

Cost-Benefit Analysis for Geophysical Surveys Used in the Metal Earth project

David Snyder
Geophysical Consultant to Metal Earth



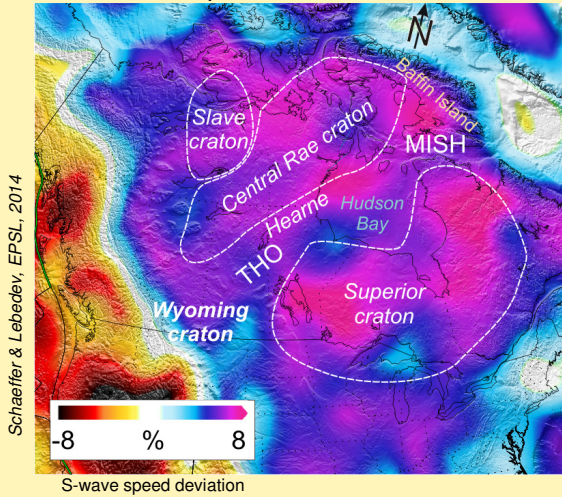
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A Metal Earth based Cost-Benefit Analysis

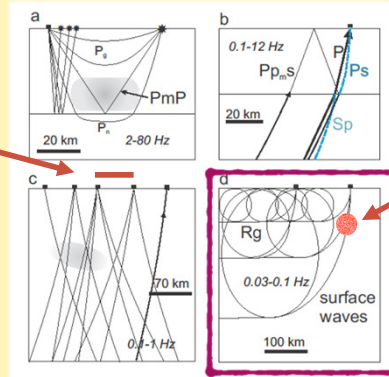
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| Receiver functions | POLARIS | 0.03-0.5 | 10-200 km | 5 km | 5000 | 5 | 400 | 1 | 5 | (C\$20K/site) @50 km spacing |
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Continent-scale exploration

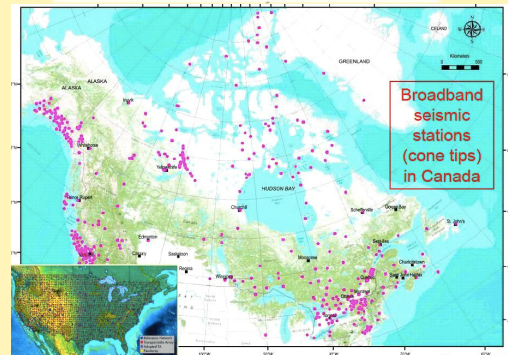
Mantle S-wave tomography:
A depth slice at 90 km



