

Geology and mineralization of the Halls Creek Orogen

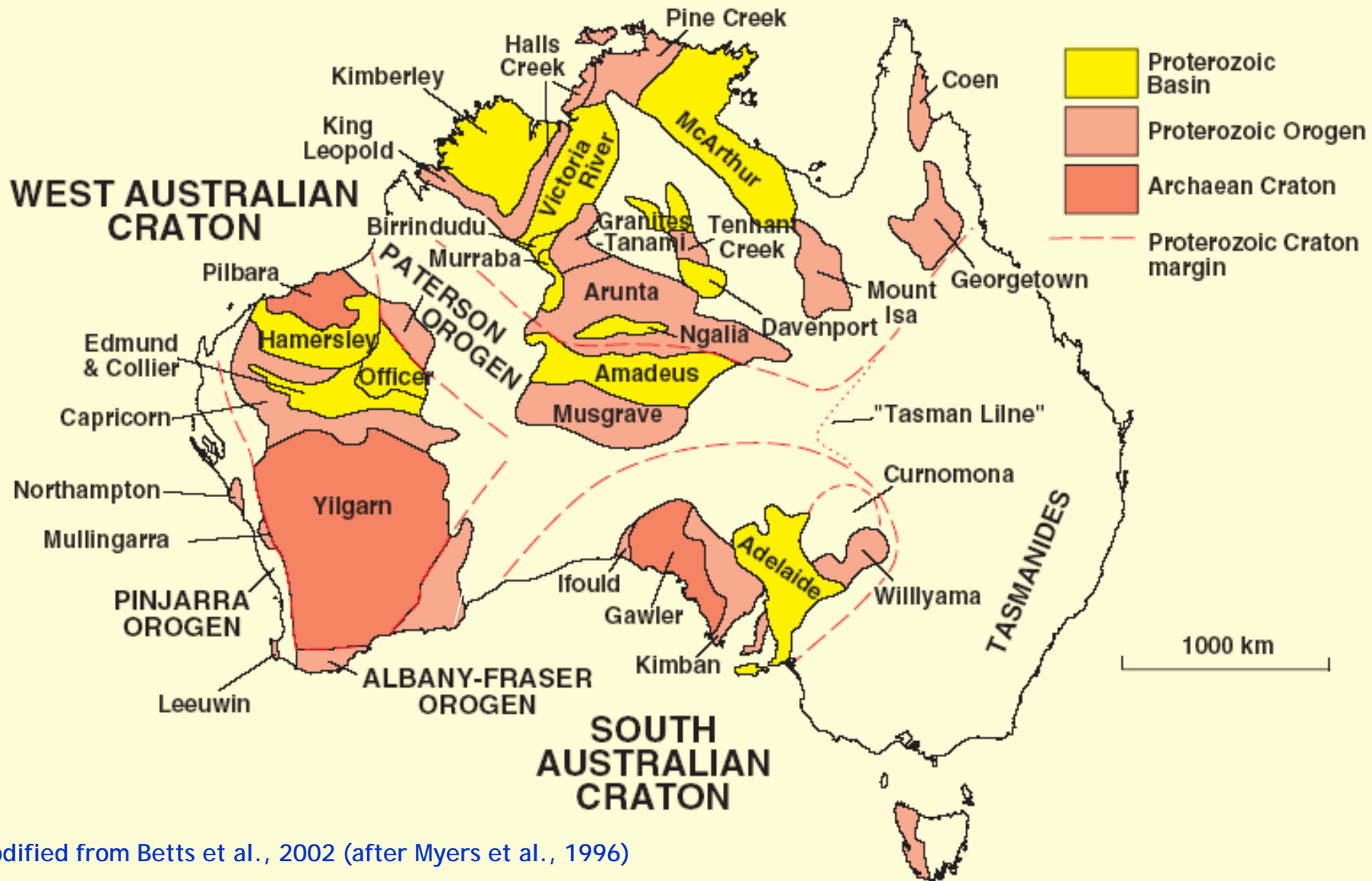


Ian Tyler and Steve Sheppard, with acknowledgement to Tim Griffin, Alan Thorne, Simon Bodorkos (Curtin, now GSWA), Russell Shaw, Rod Page, Dean Hoatson, Gladys Warren, Dave Blake (AGSO/GA)

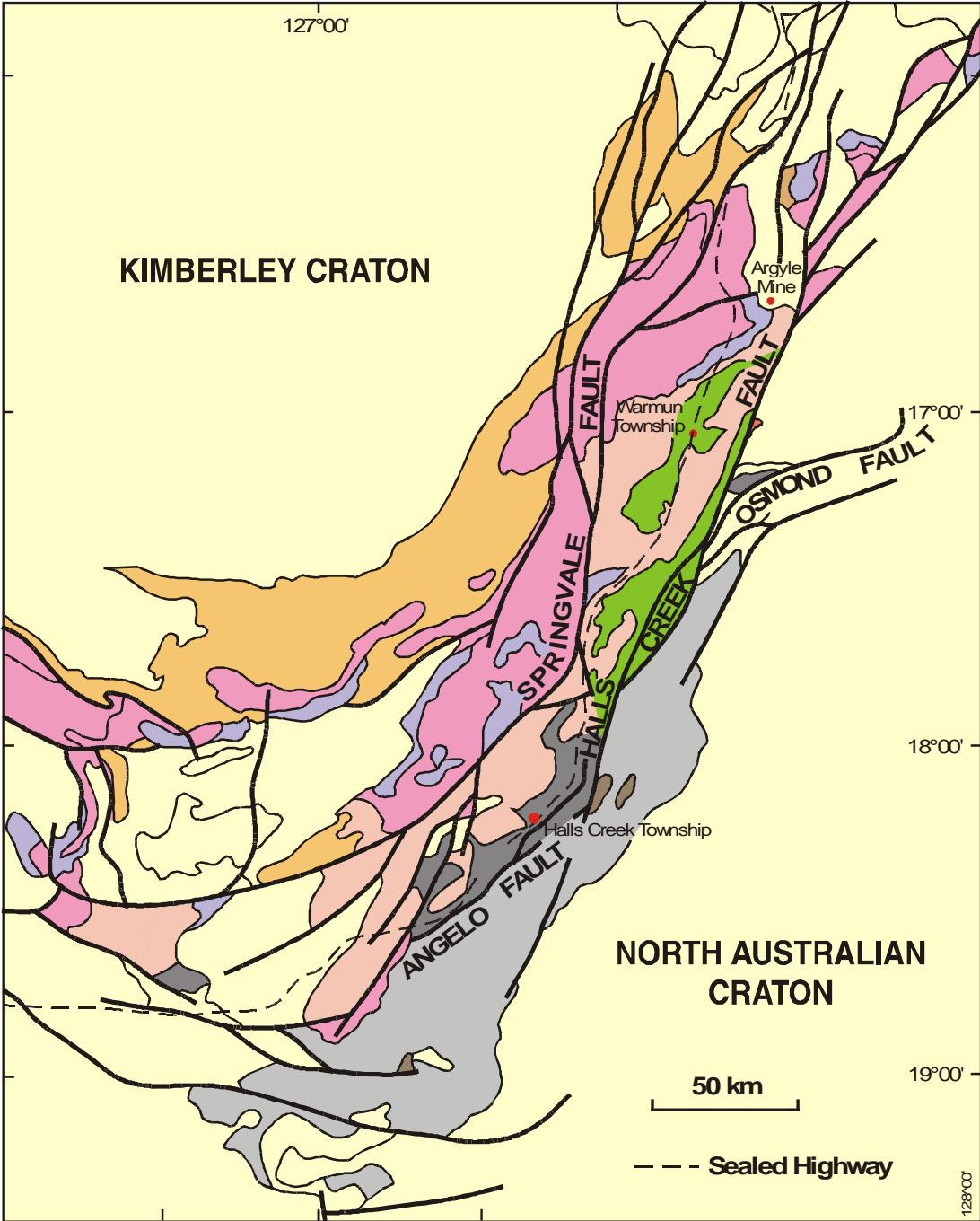


Department of
Industry and Resources

NORTH AUSTRALIAN CRATON



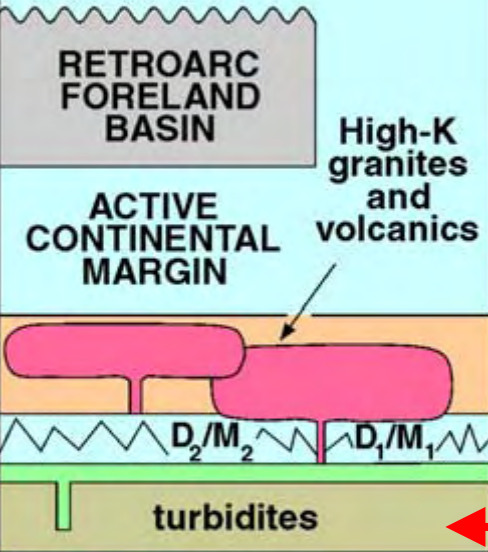
Modified from Betts et al., 2002 (after Myers et al., 1996)



- Younger rocks
 - Retroarc foreland basin (c. 1835 Ma)
 - Andean type and post-collisional granites (1835–1805 Ma)
- Western zone**
- High-K granite and felsic volcanics (c. 1855 Ma)
 - Active continental margin (1870–1863 Ma)
- Central zone**
- Rifted arc terrane (c. 1843 Ma)
 - Island arc terrane (1865–1850 Ma)
- Eastern zone**
- Passive margin sequence (1880–1845 Ma)
 - Basement (c. 1910 Ma)

WESTERN ZONE

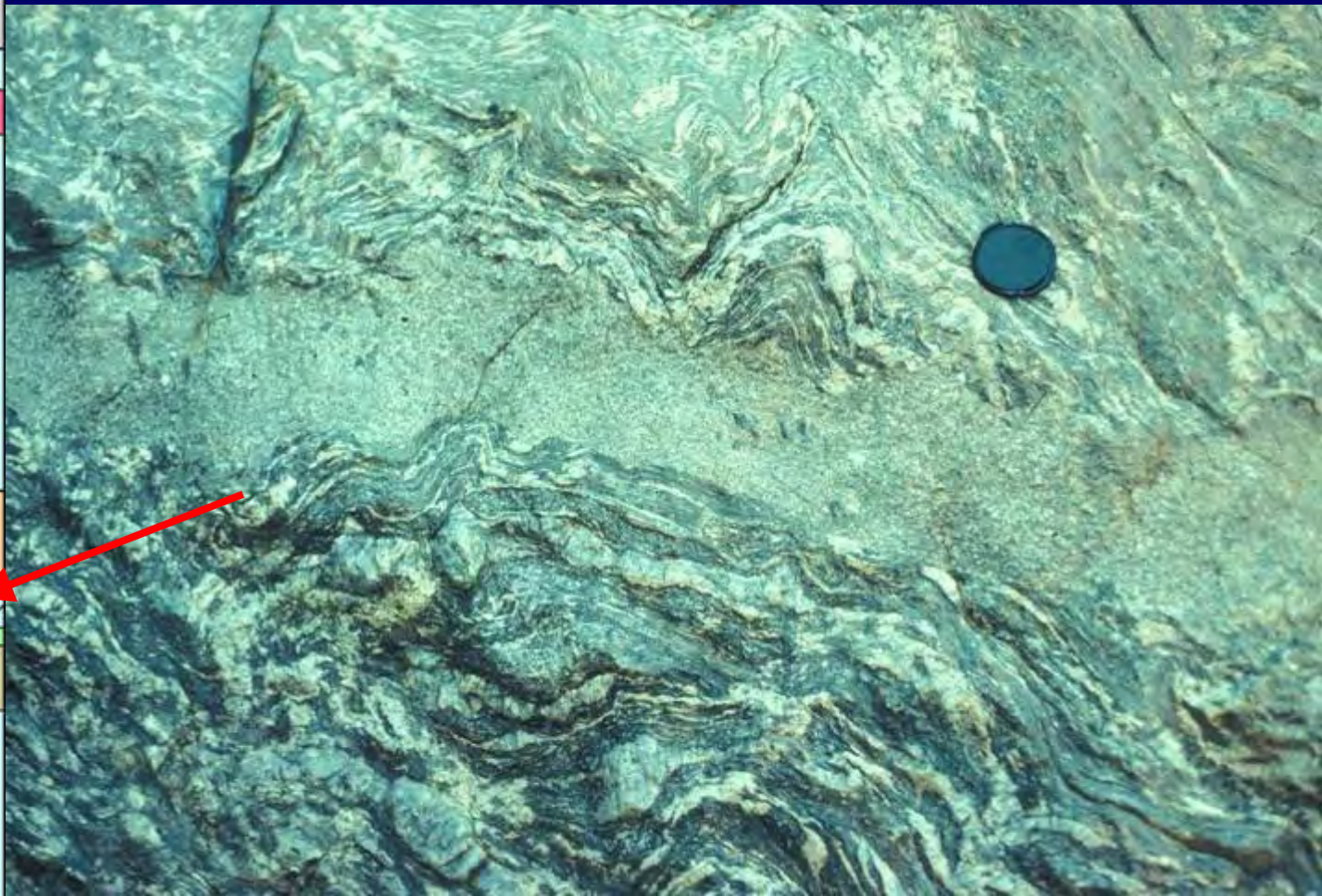
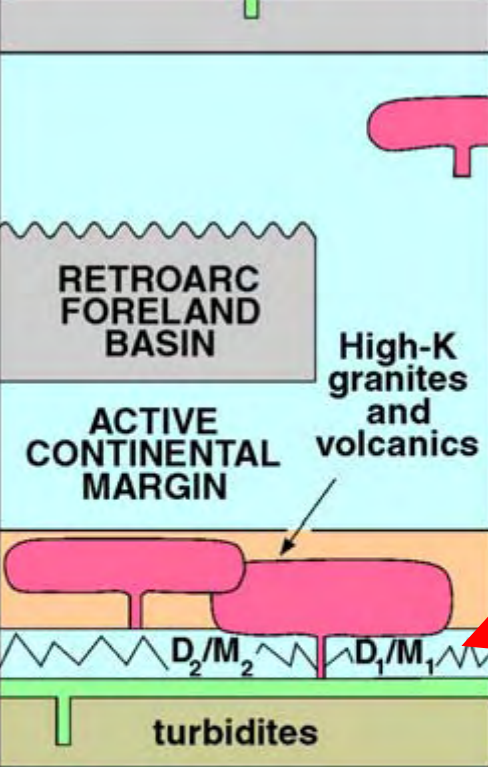
Marboo Formation - c. 1870 Ma

