which, in association with magnetic data, can be interpreted to represent fault zones. The listric feature at 200-400 m depth in the constrained inversion likely corresponds to the faulted Precambrian-Paleozoic contact. The HTD conductive zone is associated with = a magnetic lineament and a sub-vertical conductive zone suggesting a moderately extensive fault zone. Further 2-D inversions and 3-D inversions are required for final interpretations.

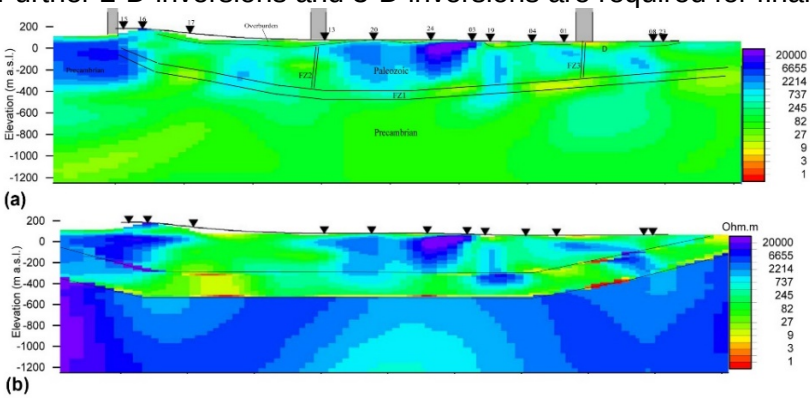

Figure 4. (a) Unconstrained and **(b)** constrained 2-D inversion models. For the unconstrained inversion with TE/TM phase and apparent-resistivity error floors of 6%/3% and 24%/12% respectively the root mean square error is 1.77. Grey shaded boxes denote the position of linear aeromagnetic features (Figure 3) and "D" denotes the HTD. In the constrained model, regularization tears (grey lines) have been included and the resulting model shows the inverted MT data are compatible with relatively resistive Precambrian rocks beneath a sub-horizontal conductive feature.

References

Chakungal, J., Sanborn-Barrie, M., James, D., Rayner, N., Whalen, J., Craven, J., Spratt, J., Kosar, K., Ross, M., Zhang, S., Coyle, M., 2008. Natural Resource Potential – Yes or No? Southampton Island Integrated Project: A Summary of 2007 & 2008 Results and Investigations; 36th Annual Yellowknife Geoscience Forum Abstracts; Northwest Territories Geoscience Office, Yellowknife, NT, YKGSF Abstracts Volume 2008.

Craven, J.A., Ferguson, I.J., Roberts, B.J., 2018. Ground geophysics in the Hudson Bay area, Nunavut: GEM-2 Kaskattama highlands and Southampton Island Project, report of activities 2018. Geological Survey of Canada, Open File 8487, 10 pp.

Heywood W.W., Sanford B.V. 1976. Geology of Southampton, Coats, and Mansel Islands, District of Keewatin, Northwest Territories. Ottawa, Canada: Geological Survey of Canada: Memoir 382, 35 pp.

Lavoie, D., Pinet, N., Dietrich, J., Zhang, S., Hu, K., Asselin, E., Chen, Z., Bertrand, R., Galloway, J., Decker, V., Budkewitsch, P., Armstrong, D., Nicolas, M., Reyes, J., Kohn, B.P., Duchesne, M.J., Brake, V., Keating, P., Craven, J., Roberts, B. (2013): Geological framework, basin evolution, hydrocarbon system data and conceptual hydrocarbon plays for the Hudson Bay and Foxe basins, Canadian Arctic; Geological Survey of Canada, Open File 7363, 200 p.

McNeice G.W., Jones A.G., 2001. Multisite, multifrequency tensor decomposition of magnetotelluric data. Geophysics. 66, 158–173

Marks, J., 2019. Delineation of a hydrothermal dolomite occurrence on Cape Donovan, Southampton Island using magnetotellurics. B.Sc. (Hons.) Thesis, U. Manitoba, Winnipeg, Canada.

Natural Resources Canada 2008: CAGDB - Southampton Island magnetic data. URL https://open.canada.ca/data/en/dataset/1280e0b0-3445-5e00-b551-ca2830b5e9d8. Date accessed Feb 2, 2019.

Roberts B, Craven J. 2012. Results of a magnetotelluric survey in Churchill, Manitoba: GEM Energy, Hudson Bay. Geological Survey of Canada, Open File 7151, 24 pp.

Rodi, W., Mackie, R.L., 2001. Nonlinear conjugate gradients algorithm for 2-D magnetotelluric inversions. Geophysics 66, 174-187.

Spratt J.E., Craven J.A., Sanborn-Barrie M. 2012. Southampton Island magnetotelluric survey: data acquisition and preliminary analysis. Geological Survey of Canada Open File 6988, 36 pp.

Zhang, S. 2008. New insights into Ordovician oil shales in Hudson Bay Basin: their number, stratigraphic position, and petroleum potential. Bulletin of Canadian Petroleum Geology, 56(4): 300–324.

Zhang S. 2010. Upper Ordovician stratigraphy and oil shales on Southampton Island field trip guidebook. Geological Survey of Canada, Open File 6668, 42 pp and appendices.