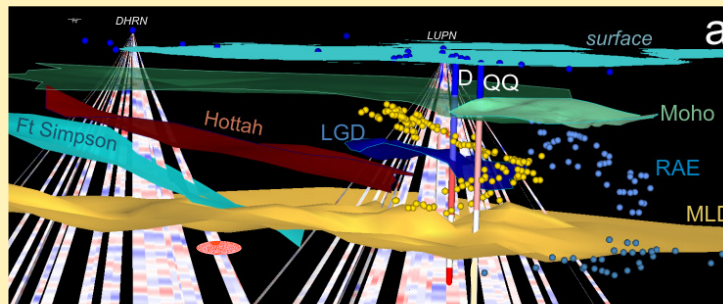
Practical
Resolution



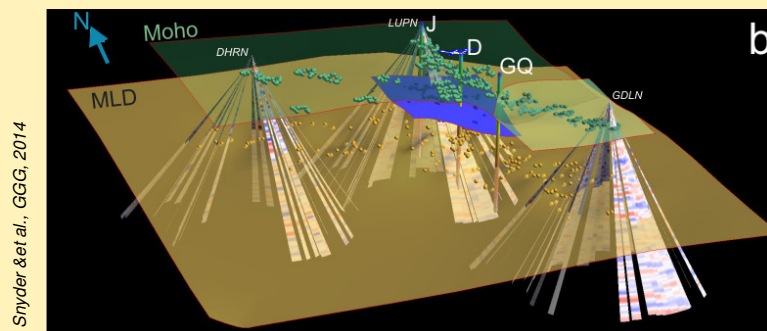
Physical
(theoretical)
Resolution



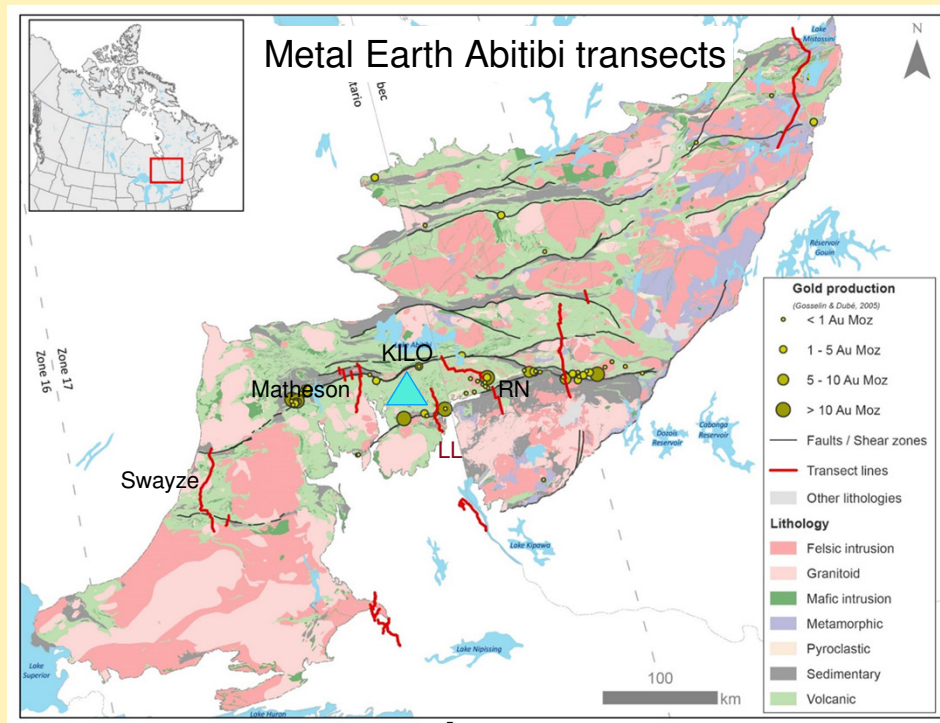
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Mantle seismic discontinuity surfaces as derived from 3D receiver functions

