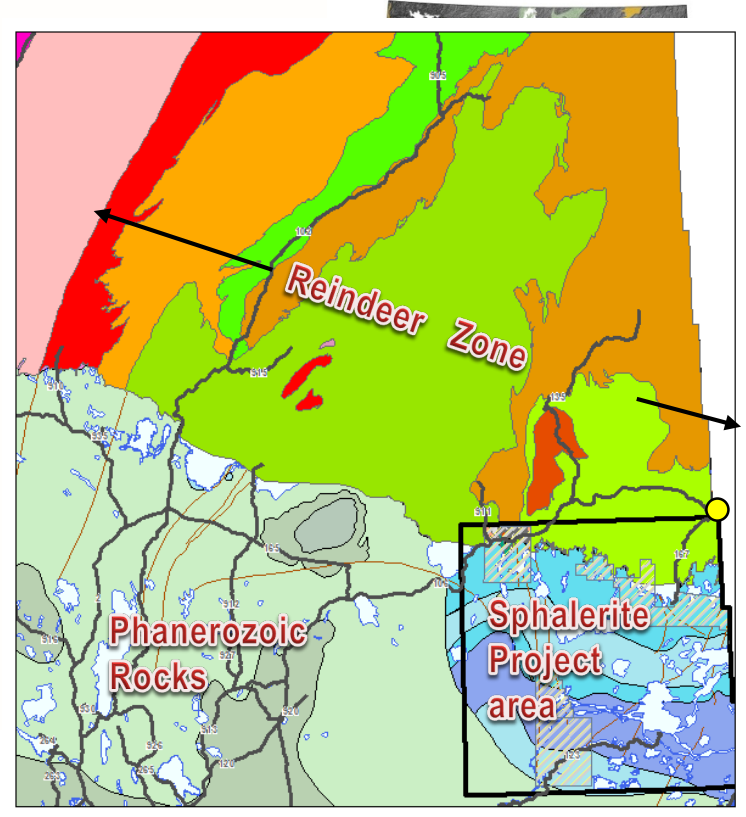
Project SPHALERITE

- Sub-**Phanerozoic** core **L**ogging and **E**nhanced geoscience **R**esearch Initiative (project SPHALERITE)
- Part of Saskatchewan's Mineral Development Strategy (SMDS)
- Collaborations between GSC, SGS, MGS
- Key objective: improved understanding of sub-Phanerozoic geology of Reindeer Zone rocks to give context to VMS and gold exploration projects
- To be incorporated into NGSC Flin Flon Pilot Project



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Geophysical data modeling
Bigstone Lake EM/Mag/Gravity Gradiometry survey

Conductivity sections:
Inversion of time-domain electromagnetic data

Heli-TEM data

20 km
24 km

3D conductor modeling using Maxwell plates



Regional data modeling

3D magnetic susceptibility model
(regional magnetic data inversion)

Deschambault Lake

Amisk Lake

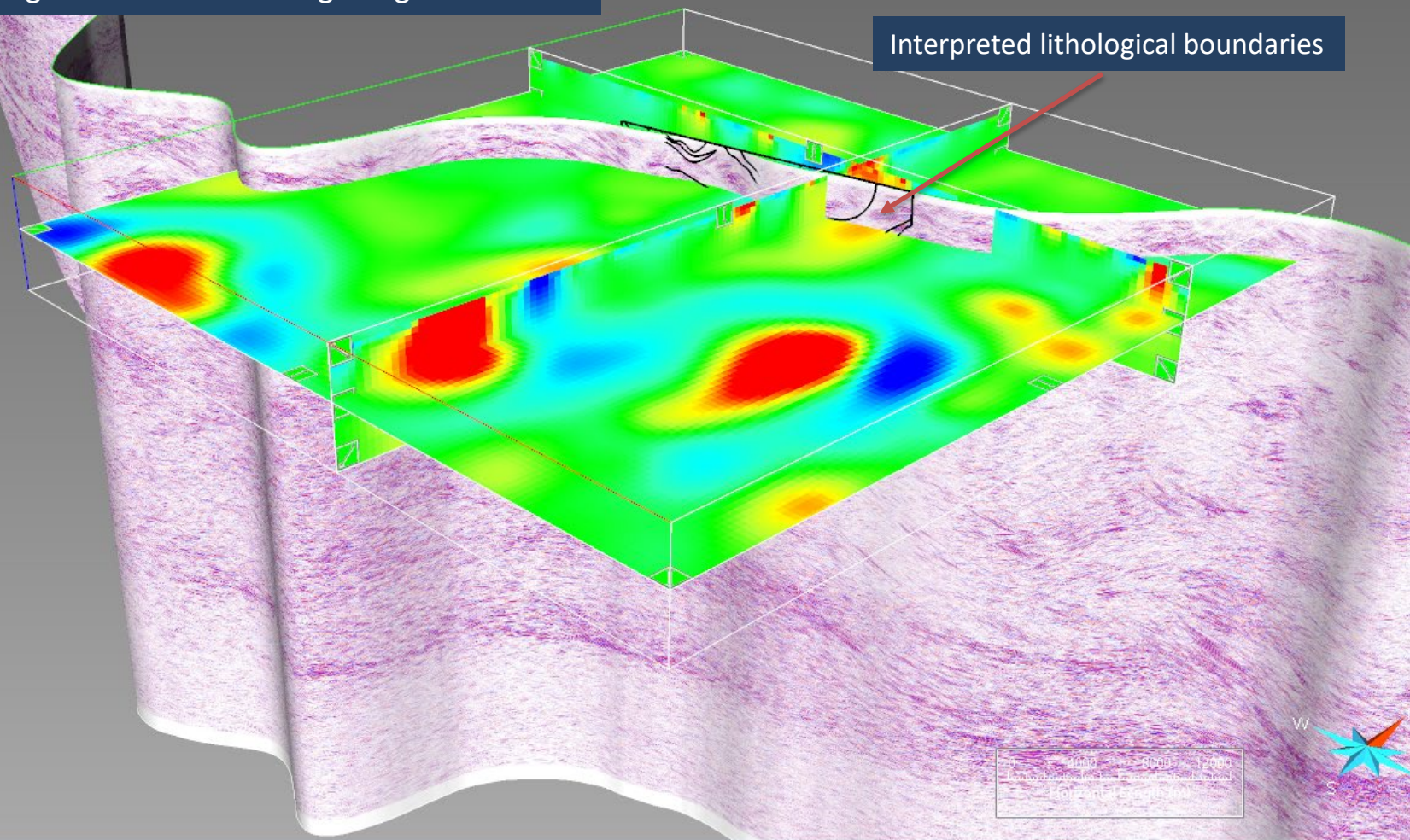
Lithoprobe line (L9)

3D density model
(local gravity gradiometry data inversion)



Using regional data to create geological sections

Interpreted lithological boundaries



See accompanying video file for
overview of Athabasca Basin region
and Phanerozoic models