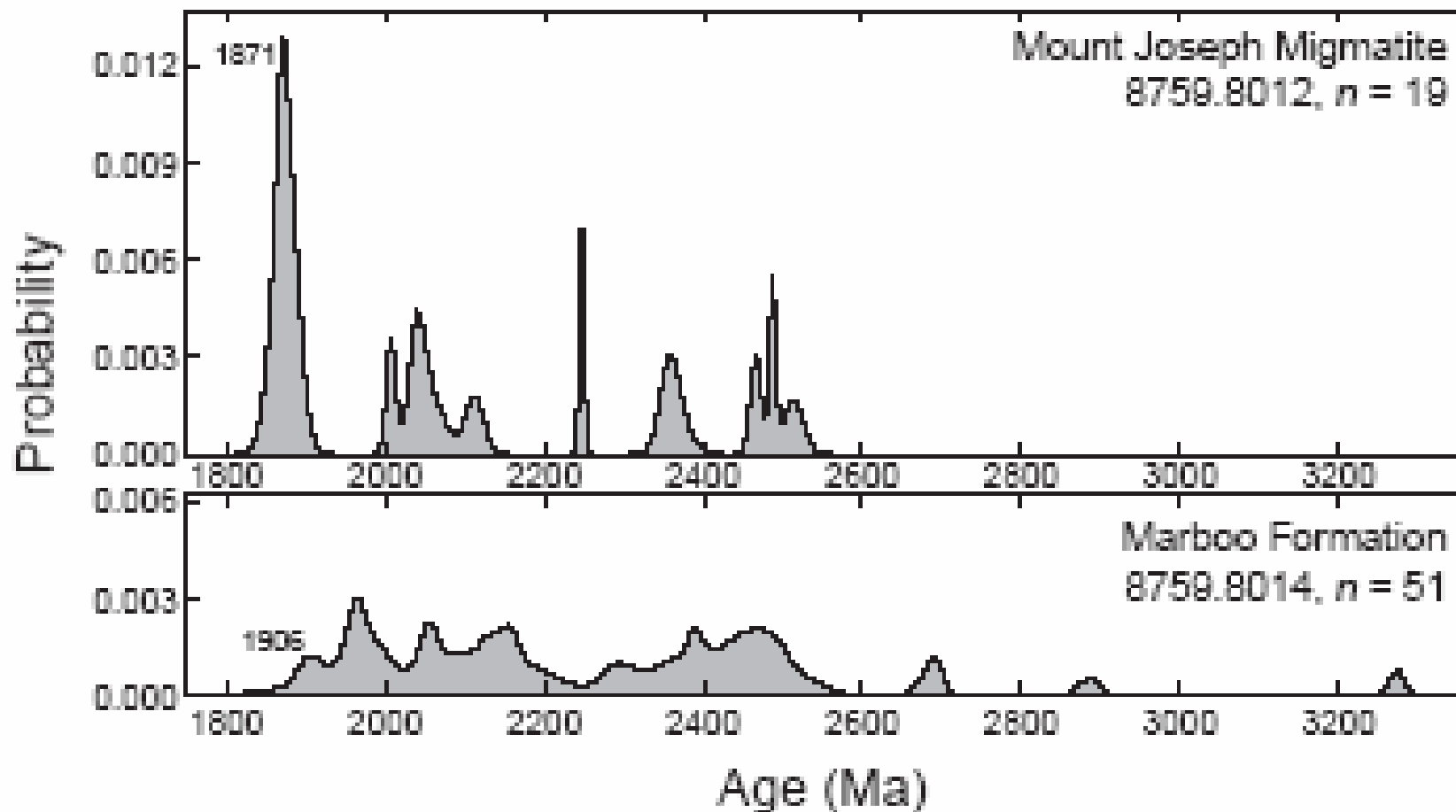


WESTERN ZONE

Mount Joseph Migmatite

- $M_2 = 1861_{\pm 5}$ Ma

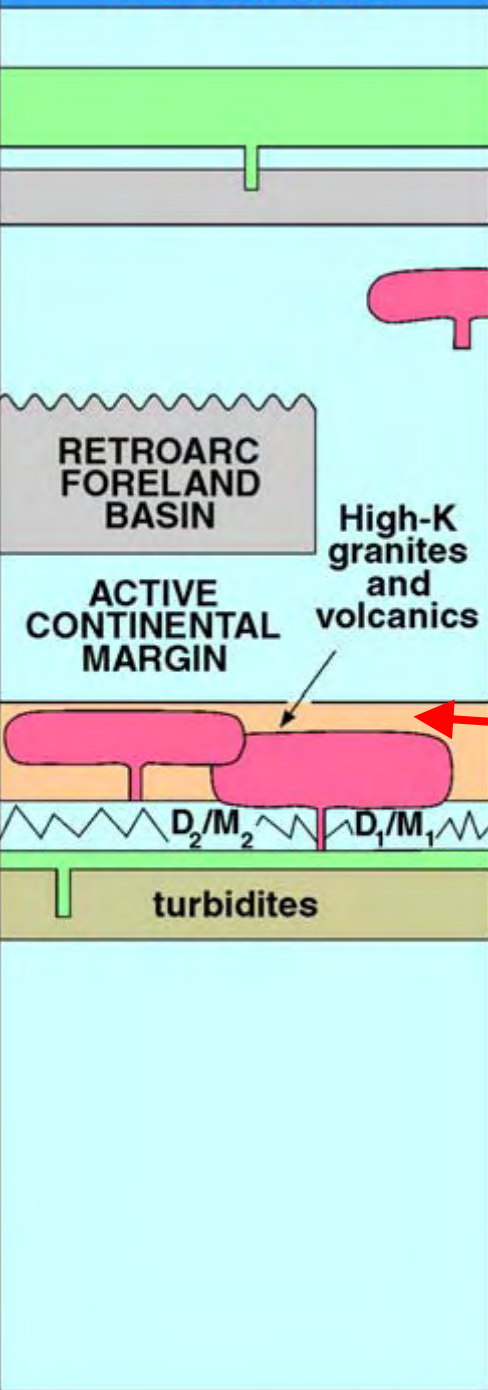




Courtesy of Simon Bodorkos. Data from Tyler et al. (1999)

