A non-plate tectonic model for the Yilgarn Craton, Western Australia

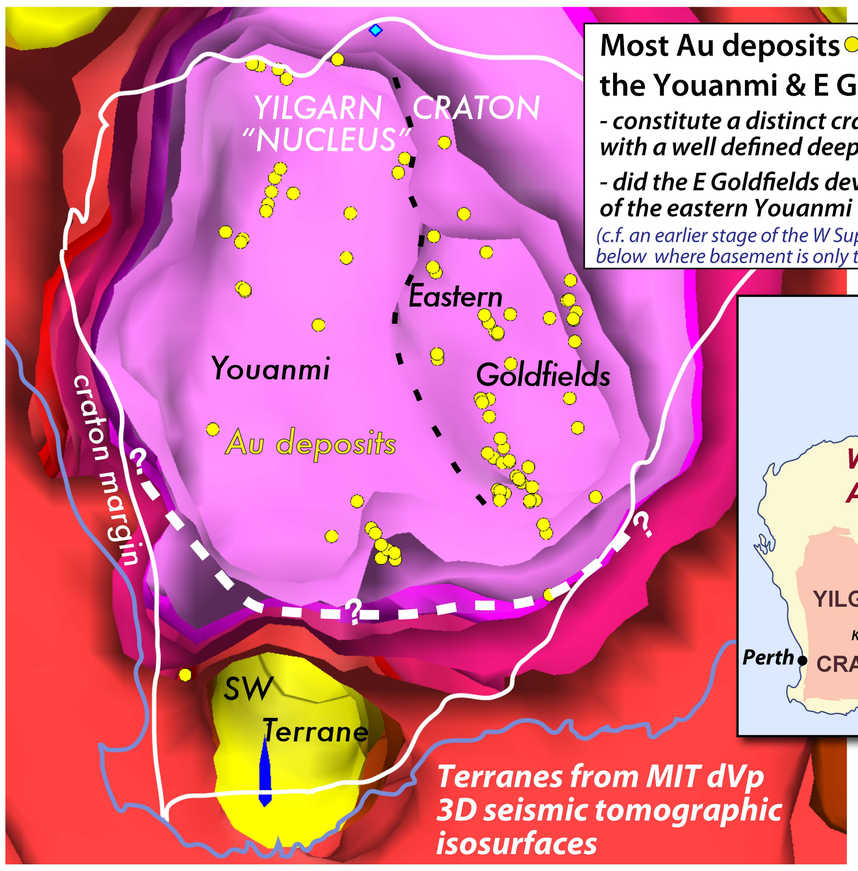
– exploration implications & comparisons with the Superior Craton, Canada

Lyal Harris *(INRS-ETE, Québec)*

Jean Bédard *(GSC-Québec)*

INRS UNIVERSITÉ DE RECHERCHE A RESEARCH UNIVERSITY

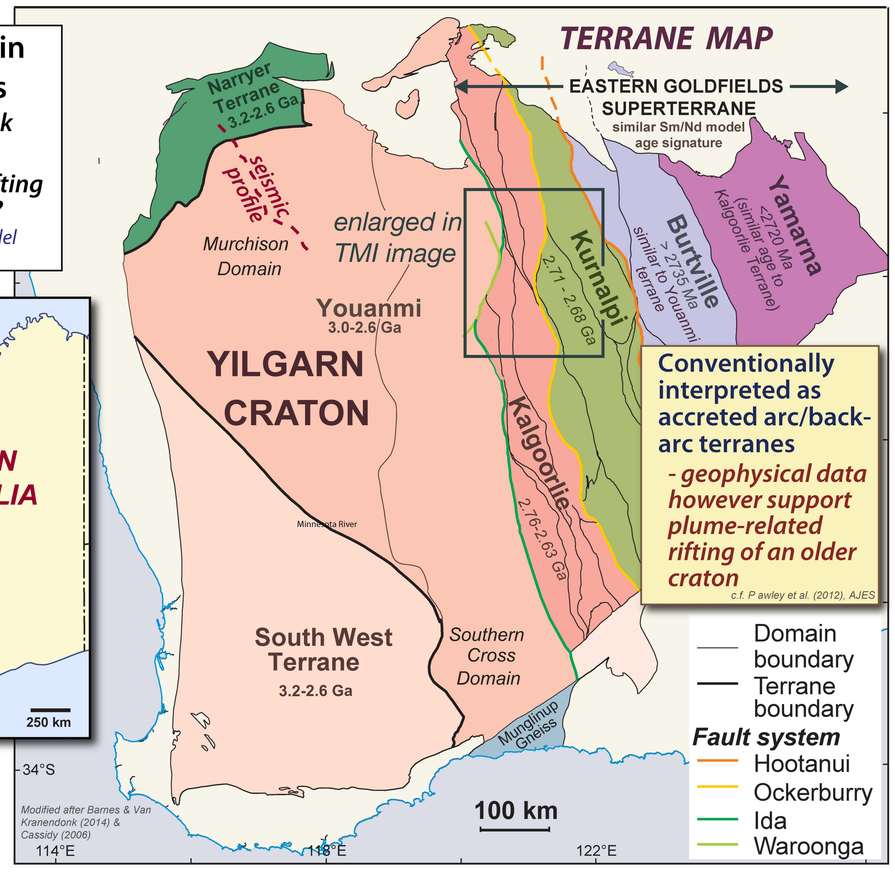
CANADA 1842 GEOLOGICAL SURVEY - COMMISSION GÉOLOGIQUE