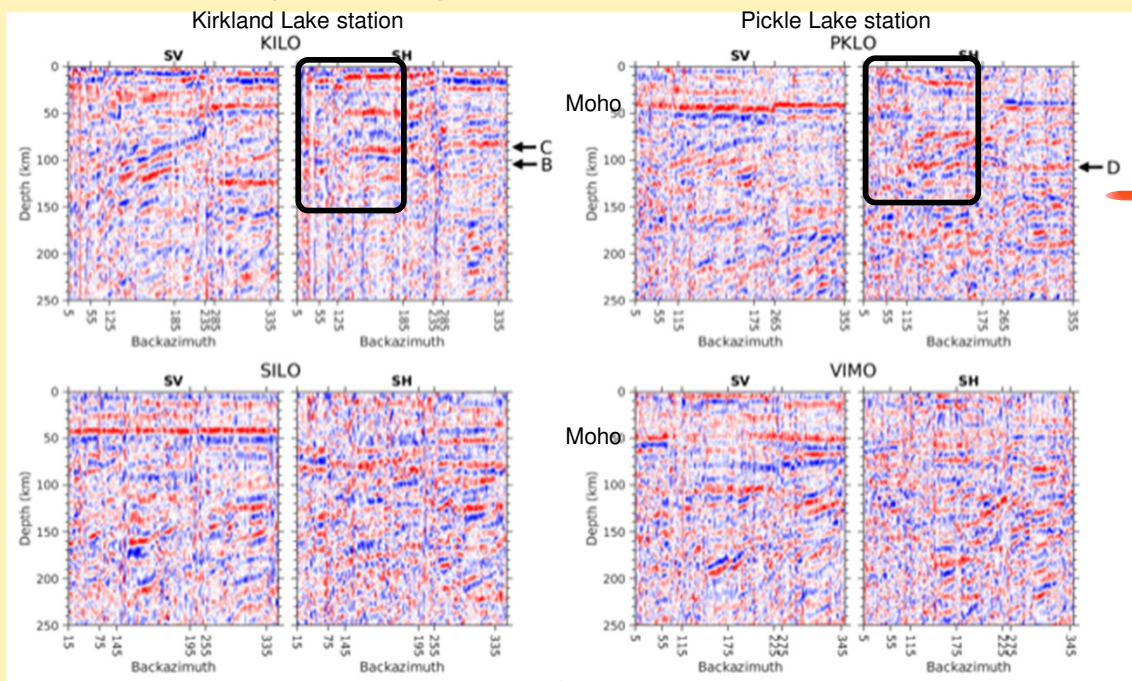


4



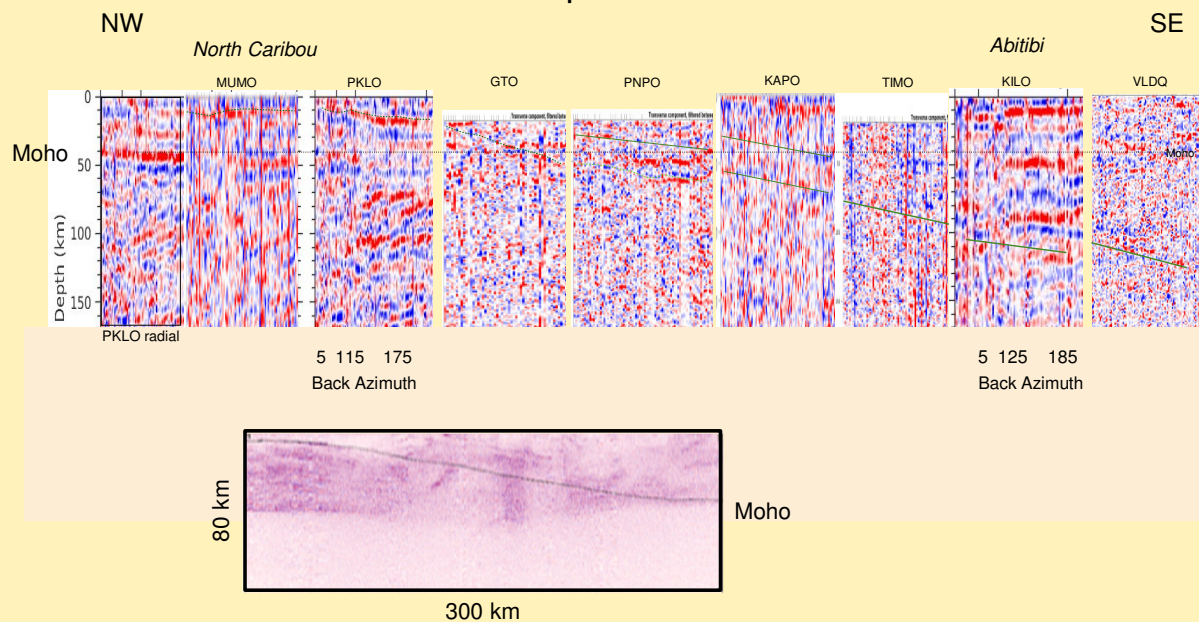
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Examples of Superior craton receiver functions



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Transect of Superior craton receiver functions

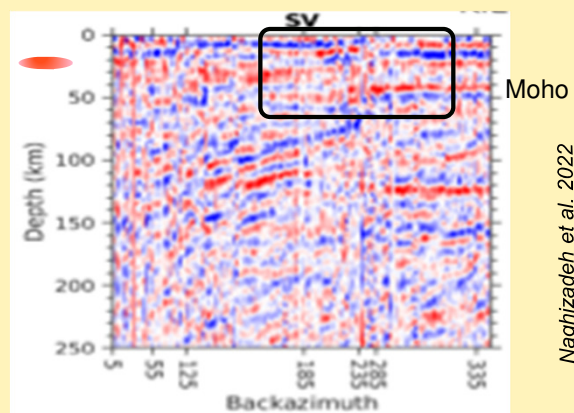


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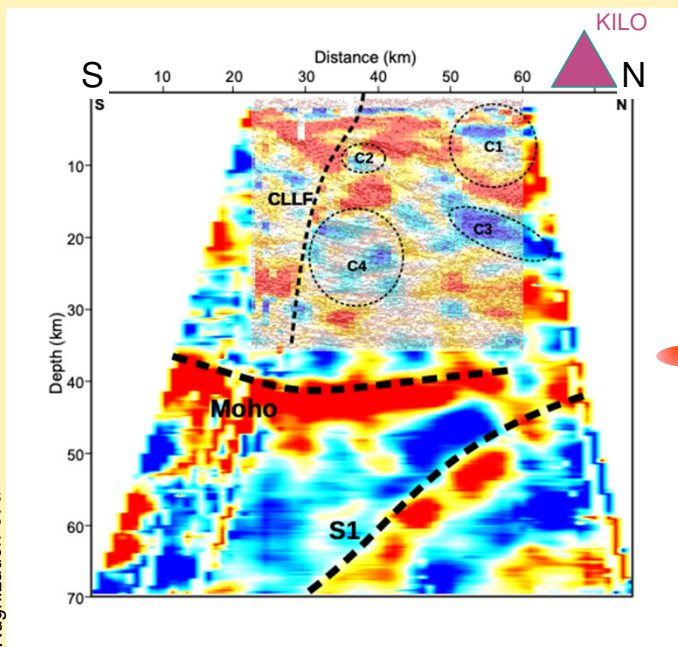
Coincident Passive + Active seismic sections