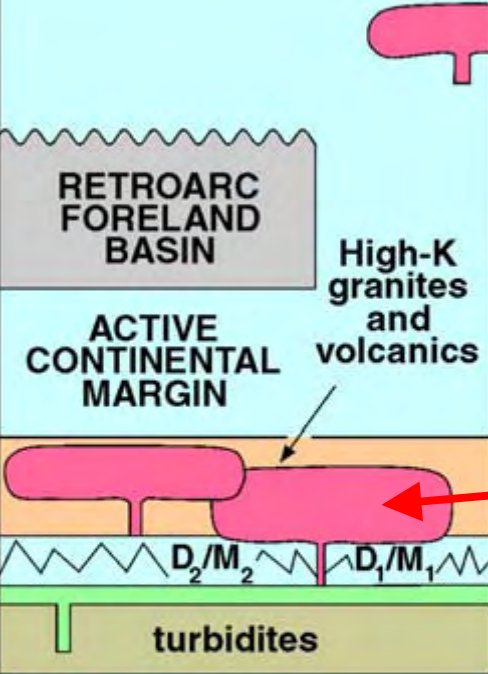
WESTERN ZONE

Whitewater Volcanics - c. 1855 Ma

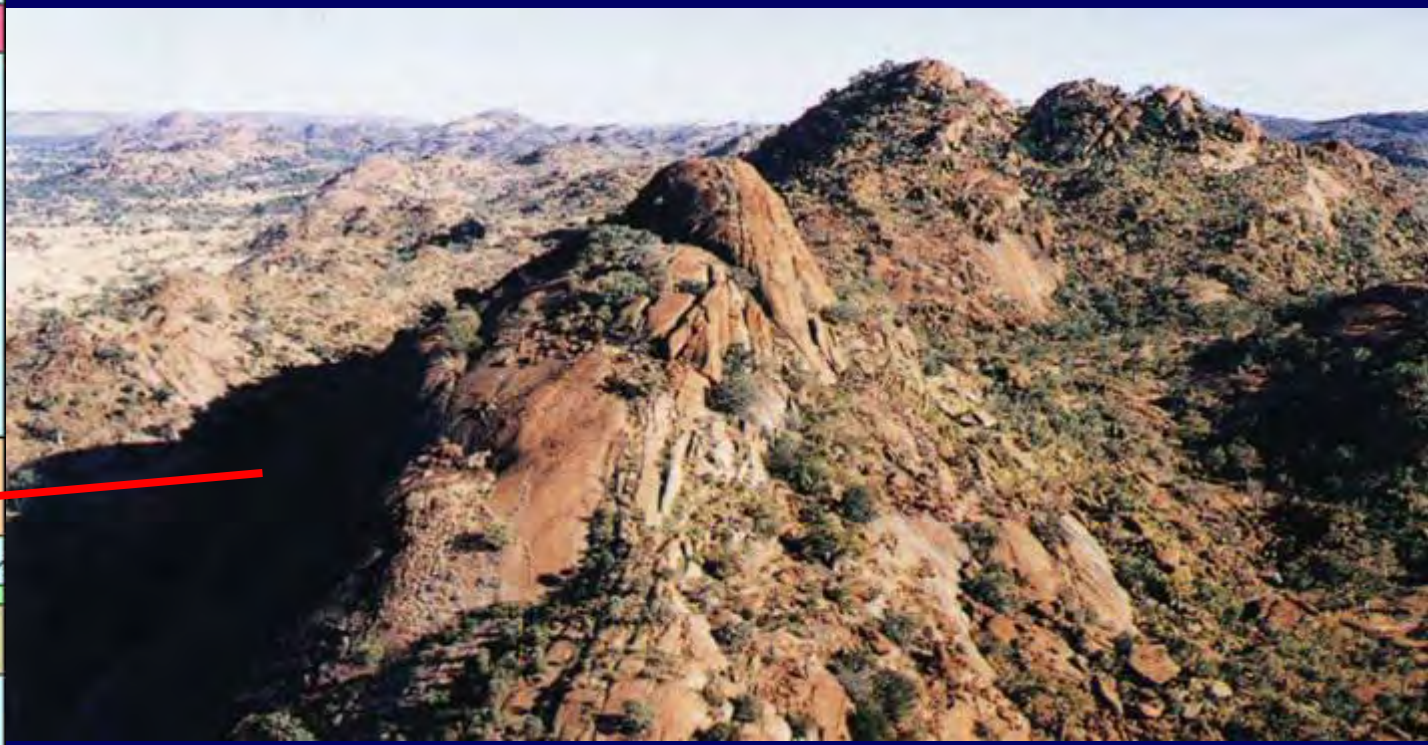


WESTERN ZONE

Paperbark Supersuite - 1865-1850 Ma

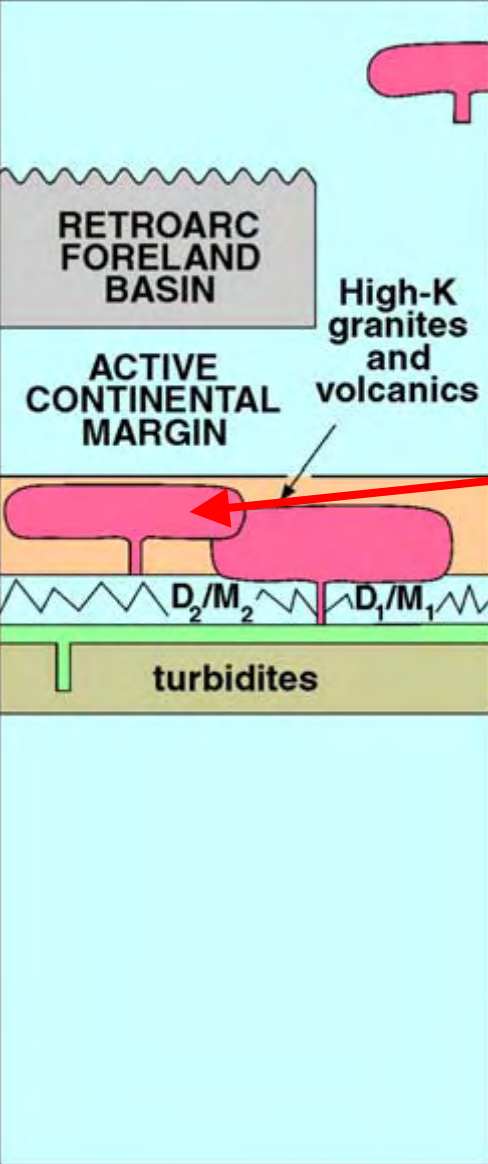


High-K
granites
and
volcanics



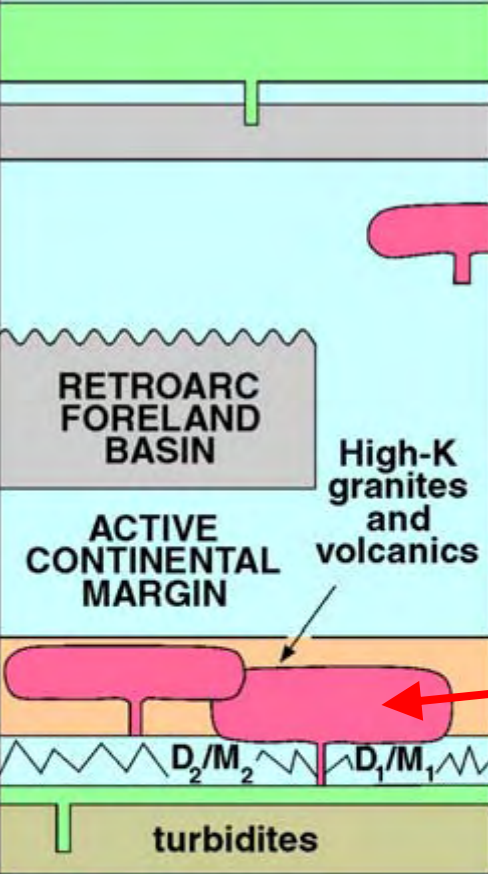
WESTERN ZONE

Paperbark Supersuite - 1865-1850 Ma

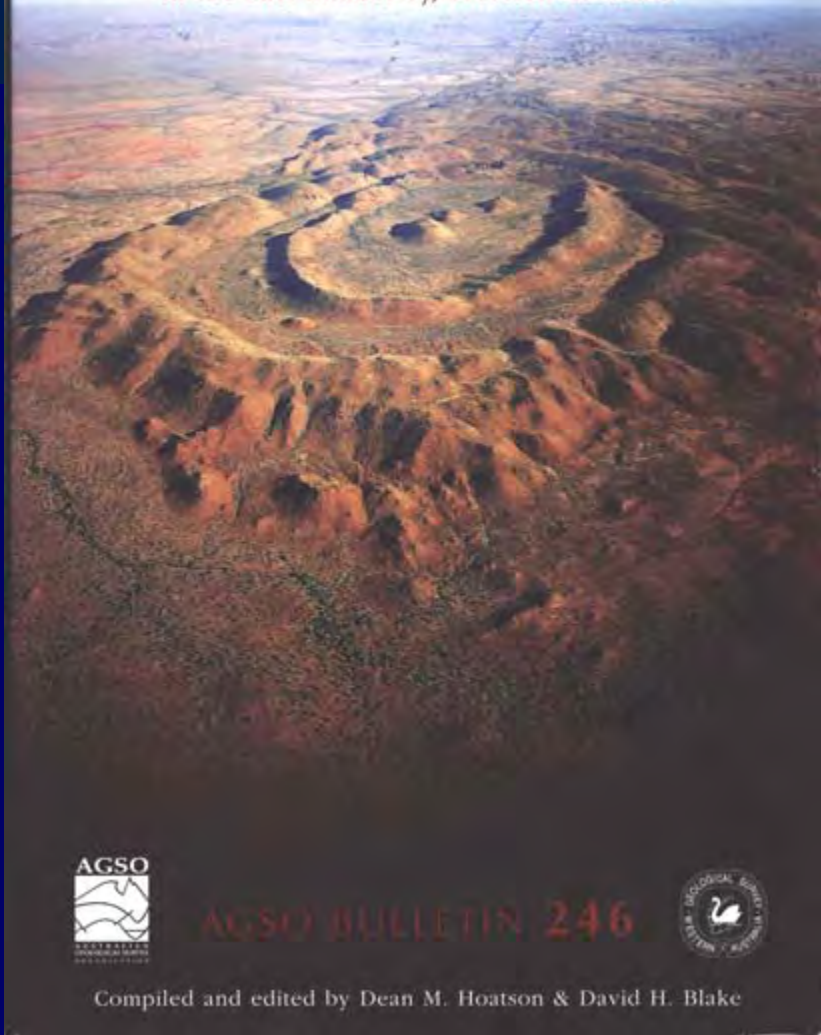


WESTERN ZONE

Paperbark Supersuite - 1865-1850 Ma

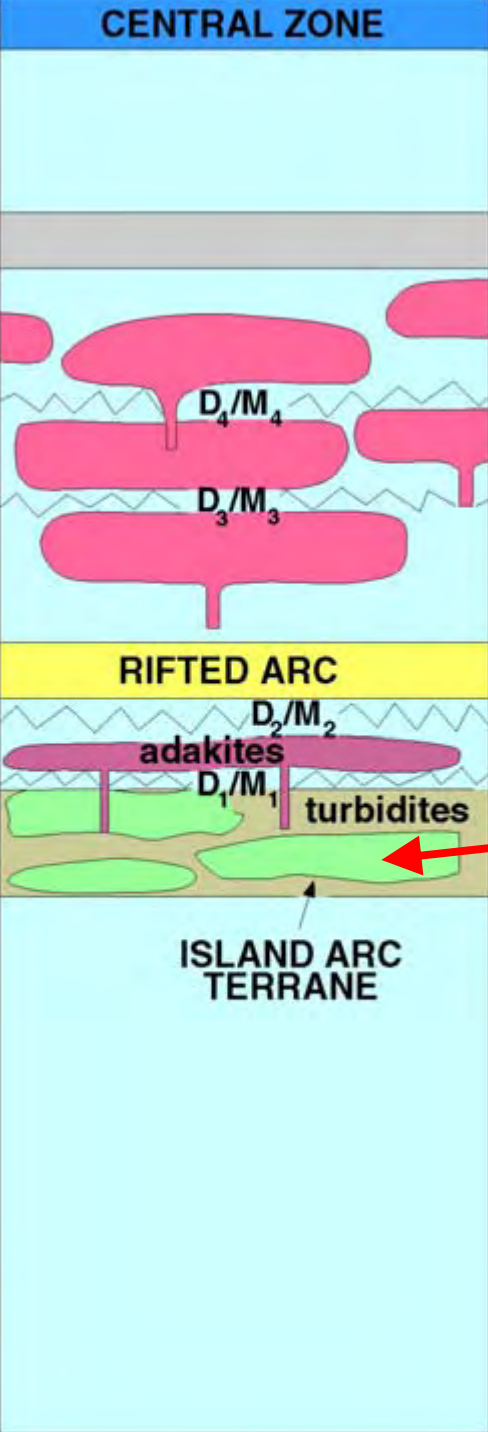


Geology and economic potential of the
Palaeoproterozoic layered mafic-ultramafic intrusions
in the East Kimberley, Western Australia



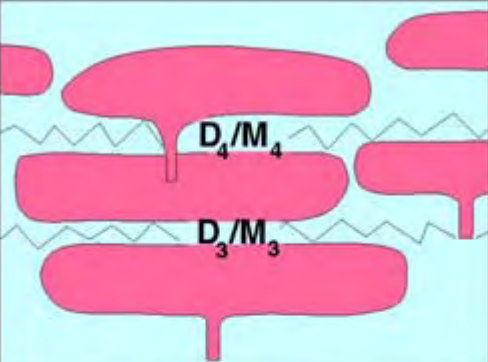
- Group II
 - Springvale intrusion
 - c. 1857 Ma
- Group III
 - Toby Gabbro
 - c. 1855 Ma

Tickalara Metamorphics - c. 1865 Ma



CENTRAL ZONE

Tickalara Metamorphics - c. 1865 Ma



RIFTED ARC

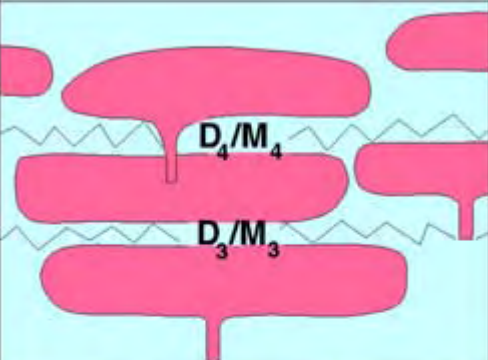


ISLAND ARC TERRANE



CENTRAL ZONE

Tickalara Metamorphics - c. 1865 Ma

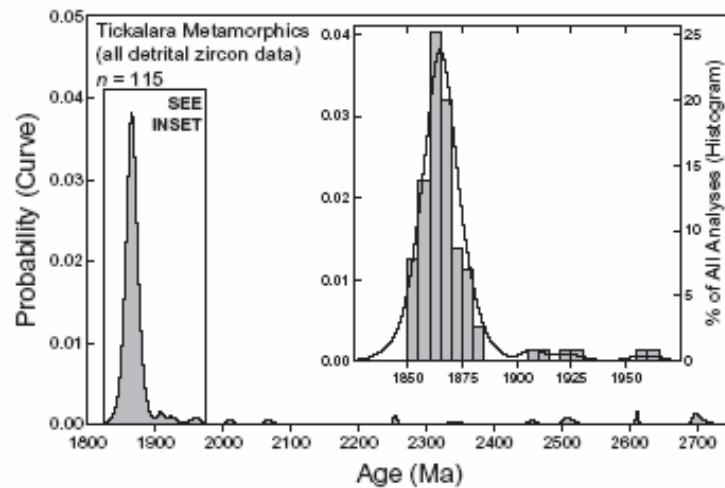
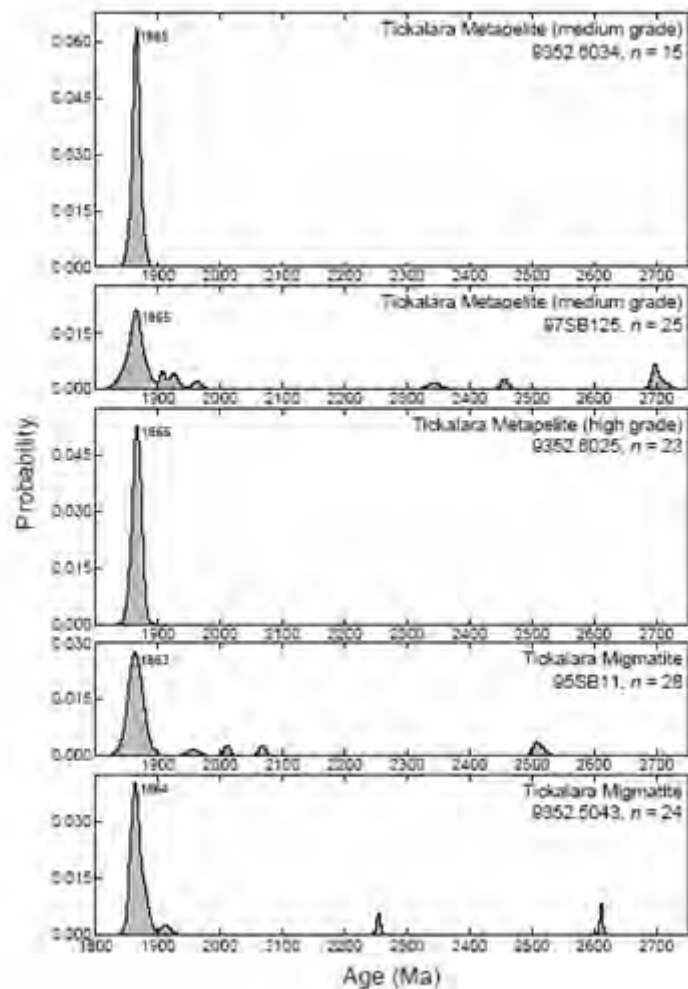


RIFTED ARC



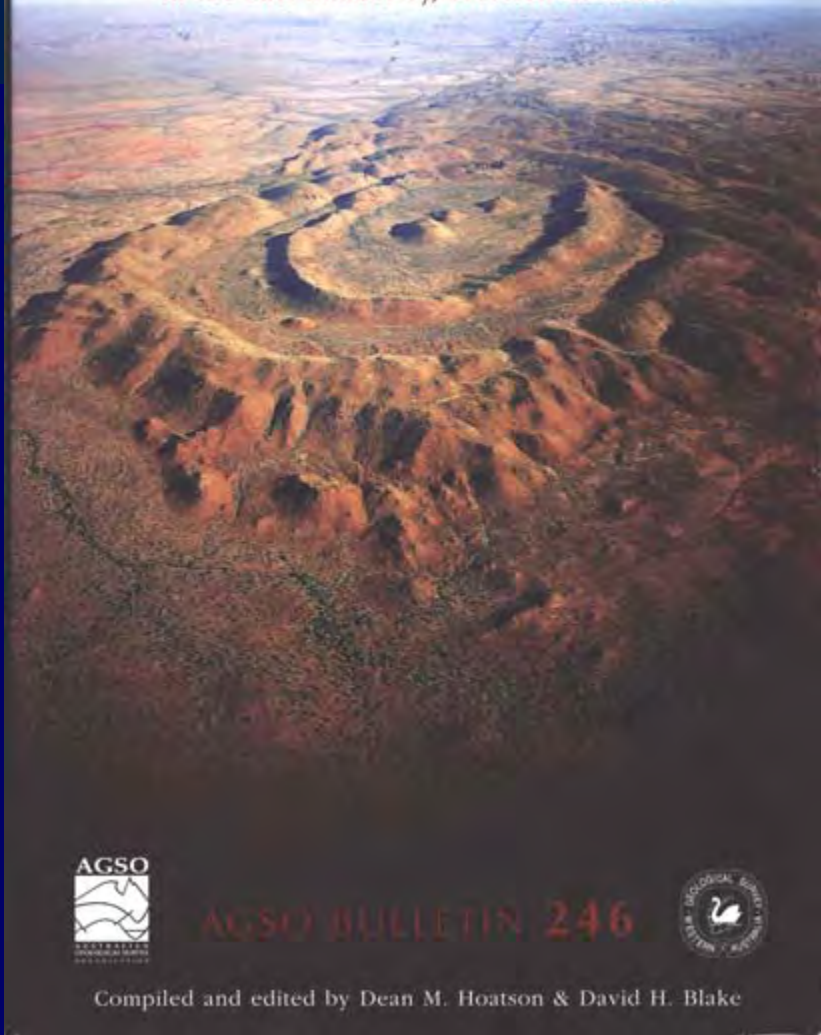
ISLAND ARC
TERRANE





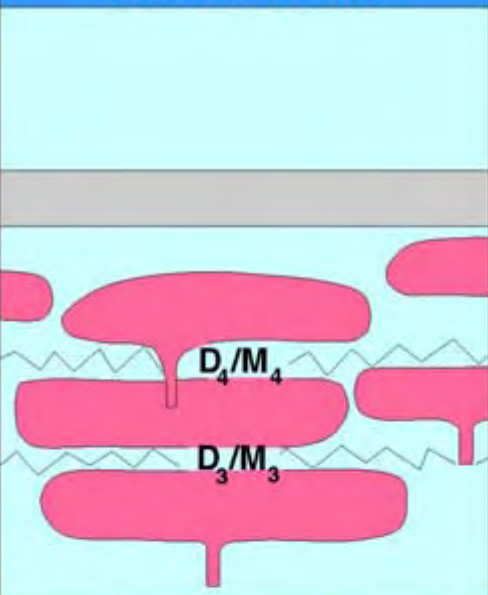
Courtesy of Simon Bodorkos. Data from Page (OZCHRON) and Bodorkos (2001)

Geology and economic potential of the
Palaeoproterozoic layered mafic-ultramafic intrusions
in the East Kimberley, Western Australia



- Group I
 - Panton intrusions
 - c. 1855 Ma

CENTRAL ZONE



RIFTED ARC

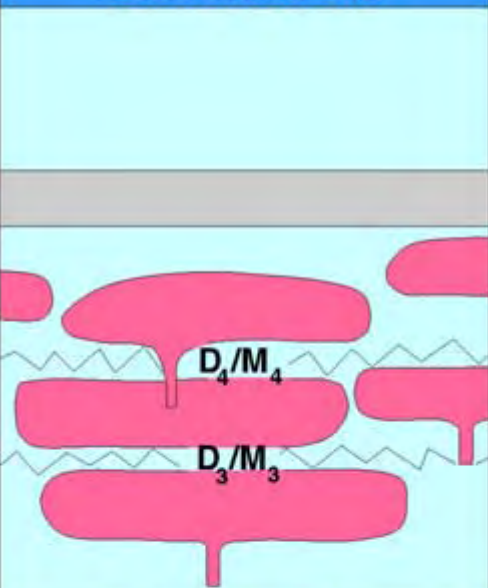


ISLAND ARC TERRANE

Tickalara Metamorphics - Dougalls Suite c. 1850 Ma



CENTRAL ZONE



RIFTED ARC

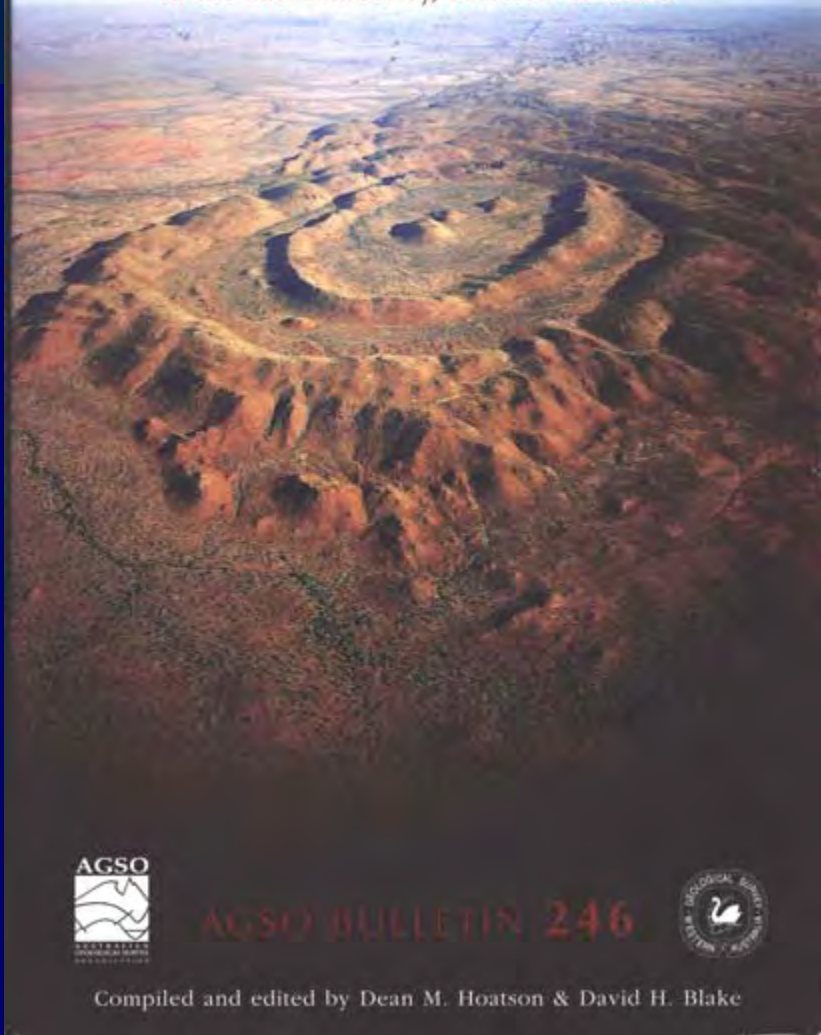


ISLAND ARC
TERRANE

Tickalara
Metamorphics
 $M_2 = c. 1845 \text{ Ma}$



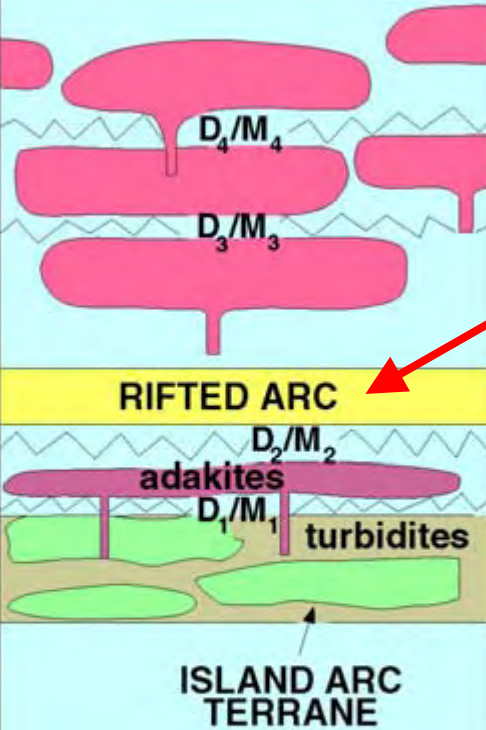
Geology and economic potential of the
Palaeoproterozoic layered mafic-ultramafic intrusions
in the East Kimberley, Western Australia