Most Au deposits lie within the Youanmi & E Goldfields

- *constitute a distinct cratonic block with a well defined deep keel*
- *did the E Goldfields develop by rifting of the eastern Youanmi 'Terrane'?*

(c.f. an earlier stage of the W Superior rift model below where basement is only thinned)



Conventionally interpreted as accreted arc/back-arc terranes

- *geophysical data however support plume-related rifting of an older craton*

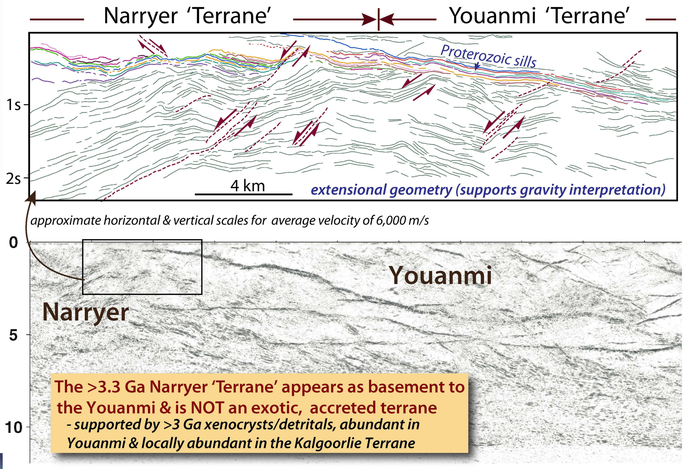
c.f. P awley et al. (2012), AJES

YILGARN CRATON, WESTERN AUSTRALIA

The conventional model of accreted arc terranes is not supported by geophysics

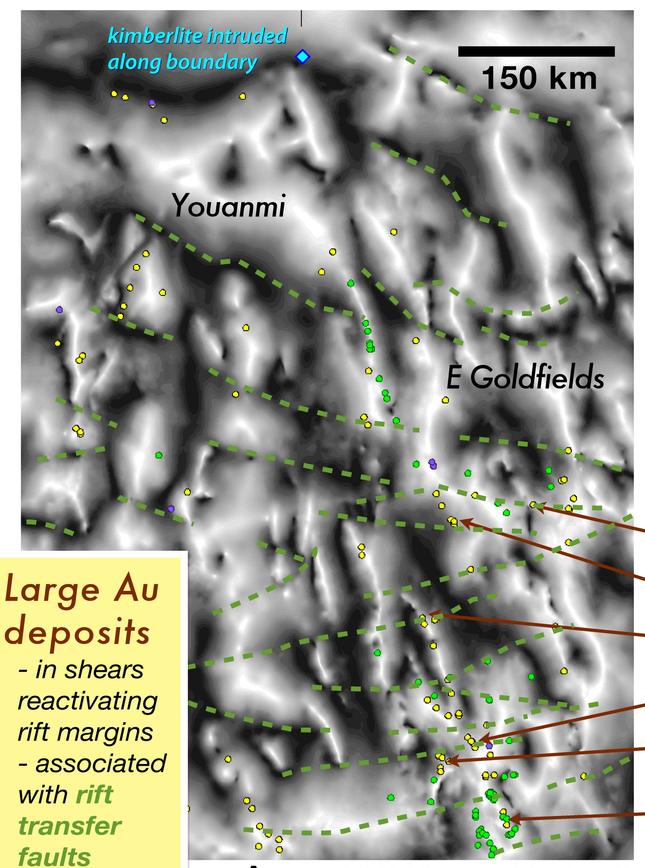
- Long wavelength Bouguer gravity highlights an early rift geometry superposed on previously accreted terranes identified from seismic tomography.
- Seismic profiles show that the Narryer is NOT an accreted terrane but is basement to the Youanmi terrane.