Metal Earth Larder Lake transect

30 km east of KILO station

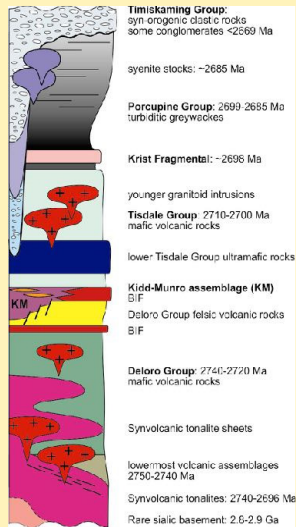


Naghizadeh et al. 2022

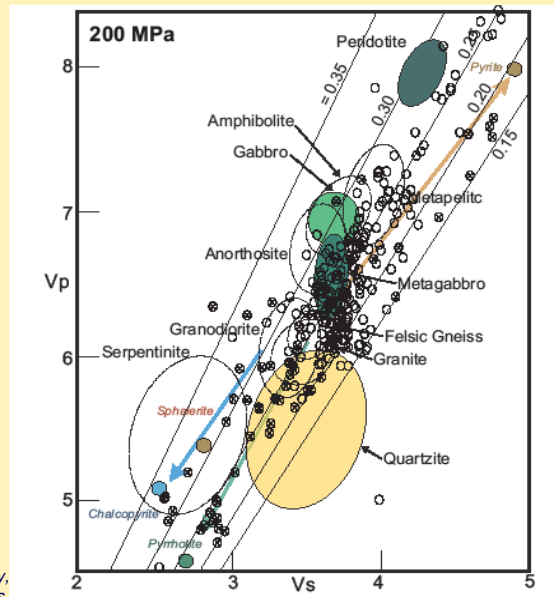


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Relating rock stratigraphy & ores to seismic sections using physical properties, here the Timmins ON area & Poisson's ratio



Snyder, Carey, & Salisbury, 2009, *Tectonophysics*.

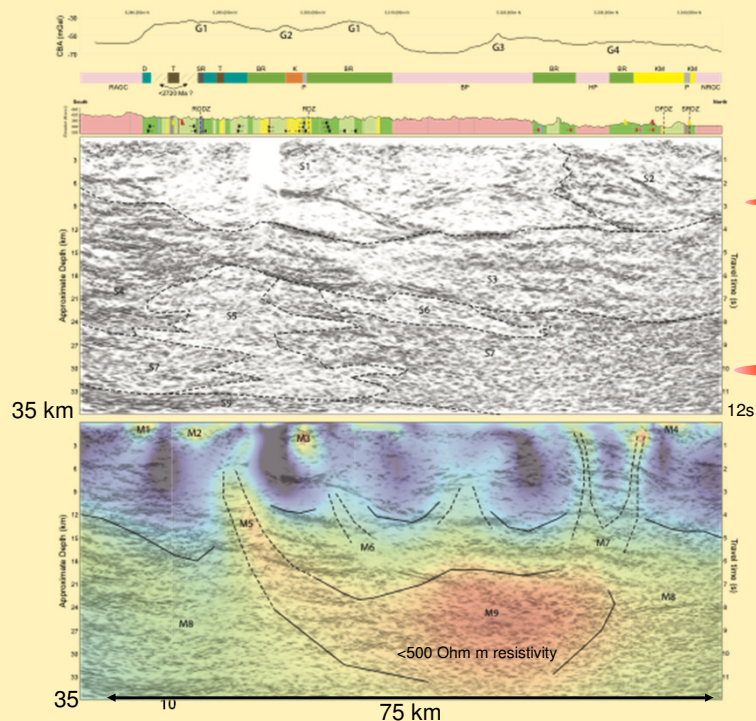


9

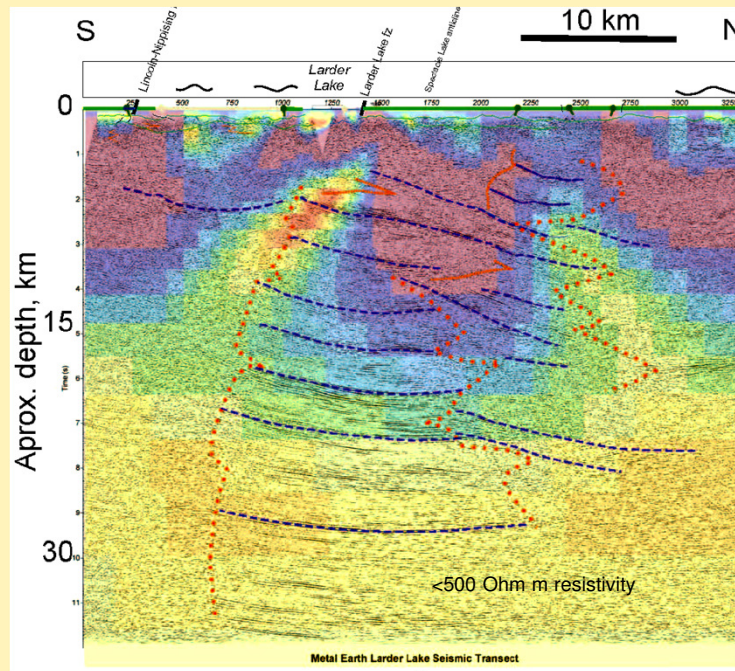
Metal Earth Swayze transect (75 km long)