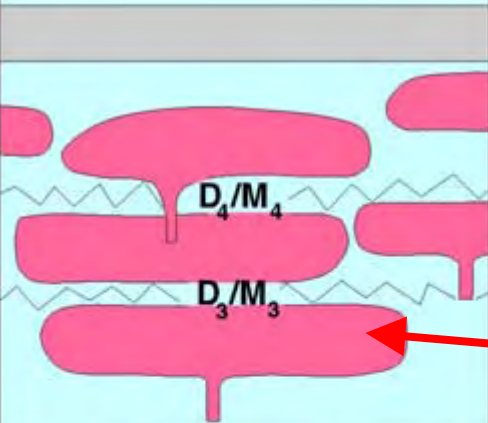
- Group V
 - Sally Malay intrusions
 - c. 1844 Ma

CENTRAL ZONE

Koongie Park Formation - c. 1845 Ma



CENTRAL ZONE



RIFTED ARC

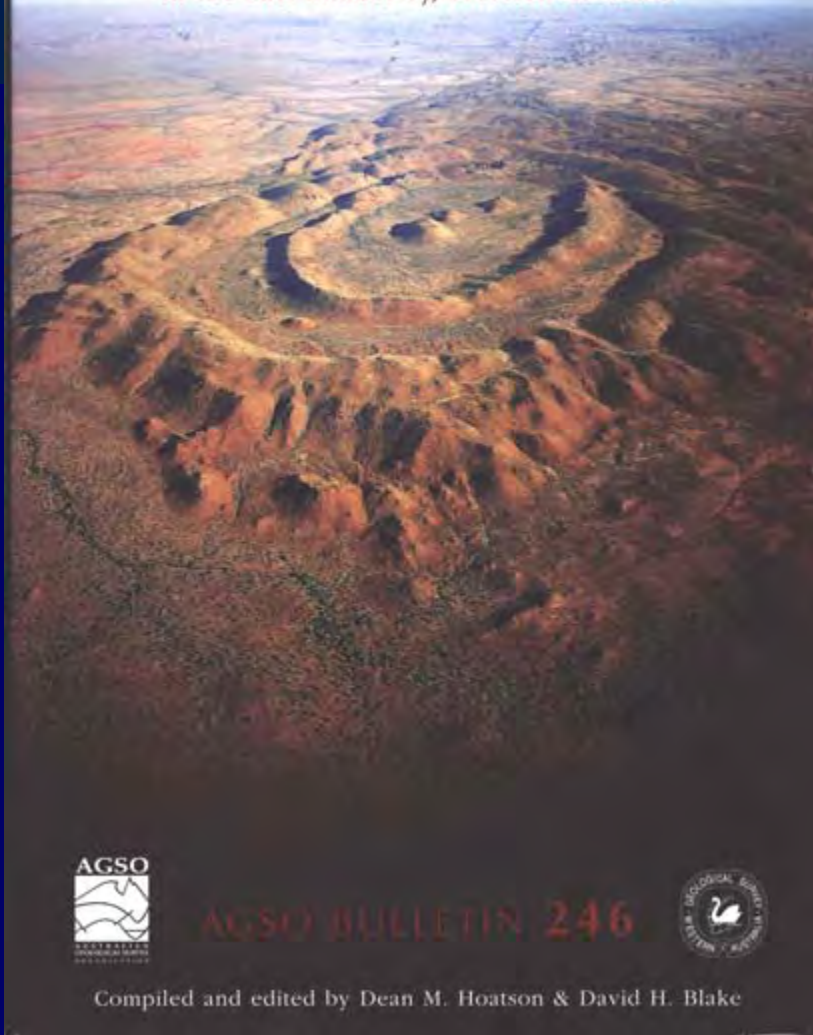


ISLAND ARC TERRANE

Sally Downs Supersuite - 1835-1805 Ma
Andean type - Mabel Downs Suite



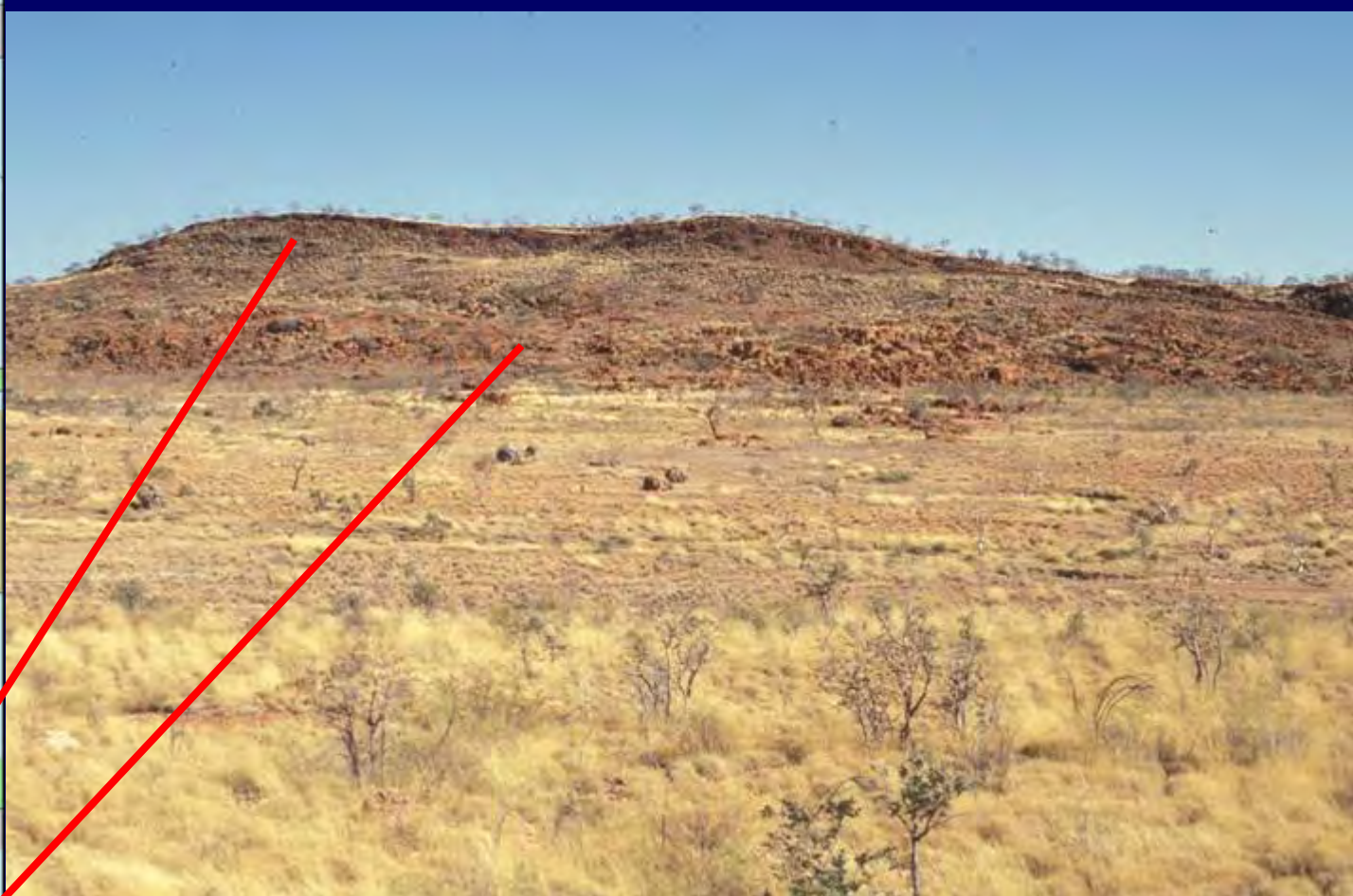
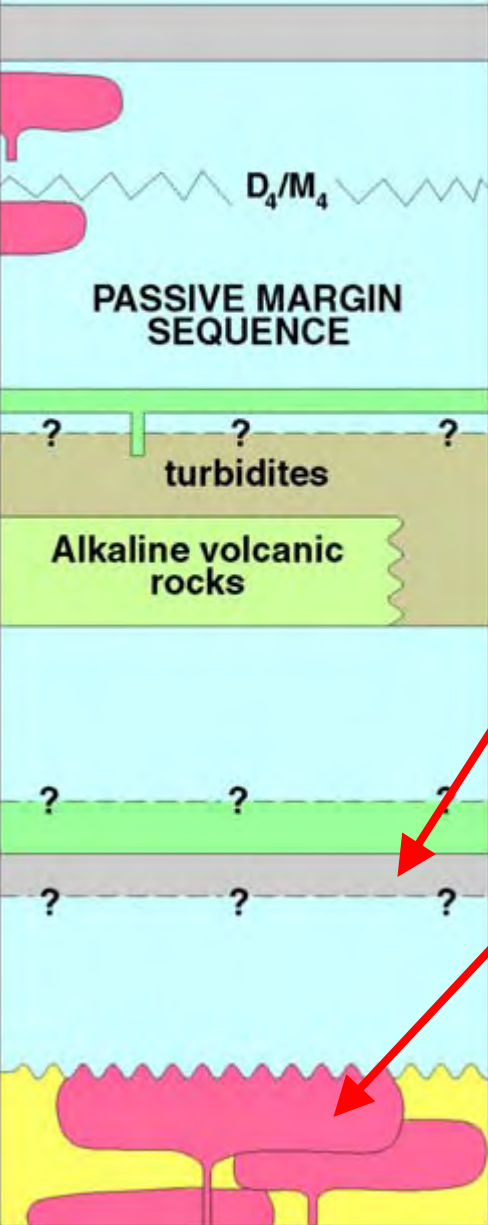
Geology and economic potential of the
Palaeoproterozoic layered mafic-ultramafic intrusions
in the East Kimberley, Western Australia



- Group IV
 - Wild Dog Creek Gabbro
- Group VI
 - McIntosh intrusion
 - c. 1830 Ma