In the SE Superior Craton, the Opatica 'Terrane' similarly represents basement to the Abitibi (Daoudene et al. 2014, M82014-04, MERN)



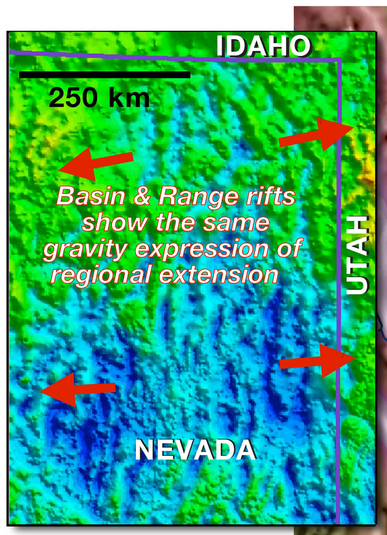
The >3.3 Ga Narryer 'Terrane' appears as basement to the Youanmi & is NOT an exotic, accreted terrane

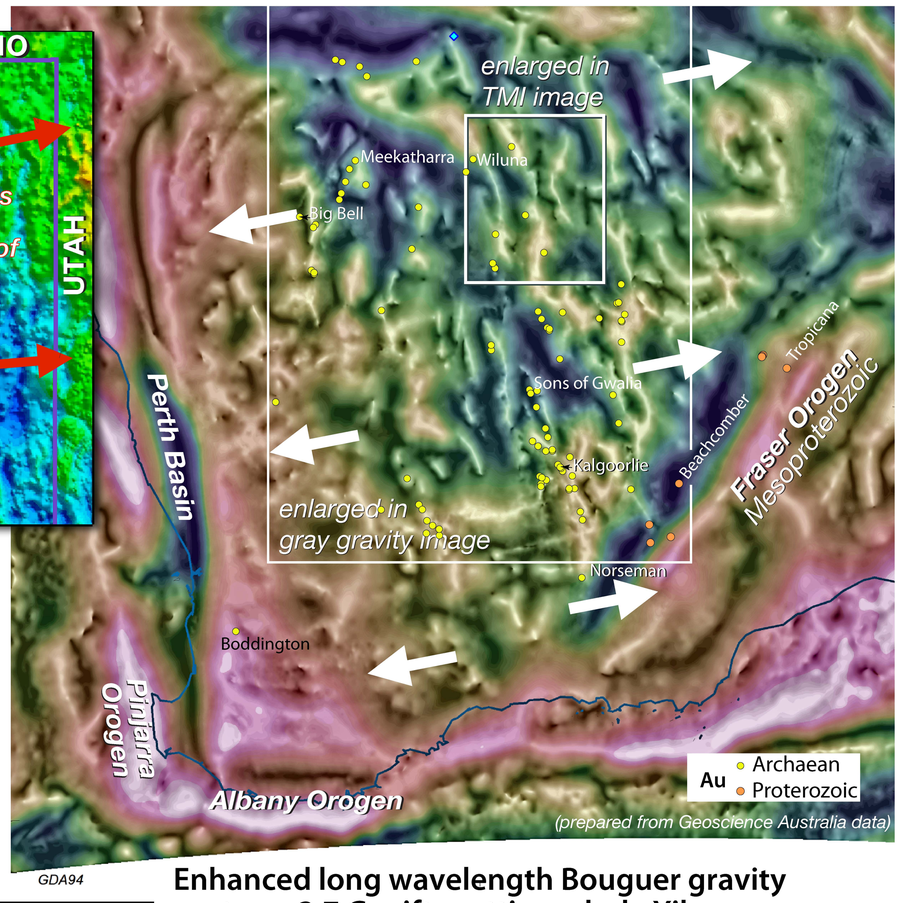
- *supported by >3 Ga xenocrysts/detritals, abundant in Youanmi & locally abundant in the Kalgoorlie Terrane*