Deep seismic reflection profiling + Broadband MT

Reflections provide key context for conductors

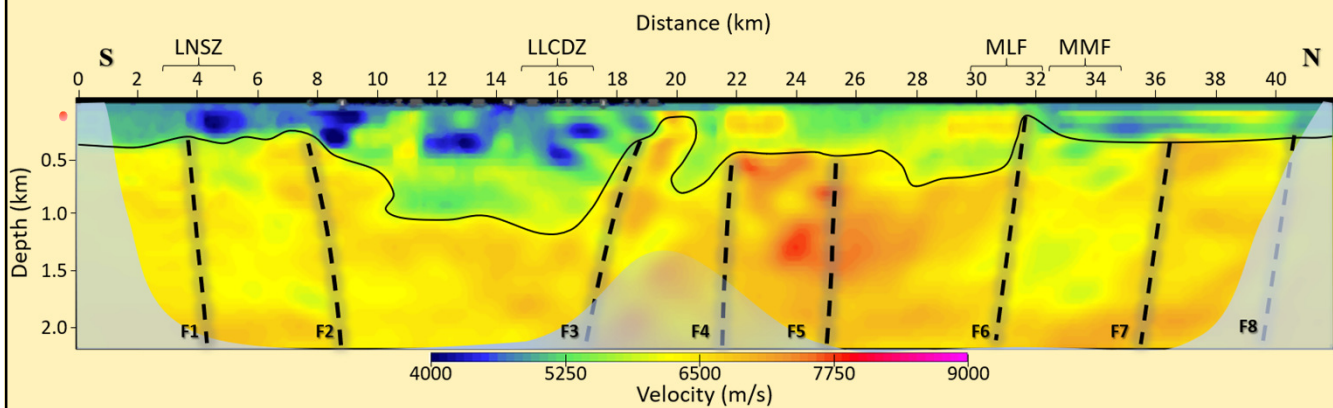


Larder Lake seismic reflection + broadband MT



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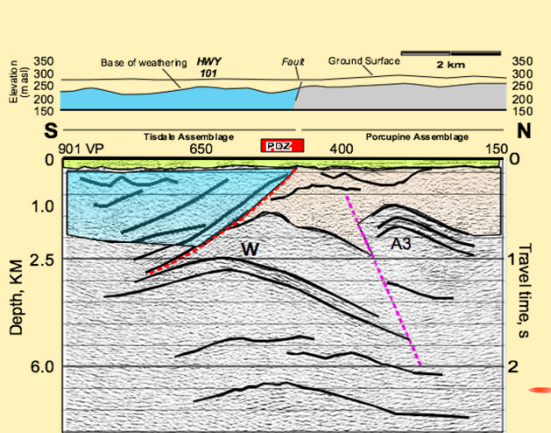
Full-waveform inversion of Larder Lake transect 2.5-D version



Brian Villamizar, PhD thesis, University of Western Ontario, 2022

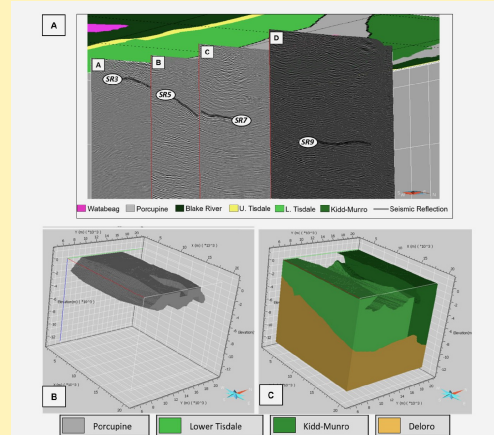
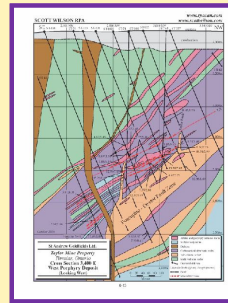
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High-resolution



Discover Abitibi (2004) High-resolution mode:
12.5 m receiver spacing; 25 m VP spacing

Snyder, Carey, & Salisbury, 2009, *Tectonophysics*.

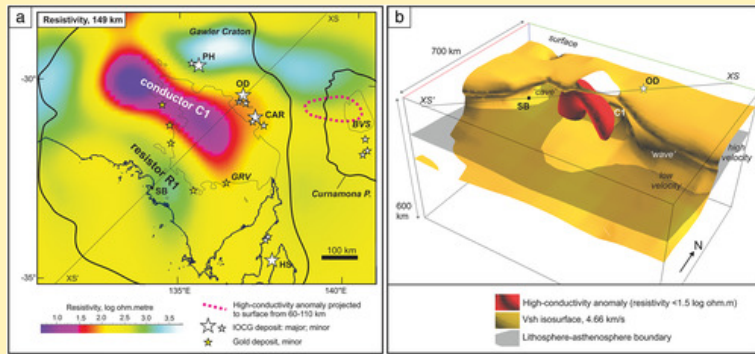


Metal Earth high-resolution seismic (A) and
3D gravity models. Della Justina (2022)

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A Metal Earth based Cost-Benefit Analysis

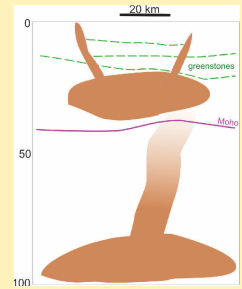
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Lithospheric scale MT surveys

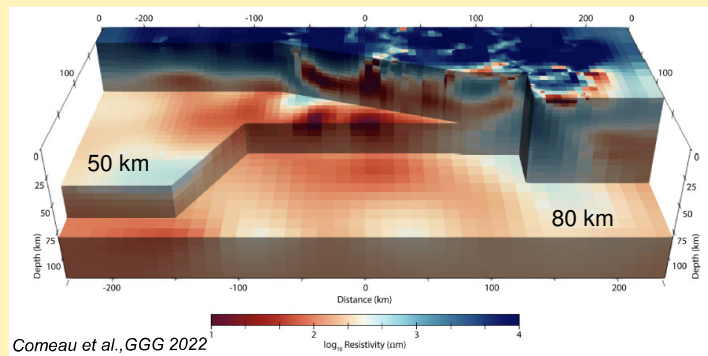
Mantle structure beneath Olympic Dam, S Australia

A generic whole lithosphere conductivity model?