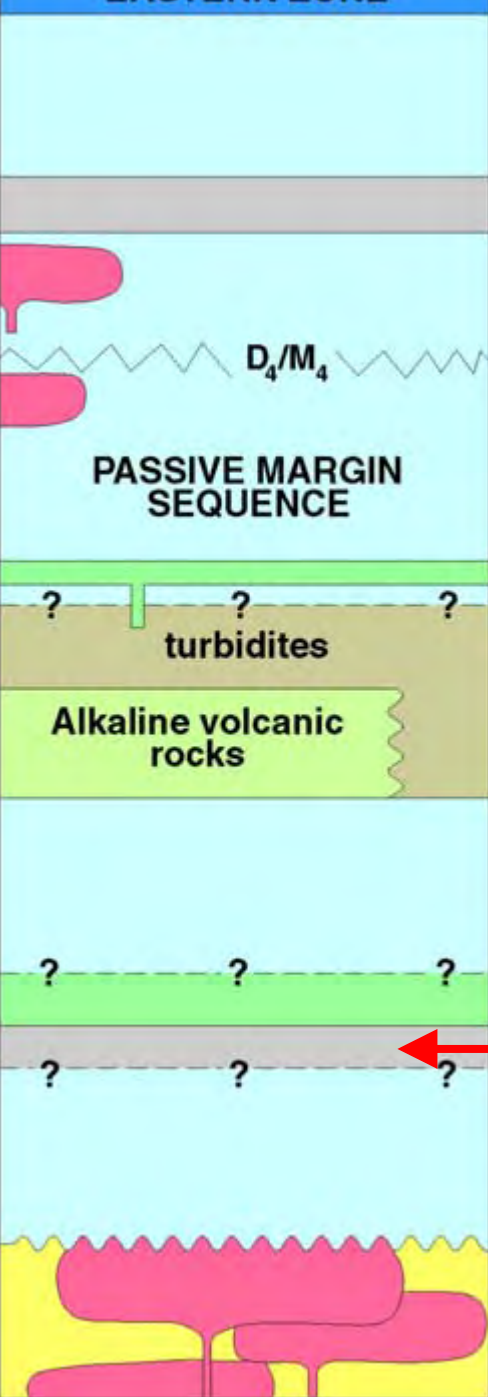
EASTERN ZONE

Halls Creek Group - Saunders Creek Formation - >1880 Ma



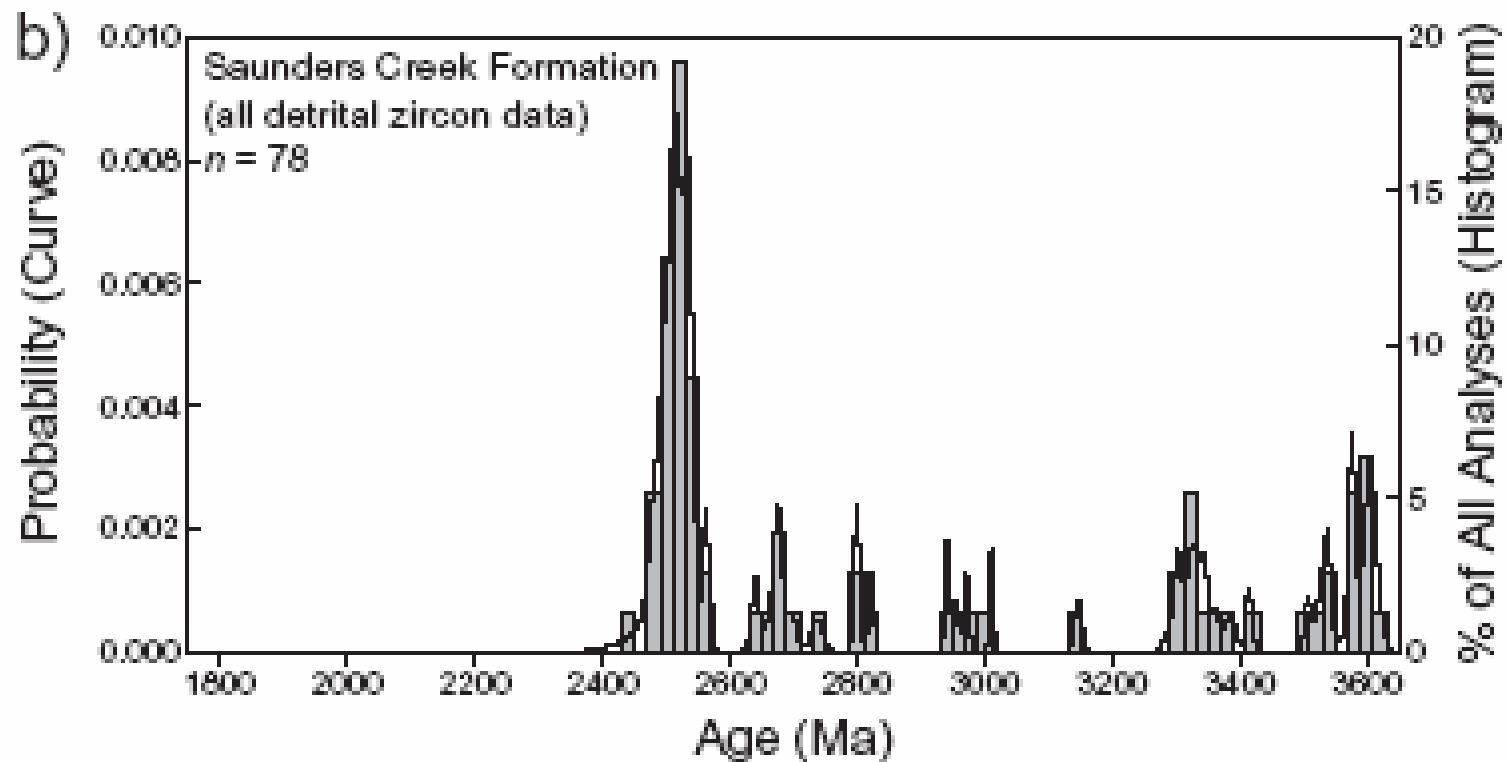
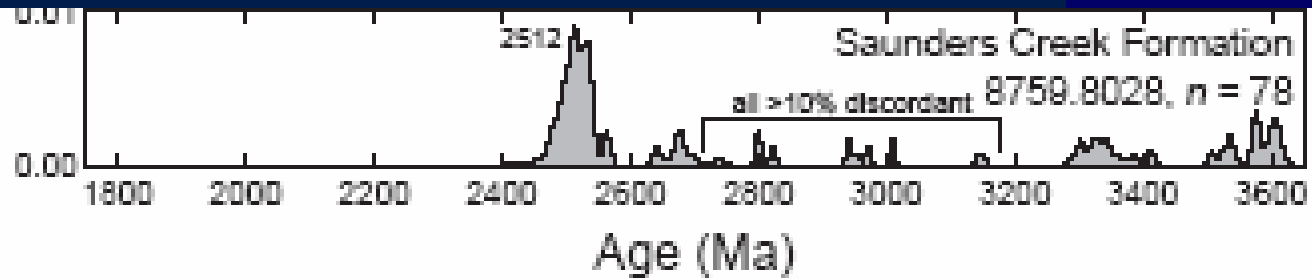
**Ding Dong Downs Volcanics
+ associated granites - c. 1910 Ma**

EASTERN ZONE



**Halls Creek Group:
Saunders Creek
Formation
- >1880 Ma**

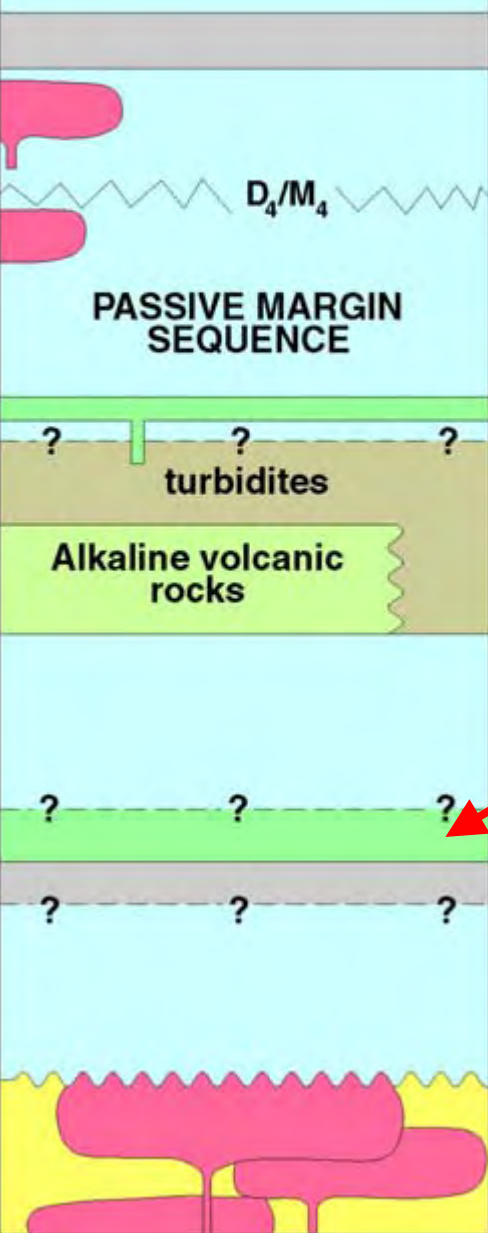




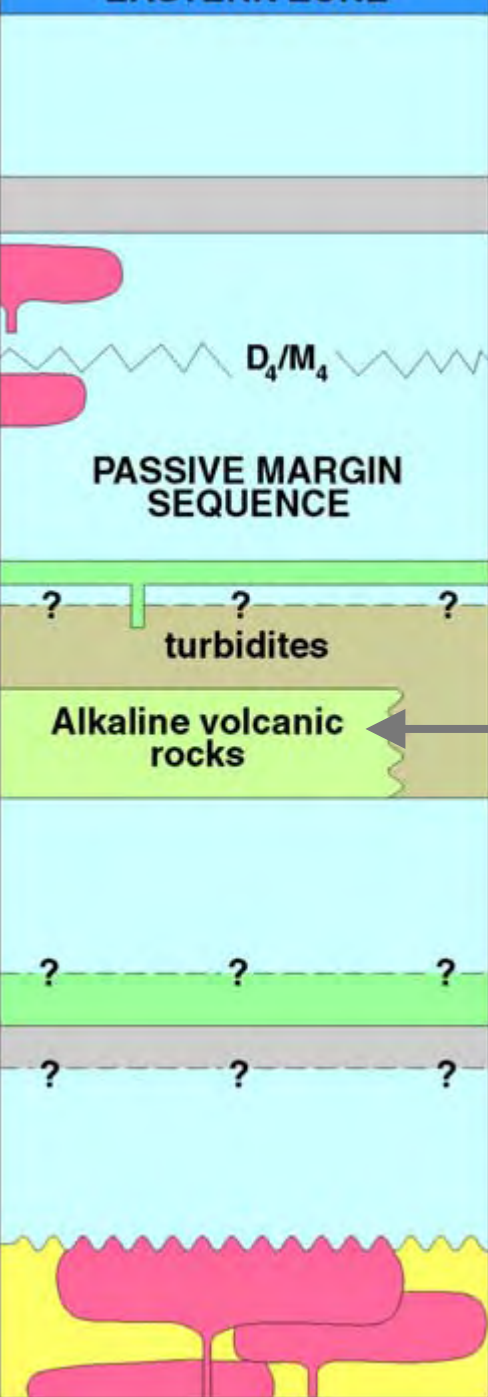
Courtesy of Simon Bodorkos. Data from Page (OZCHRON)

EASTERN ZONE

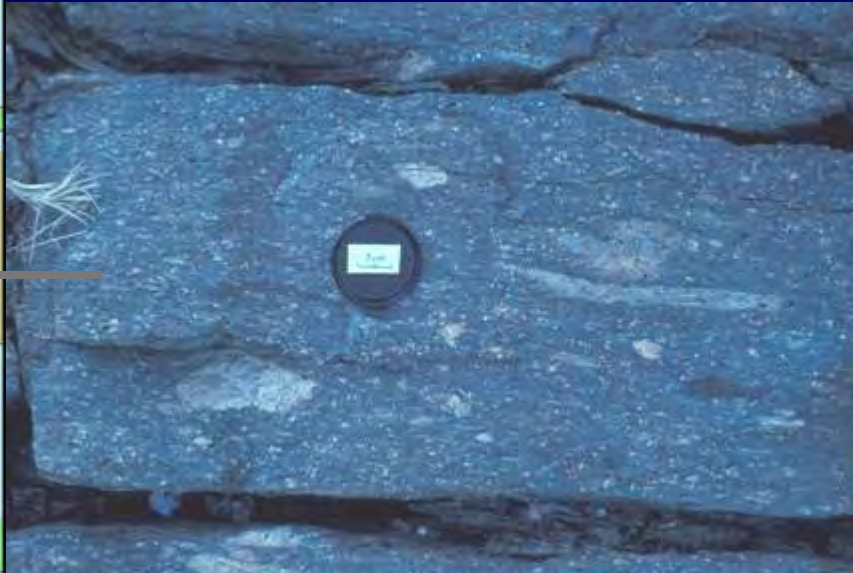
Halls Creek Group: Biscay Formation - c. 1880 Ma



EASTERN ZONE

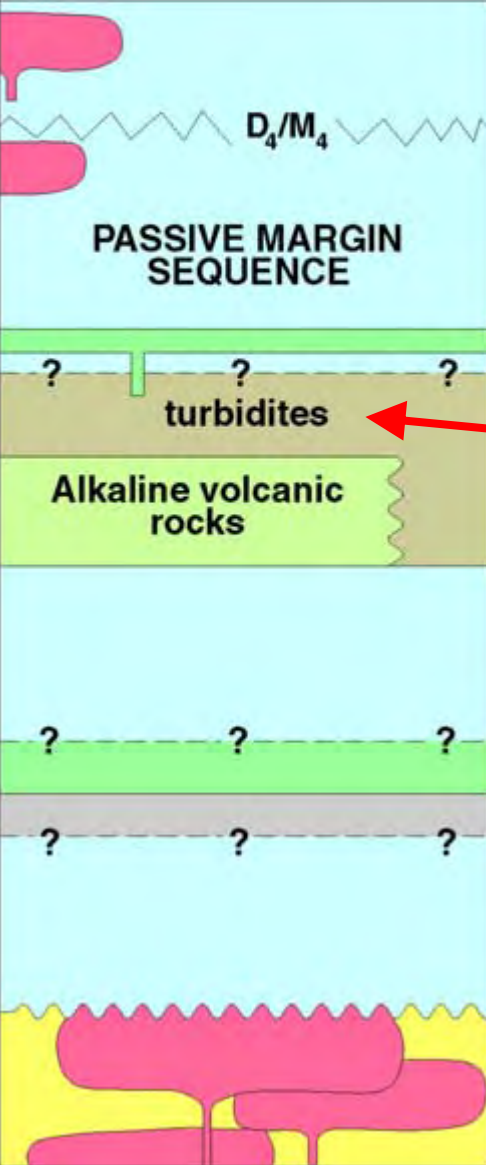


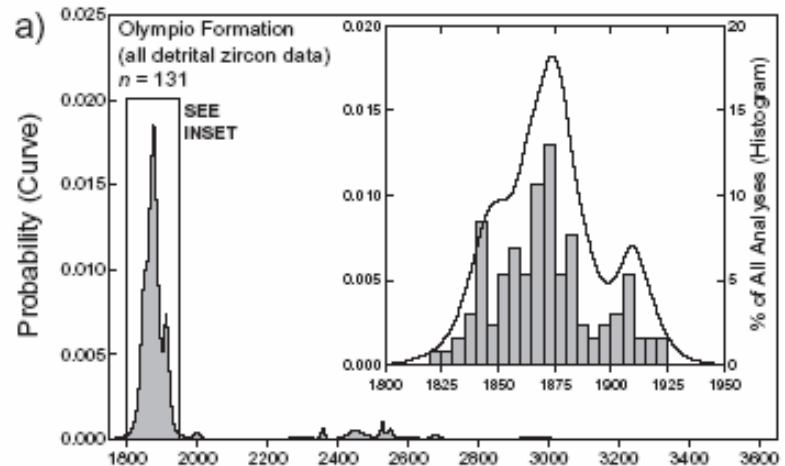
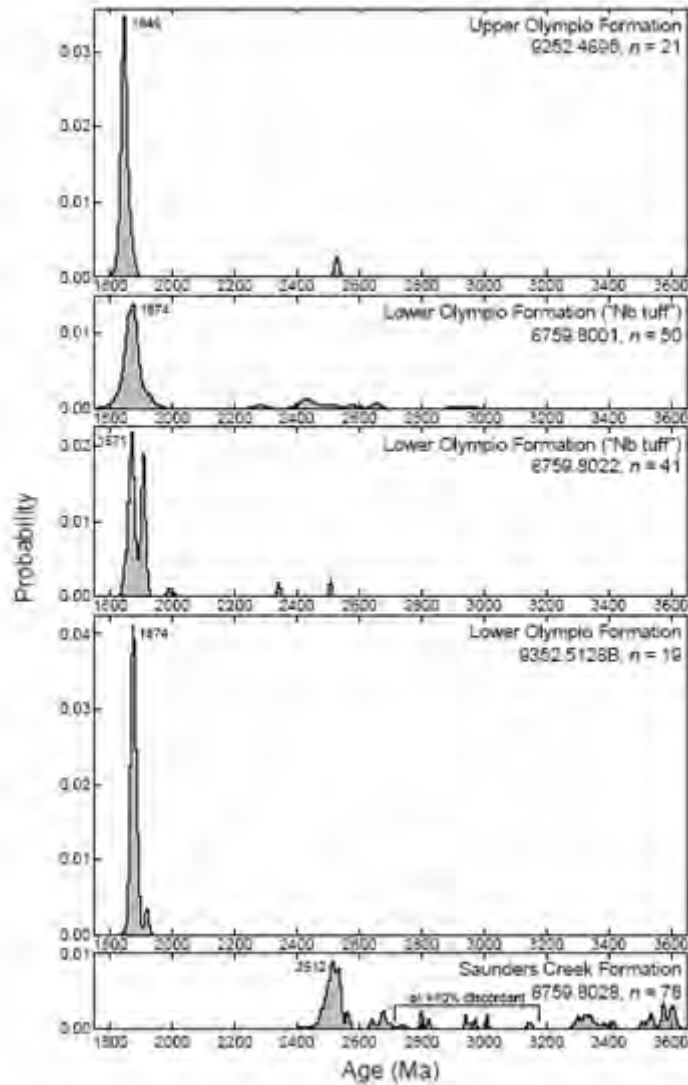
Halls Creek Group: Olympio Formation
lower turbidites - <1871 Ma
Butchers Gully Member - c. 1845 Ma
Maude Headly Member - c. 1857 Ma