Large Au deposits

- *in shears reactivating rift margins*
- *associated with rift transfer faults*

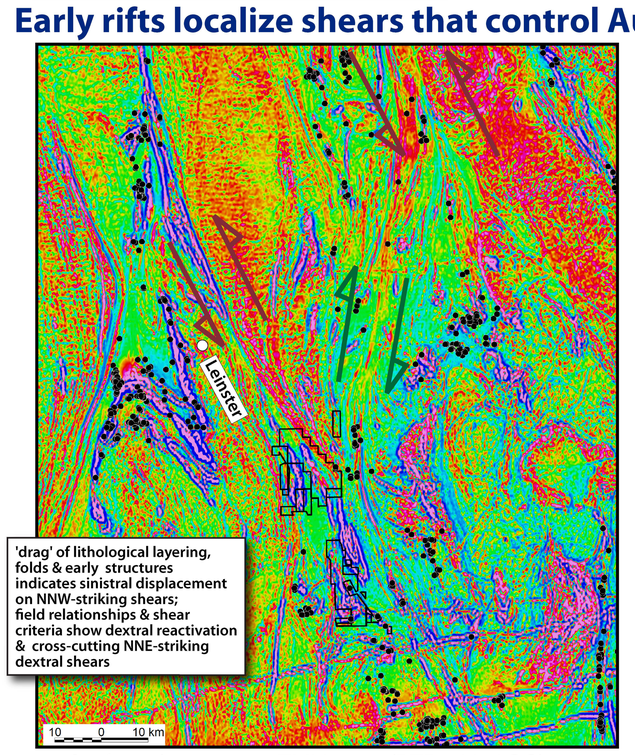




Enhanced long wavelength Bouguer gravity portrays 2.7 Ga rifts cutting whole Yilgarn

- *similar to Basin & Range rifting, Nevada (inset top left)*

Early rifts localize shears that control Au



'drag' of lithological layering, folds & early structures indicates sinistral displacement on NNW-striking shears; field relationships & shear criteria show dextral reactivation & cross-cutting NNE-striking dextral shears

• Au deposits

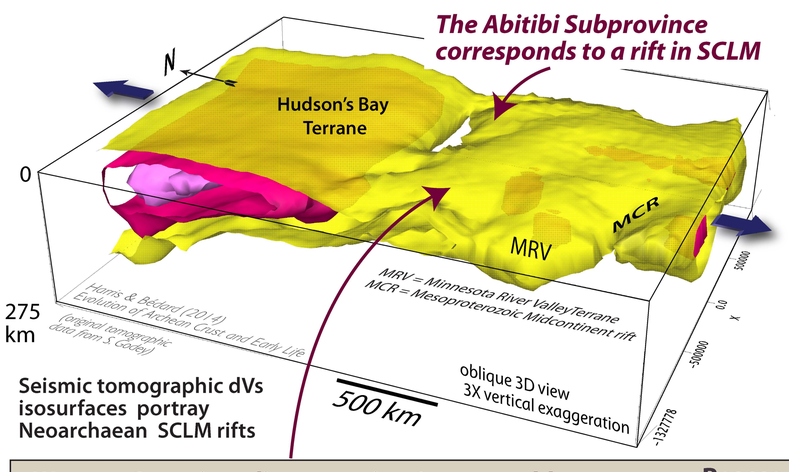
TMI image (RTP with AGC) (prepared from Geoscience Australia data)

Rift margins localize shear zones that control orogenic Au mineralization:

Sinistral transpression	*2655 - 2650 Ma*
Dextral transcurrent	*2650 - 2635 Ma*

SUPERIOR CRATON, CANADA

Greenstones in the S Superior formed during rifting of early terranes assembled to form the Superior I craton

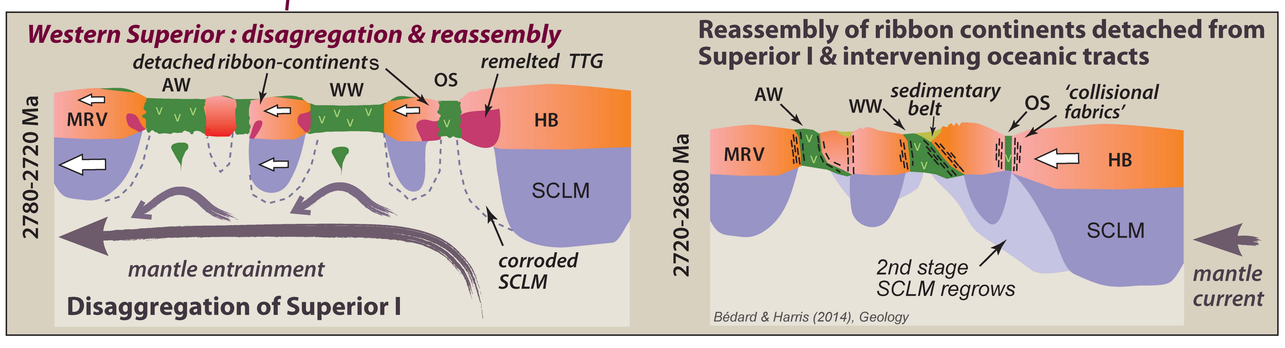


Geophysical data show that an early-assembled craton (Superior I) underwent rifting & fragmentation – *more advanced than in Yilgarn:*