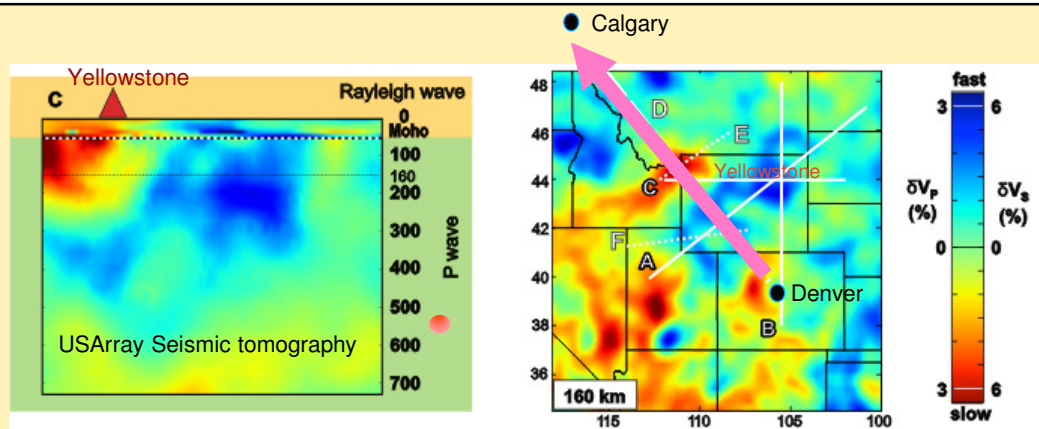


Skirrow et al., GGG, 2018

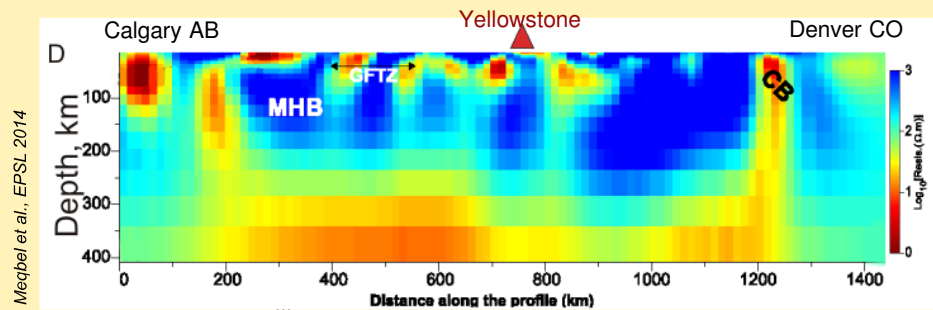
Mantle conductivity structure beneath the Bayankhongor metal belt, central Mongolia