EASTERN ZONE

Halls Creek Group:
upper Olympio Formation
<1847 Ma

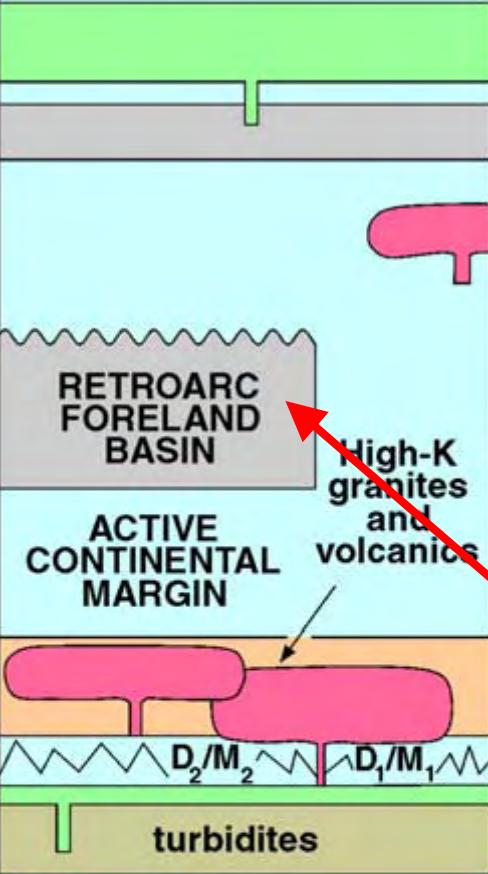




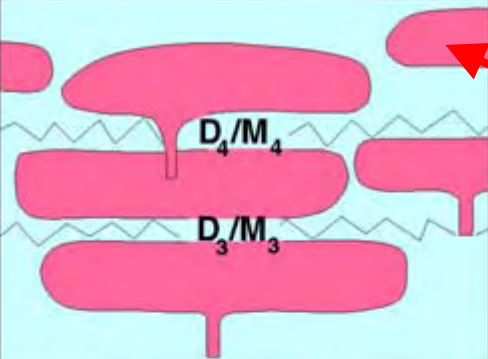
Courtesy of Simon Bodorkos. Data from Page (OZCHRON)

WESTERN ZONE

Speewah Group - c. 1835 Ma



CENTRAL ZONE



RIFTED ARC

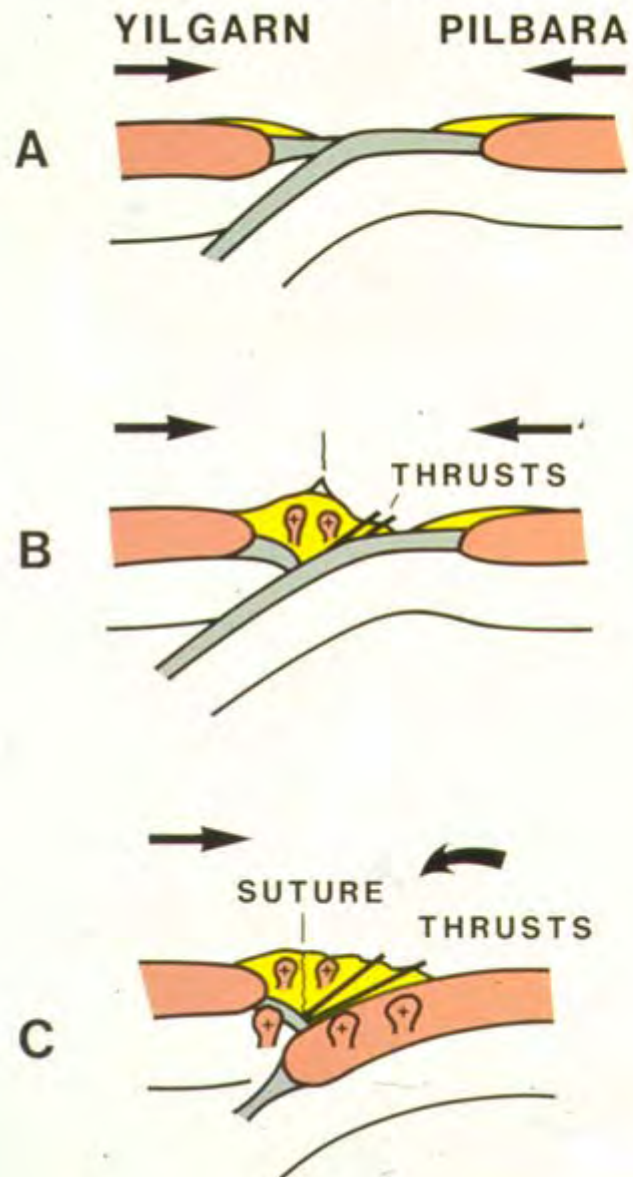


ISLAND ARC
TERRANE

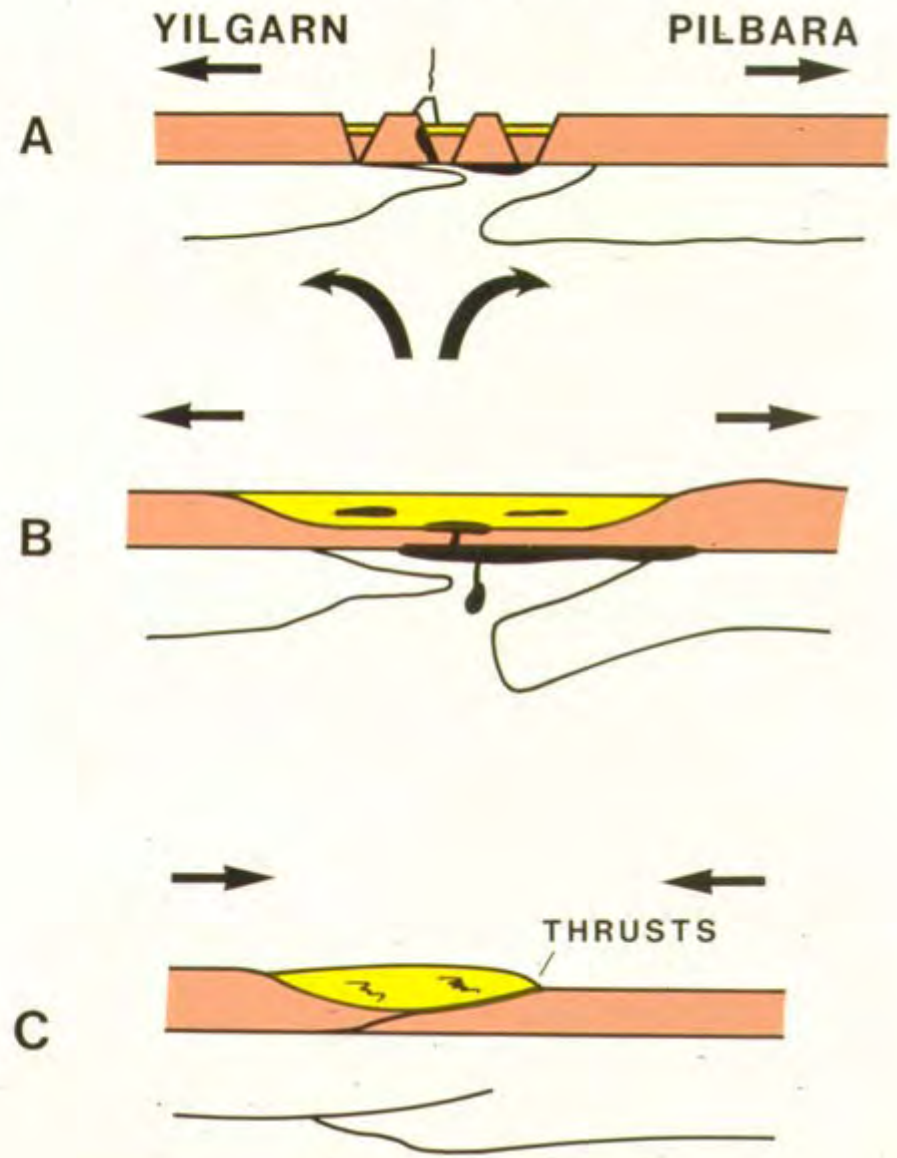
Sally Downs Supersuite - 1835-1805 Ma
Post collisional granites - Syenite Camp
/Kevins Dam Suite



B-SUBDUCTION



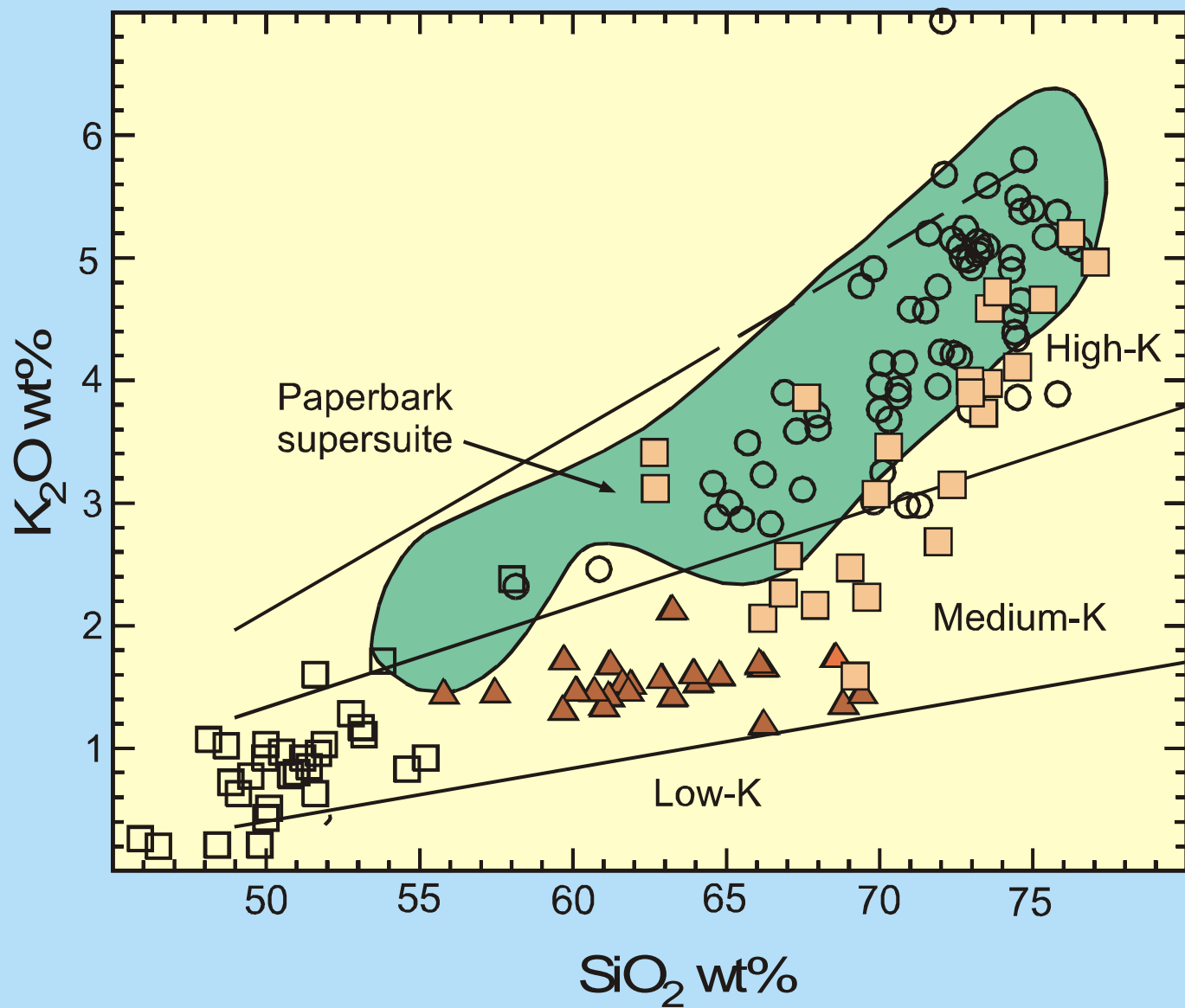
A-SUBDUCTION



Problems with A-subduction:



- In some orogens:
 - Linear magmatic belts, which include adakites and calc-alkaline granites, separate different cratons
 - Stratigraphy not continuous across the orogens
 - Fault-bounded packages with contrasting tectonothermal histories are identified

