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Building a 3D Provincial Geological Framework Model of Alberta – Version 1: Integrating decades of geological interpretation and 620,812 data points

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Summary

The Alberta Geological Survey (AGS) has created a foundational three-dimensional (3D) Provincial Geological Framework Model of Alberta V.1 (3D Model).

Introduction

The 3D Model represents a multi-layer, stratigraphically related, holistic view of our geological understanding of select provincial-scale intervals within Alberta's subsurface. This model covers 602,825 km^2 of Alberta (excluding the area of Cordilleran deformation) and contains 32 layers extending from ground surface to an assigned flat base within the Precambrian at 5000m below sea level (Figure 1 and 2).

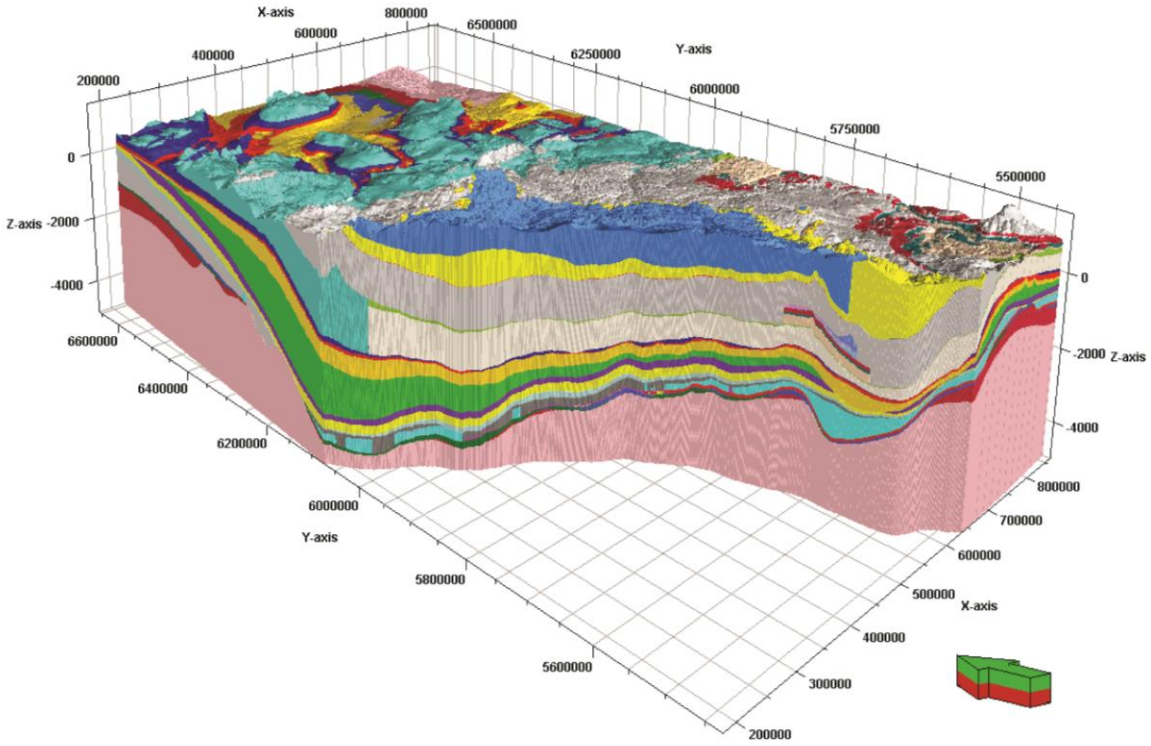

Figure 1. Oblique view (looking northwest) of all zones below the bedrock topography surface to the base of the model with the 3D Provincial Geological Framework Model of Alberta V.1 (Branscombe et al., in progress) (vertical exaggeration = 50x).