Comeau et al., GGG 2022

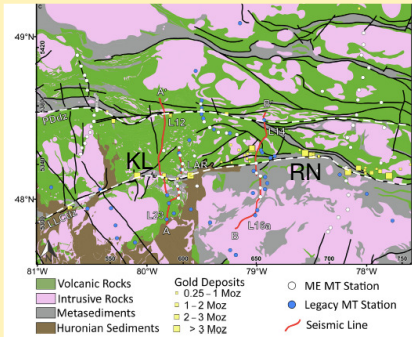


USArray Long-period MT

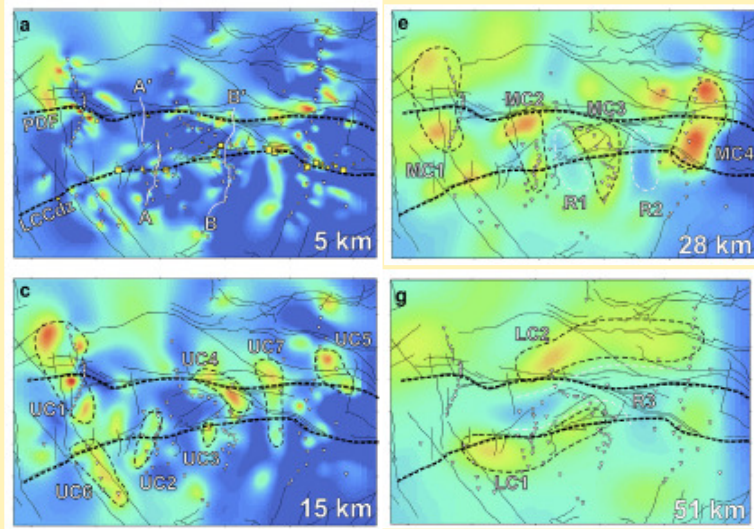


Meqbel et al., EPSL 2014

3D Regional/Broadband MT: Metal Earth Abitibi region

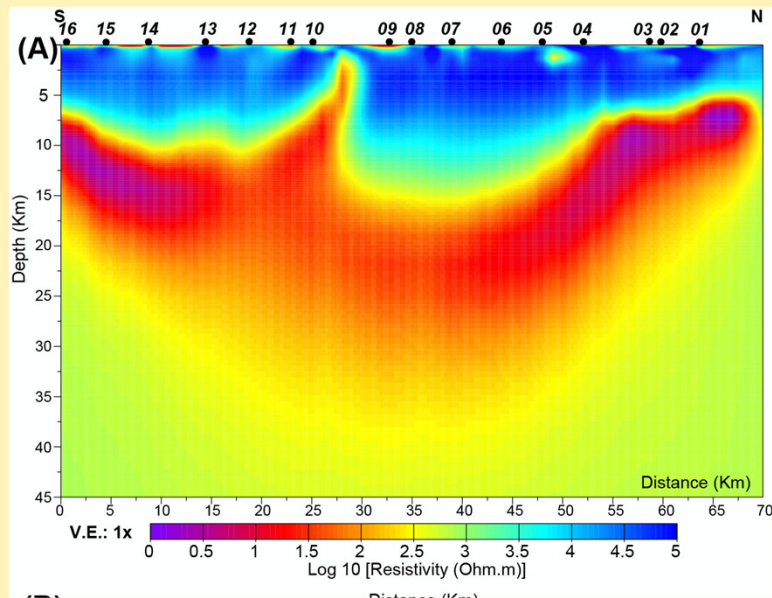


Roots et al., 2022, Gondwana Research



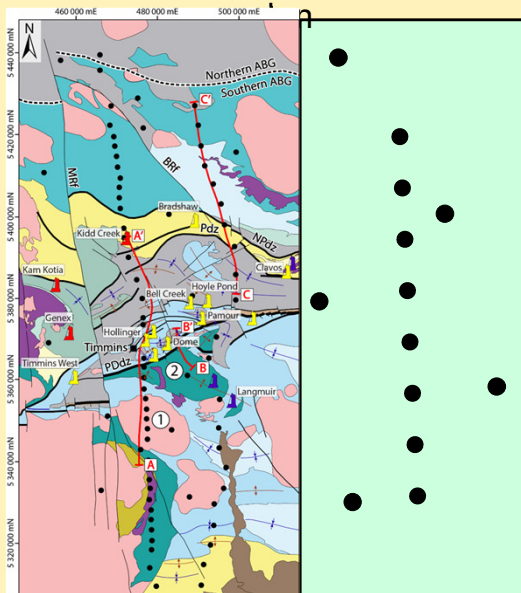
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2D Regional MT: Metal Earth Sturgeon transect



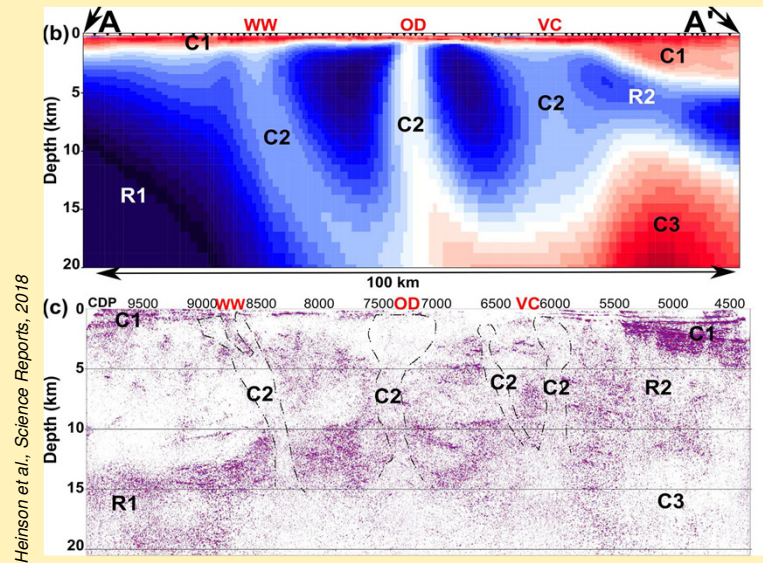
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3D MT acquisition design