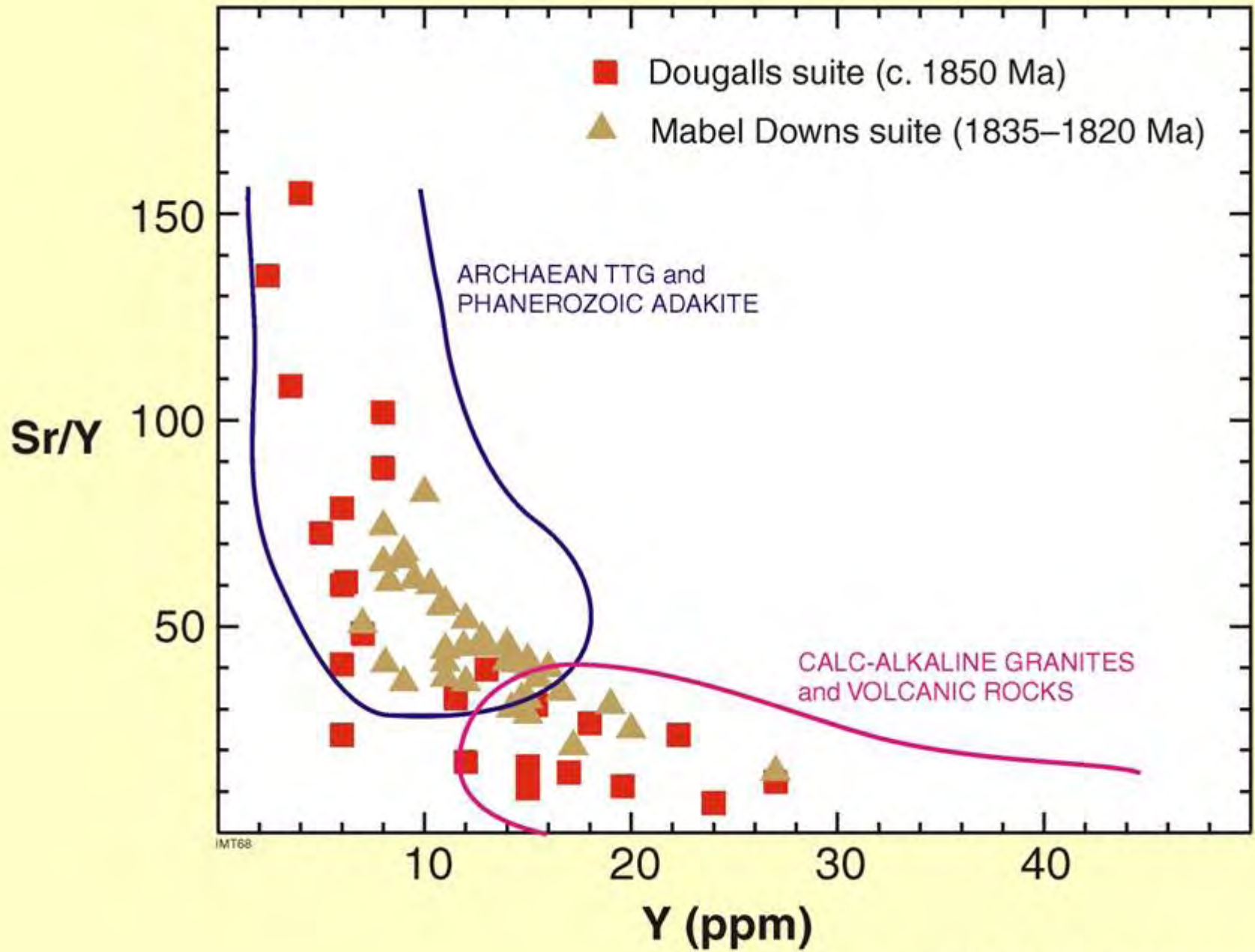


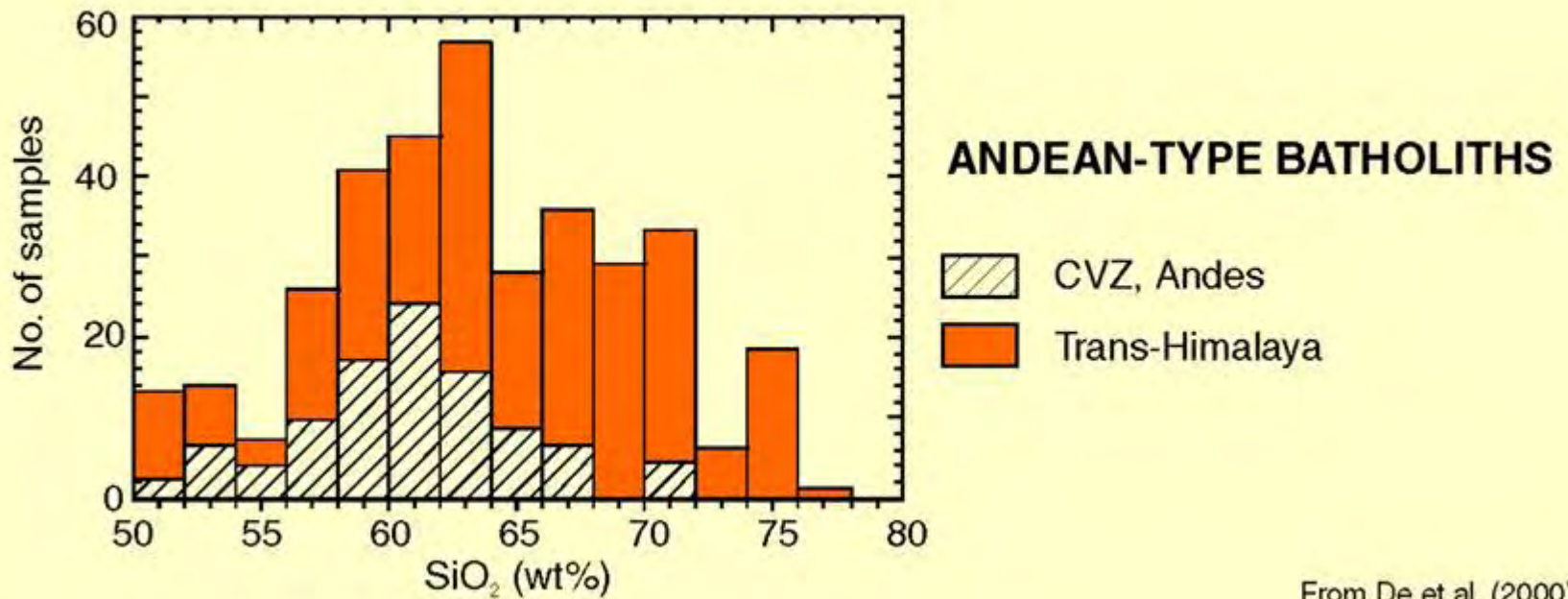
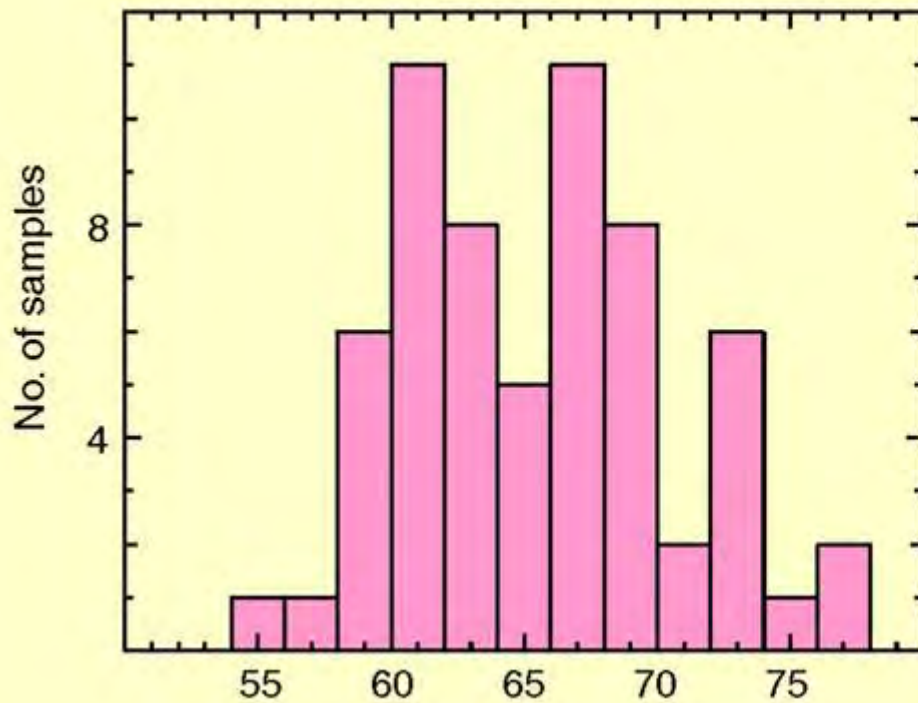
○ <1820 Ma post-collisional granites

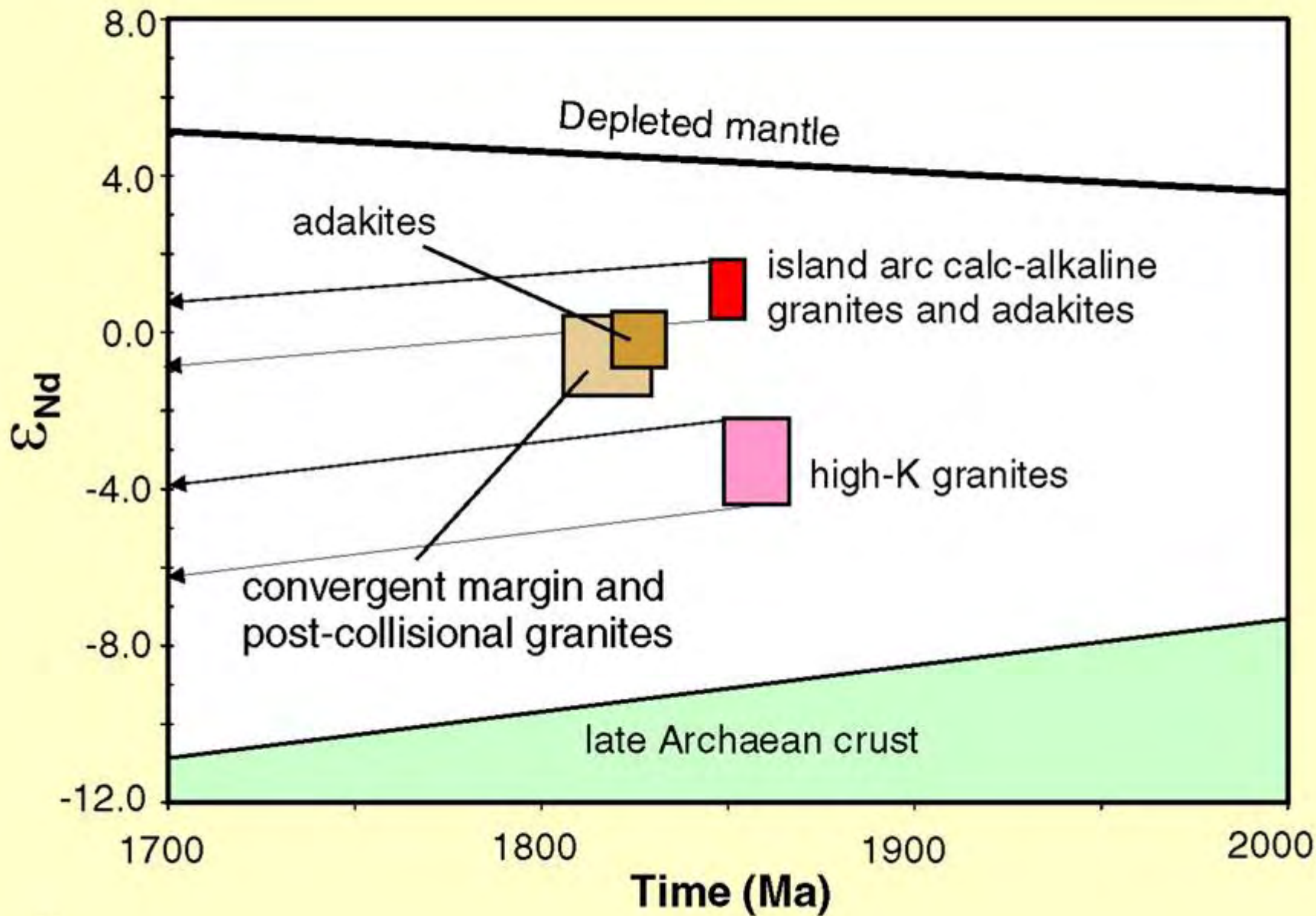
□ >1820 Ma convergent margin granites

▲ 1835-1820 Ma adakites

□ Gabbros







NW

c. 1870 Ma

Tickalara
Metamorphics

lower Olympio Fm

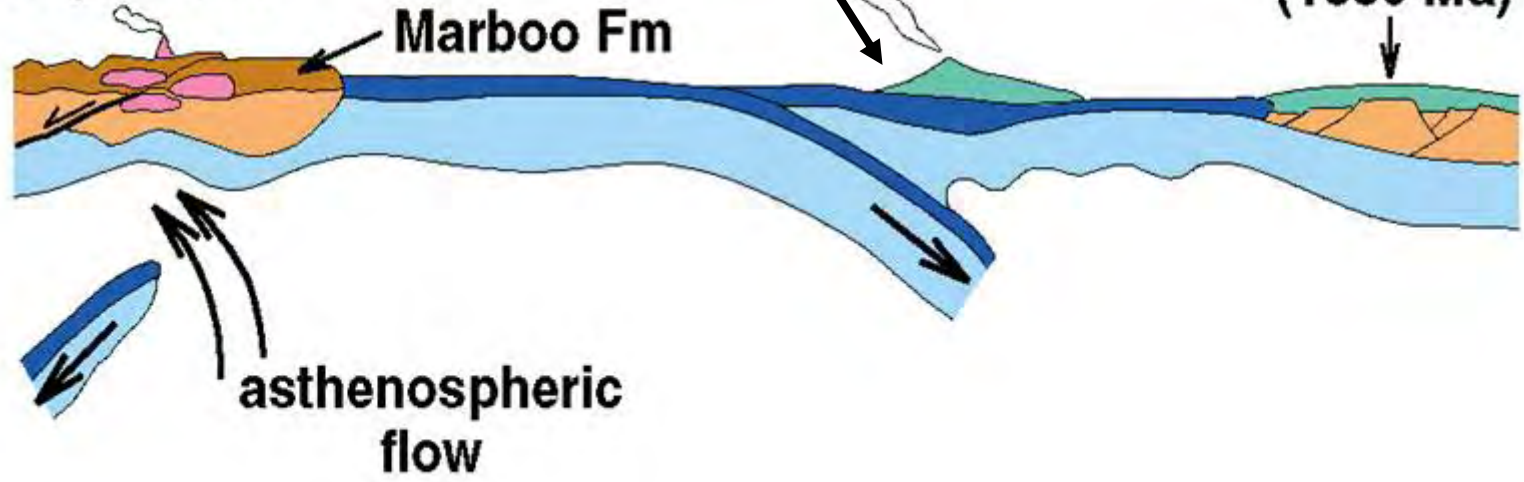
SE

Paperbark
supersuite

Marboo Fm

oceanic arc

Biscay Fm
(1880 Ma)



c. 1860 Ma

From Hollings and Ansdell (2002)

N

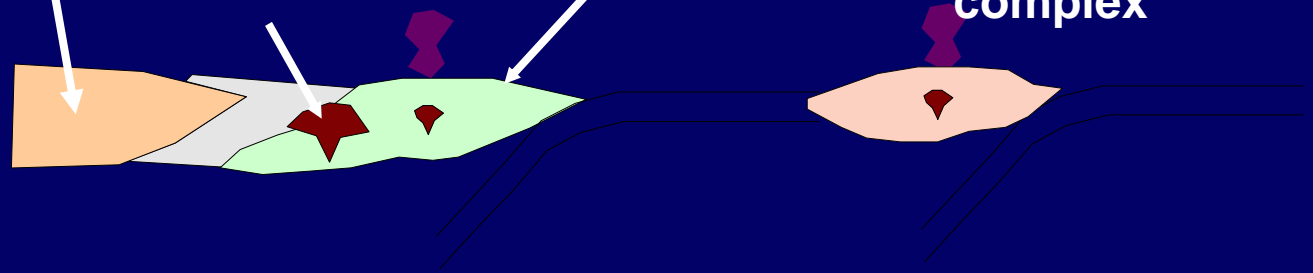
Hearne
craton

Wathaman
Batholith

La Ronge-
Lynn Lake
Belt

Flin Flon-
Glennie
complex

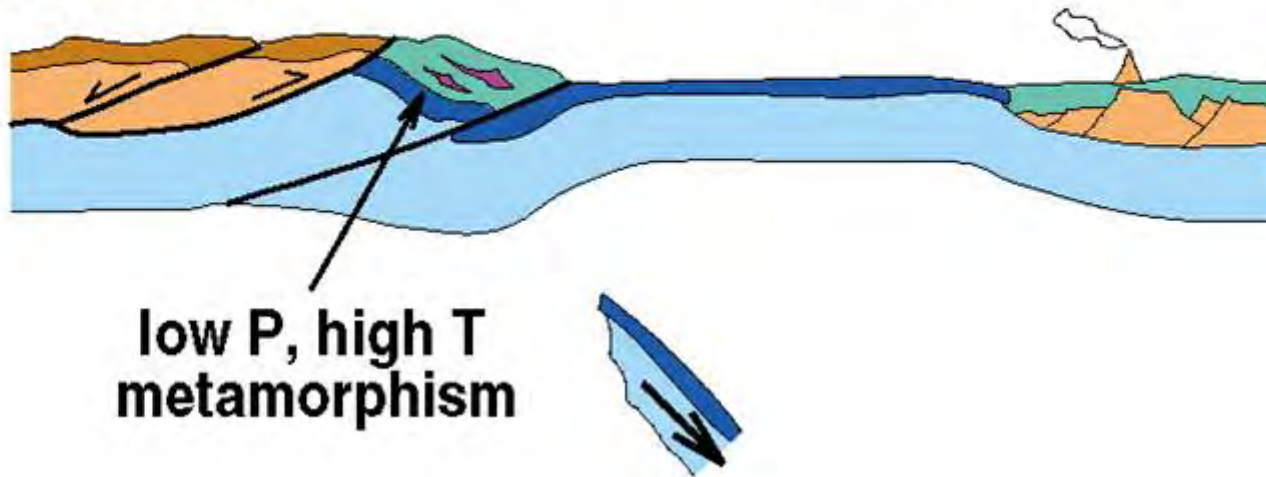
S



c. 1850 Ma

accretion of arc

alkaline volcanics



c. 1850 Ma

N

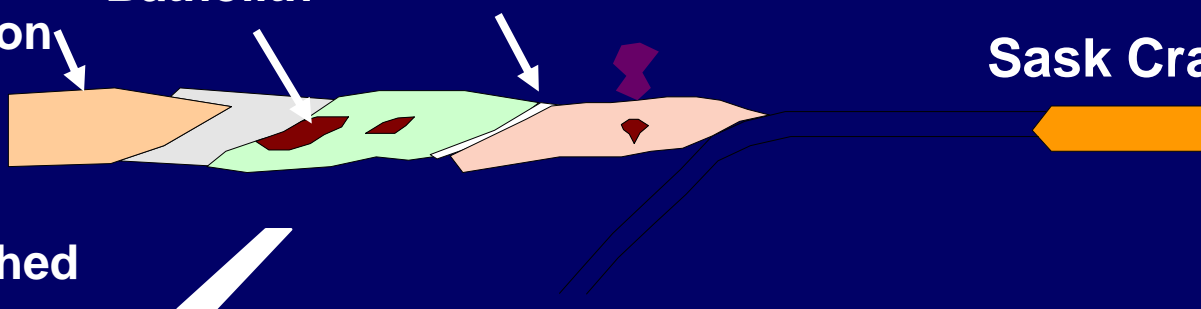
Hearne craton
Wathaman Batholith
Granville Lake Structural zone