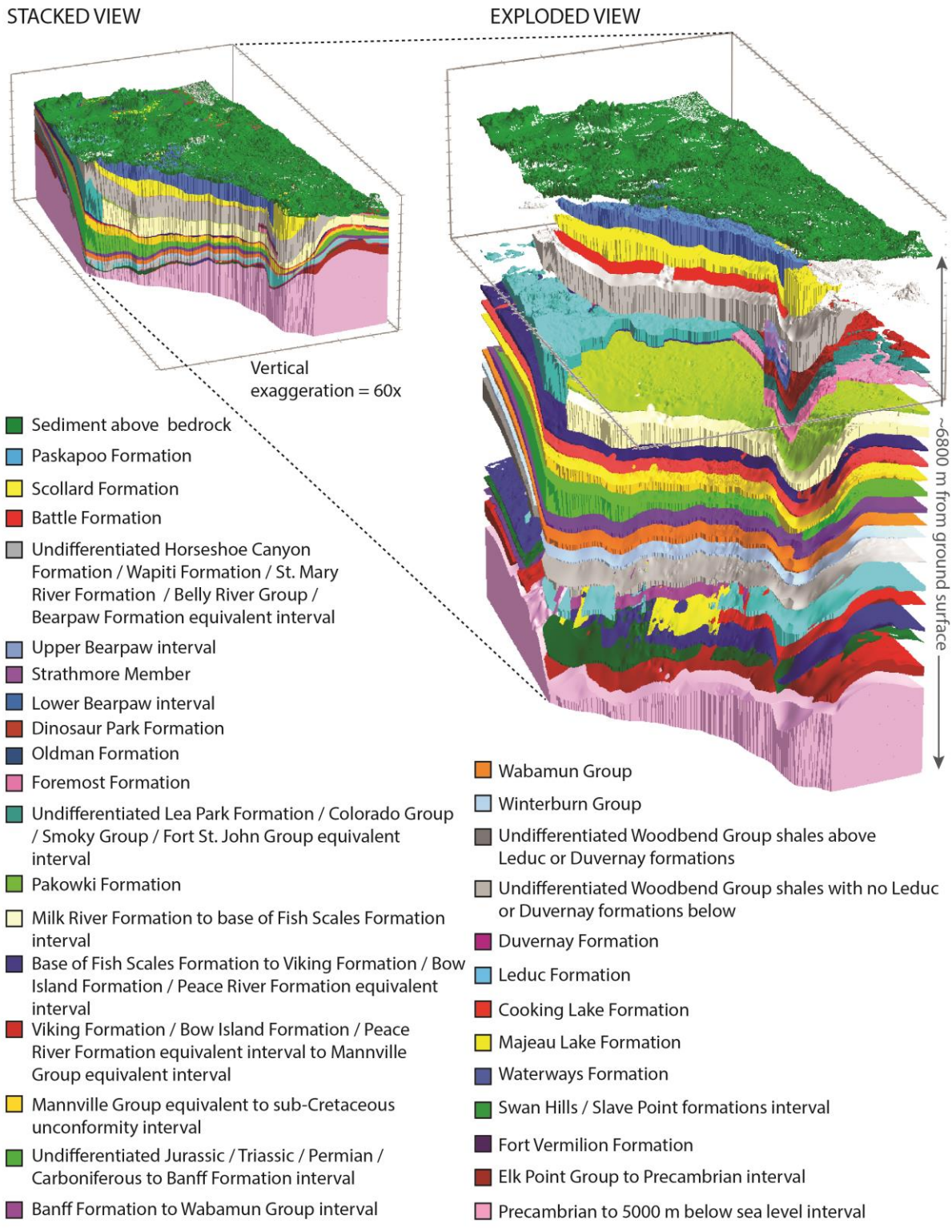

Figure 2. Oblique stacked (left) and exploded view (right) of all zones within the 3D Provincial Geological Framework Model of Alberta V.1 (vertical exaggeration = 60x) (Branscombe et al., in progress).

Theory and/or Method

An iterative modelling approach, guided by conceptual models reflecting our collective geological understanding within the Western Canada Sedimentary Basin, was used to create a reasonable regional-scale characterization of the complex geology of Alberta. The input data was largely geophysical log-based stratigraphic picks interpreted by AGS/AER geologists (representing 618 998 of 620 812 data points) but also includes outcrop data and information from reports, maps and the Table of Formations (Alberta Geological Survey, 2015).

Traditional 2D mapping doesn't allow us to effectively characterize the integrated nature of the subsurface and its resources within our basin in a holistic way. This provincial-scale 3D model brings together decades of high quality but largely singular geological interpretations and 2D mapping into a 3D, multi-layer, stratigraphically related configuration.

Conclusions

The AGS' Geological Framework project has been designed using an evergreen modelling approach. It can be used for basin-scale geological investigations within the Alberta portion of the Western Canada Sedimentary Basin, and can absorb new geological interpretation by the AGS and sub-models that the AGS Geological Modelling Team is developing for local-scale investigations. The 3D Provincial Geological Framework Model of Alberta is being used to support science based decision making at the AER and acts as the geological foundation to inform regulatory decisions related to the management of the subsurface. This work not only enables AGS to deliver geoscience information to a variety of stakeholders in a new and visually stunning way, but more importantly allows us to deliver information in a useful and easy to understand format.

Acknowledgements

References

Alberta Geological Survey (2015): Alberta Table of Formations; Alberta Energy Regulator, URL <http://ags.aer.ca/document/Table-of-Formations.pdf> [2017].

Branscombe, P., MacCormack, K.E., Babakhani, M. (in progress): 3D Provincial Geological Framework Model of Alberta V.1 – Methodology; Alberta Energy Regulator, AER/AGS.

Branscombe, P., MacCormack, K.E., Corlett, H.J., Hathway, B., Hauck, T.E., Peterson, J.T. (in progress): 3D Provincial Geological Framework Model of Alberta V.1 (dataset, multiple files); Alberta Energy Regulator, AER/AGS.