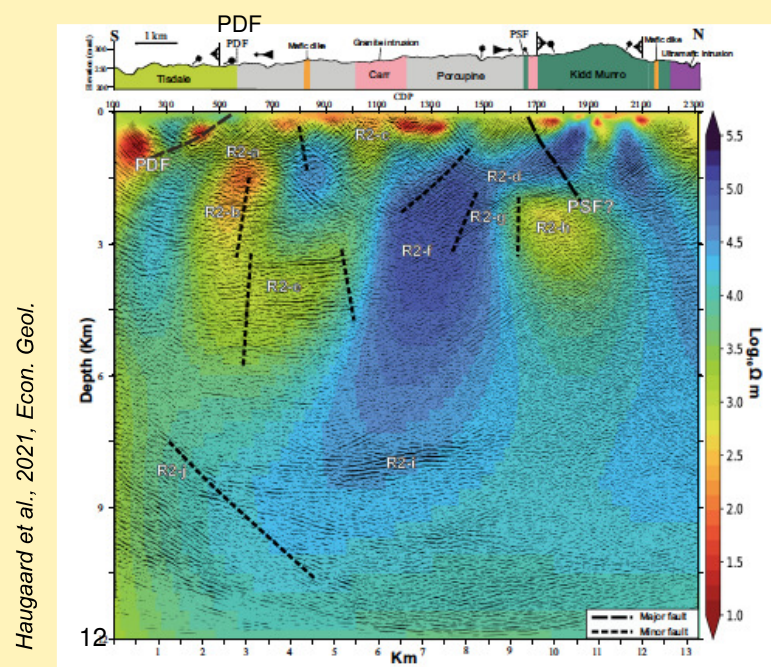
MT & Seismic sections at Olympic Dam (OD), South Australia: Take #4

... = AMT station



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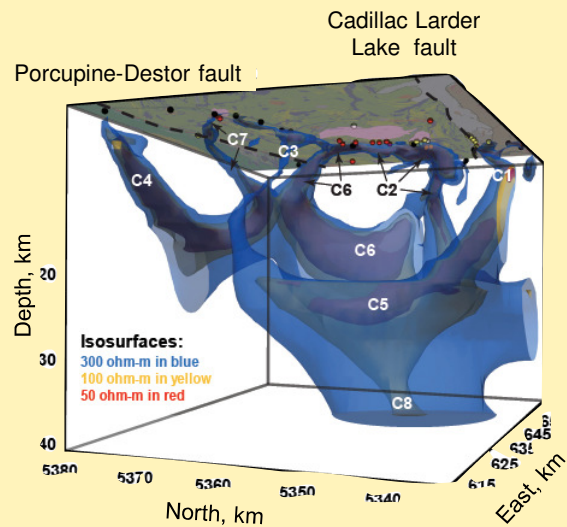
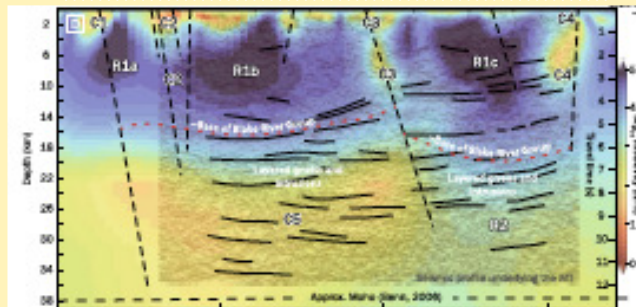
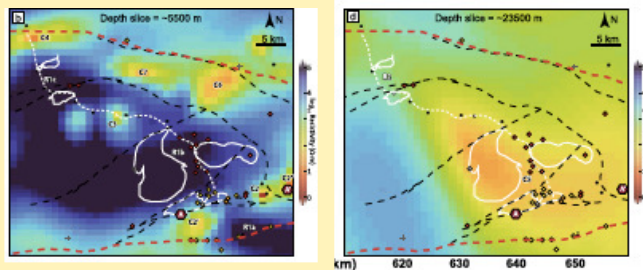
High-Res seismic reflection + AMT: Metal Earth Matheson transect



Haugaard et al., 2021, Econ. Geol.

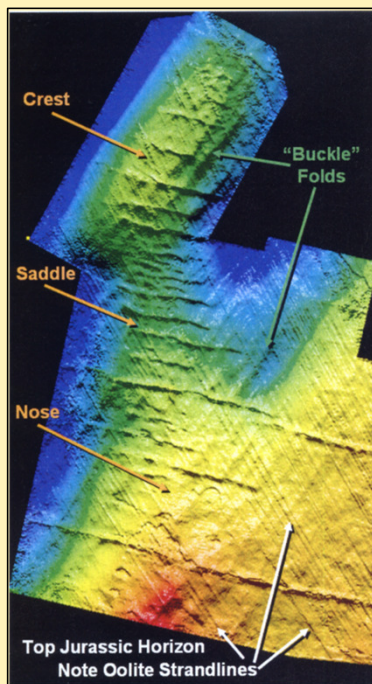
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MT: conductivity is 3D Metal Earth Rouyn-Noranda transect



Jorgensen et al., 2022, Science Reports (Nature)

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Very high resolution 3D seismic reflection survey of 'thin' shallow water sediment (oolite) layers (Middle East)

Possible application to mapping topography on 'thin' ultramafic lava flows in layered Archean intrusions?

Area shown: 50 x 120 km

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| | | | | | 23 | | | | | |

Reference articles

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