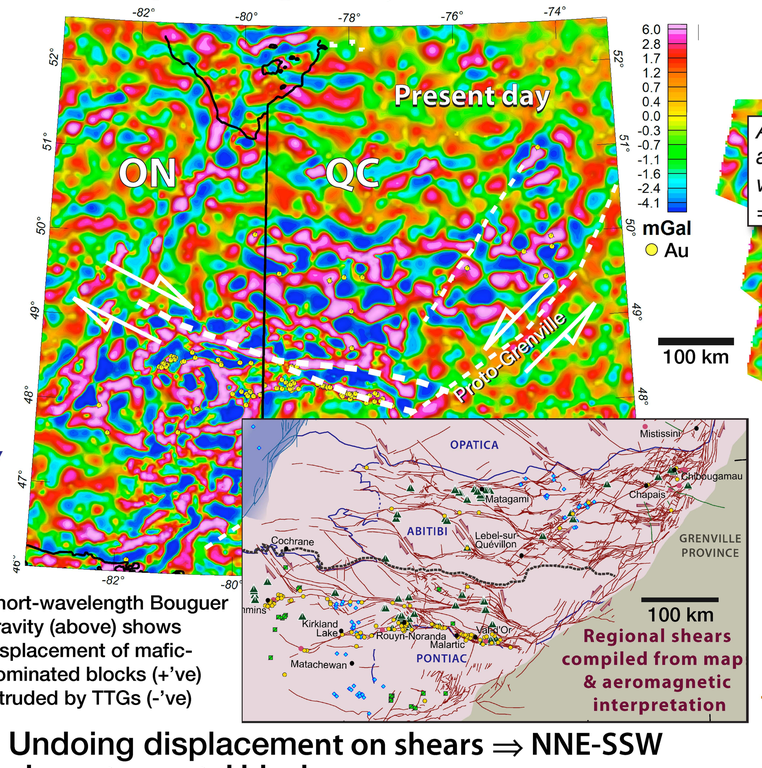
- *Greenstones in W Superior formed between detached ribbon continents*
- *The Abitibi likely formed as a NNE-SSW elongate oceanic plateau (see reconstruction on right).*

Strike-slip shear zones & thrusts, developed during subsequent N-S shortening & reassembly, cross-cut & displace early rift & transfer faults

- *Much harder in the Abitibi than in the Yilgarn to identify early structures important in localizing Au deposits*

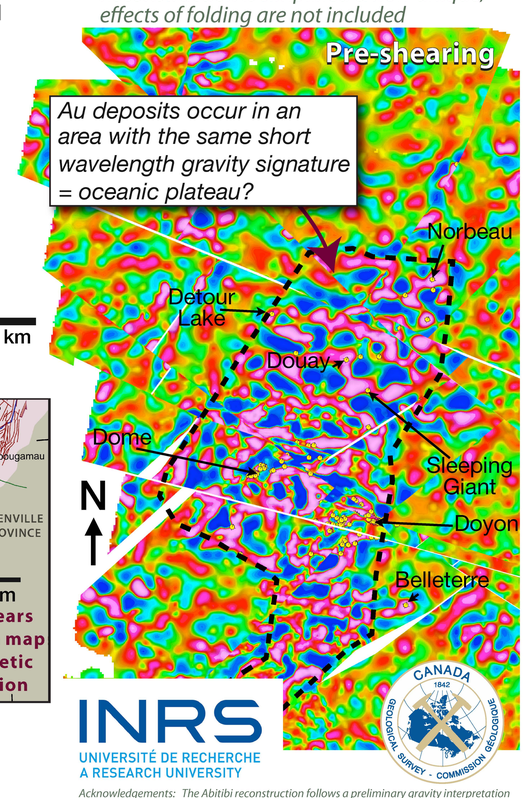


SE Superior gravity reconstruction ⇒ oceanic plateau NOT arcs



Short-wavelength Bouguer gravity (above) shows displacement of mafic-dominated blocks (+'ve) intruded by TTGs (-'ve)

Reconstruction is simplified & non-unique; effects of folding are not included



Undoing displacement on shears ⇒ NNE-SSW elongate crustal block

- *plume-related oceanic plateau?*
- *not compatible with subduction & accretion of E-W trending arcs*

Acknowledgements: The Abitibi reconstruction follows a preliminary gravity interpretation of the central Abitibi by Noémie Fayol (UQAM). Early research by LH in the Superior Craton was funded by Laurentian Goldfields. Initial studies of Archaean rifting were funded by NSERC. Breakaway Resources funded research in the Leinster area (Yilgarn).