Sask Craton

S

Detached slab

Kisseynew North Flank Seismic interpretation (White et al 2000)



N
W

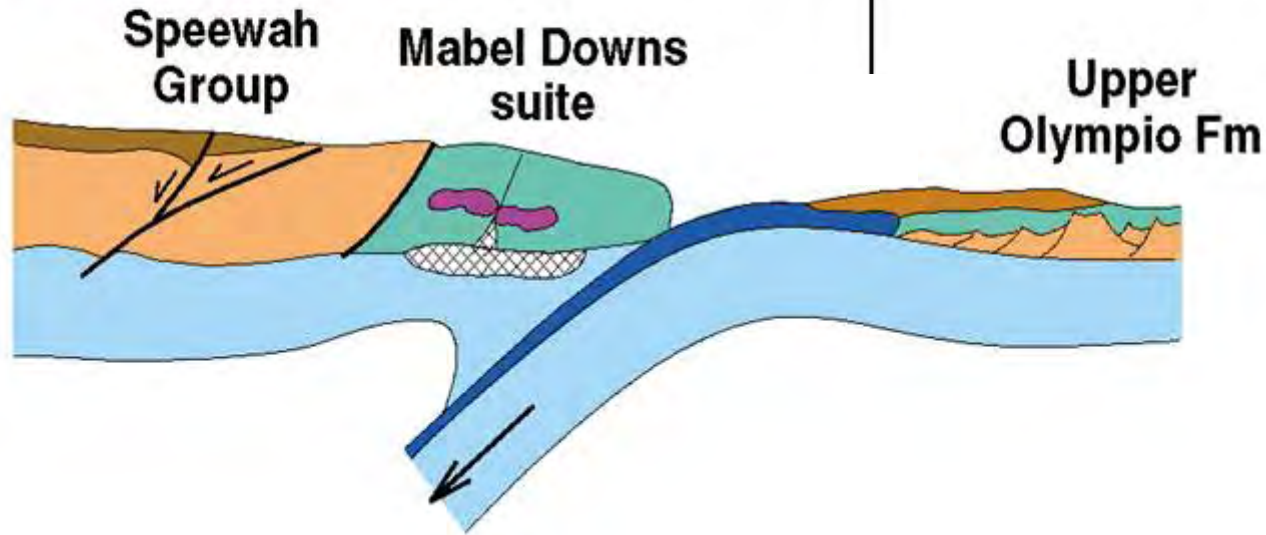
W

c. 1830 Ma

Longitudinal
transport

E

SE



N

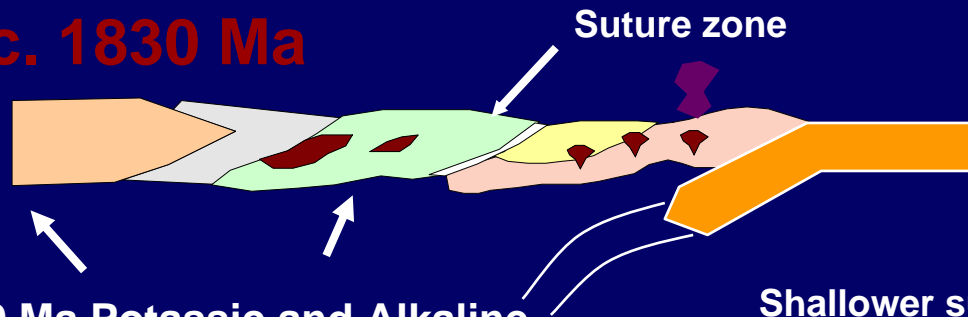
c. 1830 Ma

Suture zone

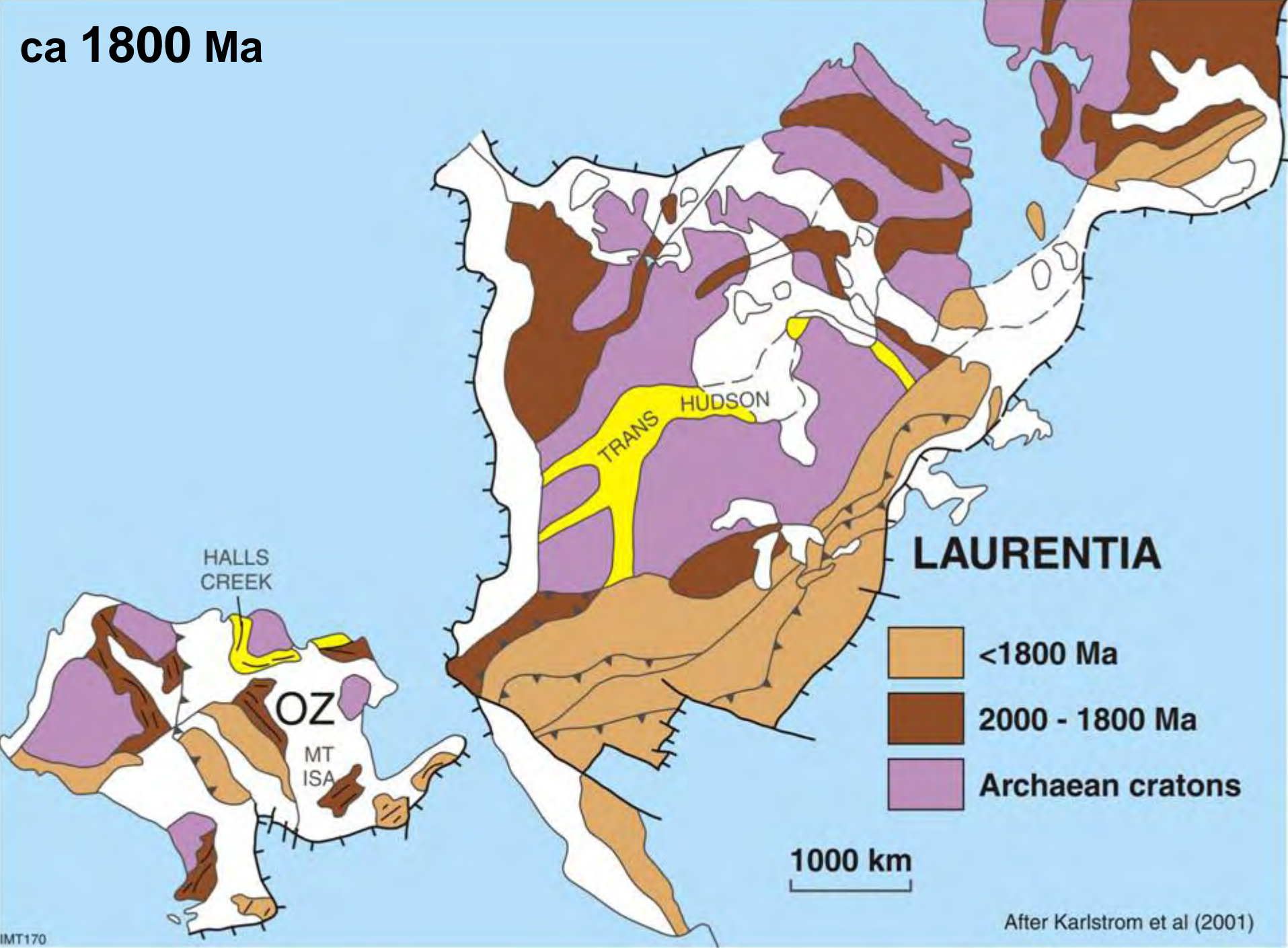
S

Post-1830 Ma Potassic and Alkaline
magmatism in Hearne craton.
Reactivation of structures as
Paleoproterozoic collision
continues.

Shallower subduction angle
as Sask Craton plate subducts
(cf. Gutscher et al., 2000)



ca 1800 Ma



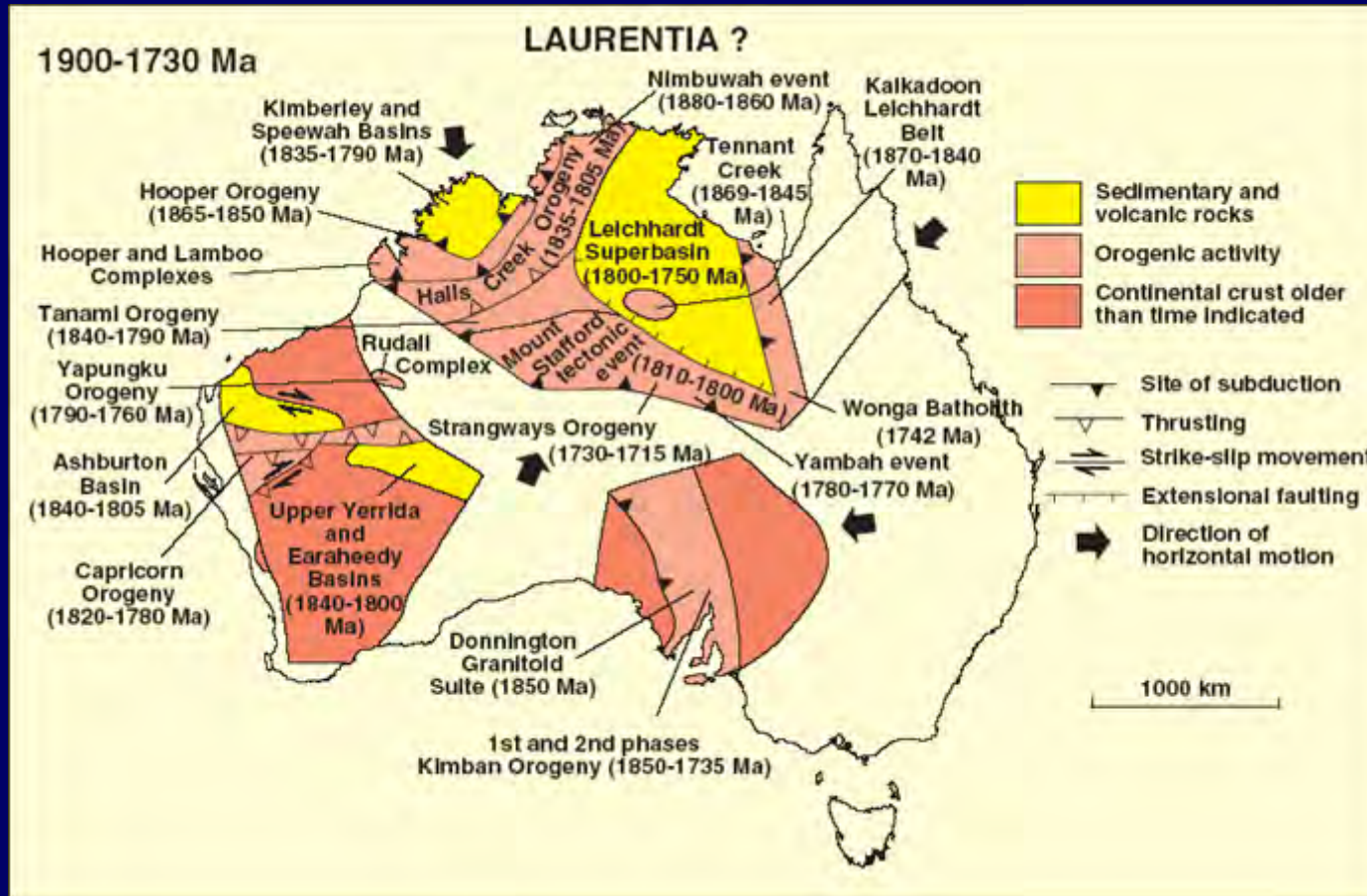
After Karlstrom et al (2001)

San Sou Suite granites



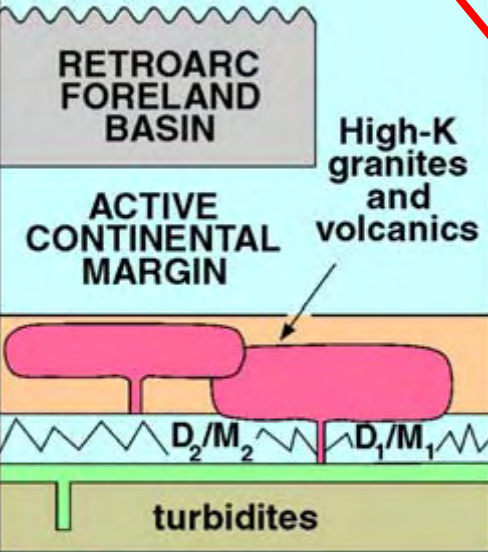
- Eastmans Granite – $1804_{\pm 5}$ Ma
- San Sou Granite – $1788_{\pm 6}$ Ma
 - Page et al. (2001)

Assembly of North Australian Craton



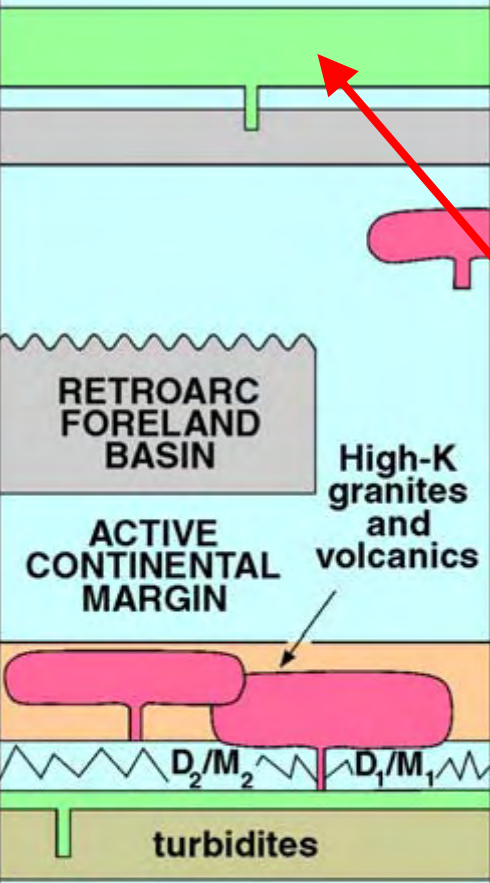
WESTERN ZONE

Kimberley Group -
>1835 - <1780 Ma








WESTERN ZONE

Hart Dolerite - c. 1780 Ma



North Australian Craton

			 The Granite: Au-Cu	Early + Late Strangways Orogenies (1790–1730 Ma)	Leichhardt Superbasin (1800–1750 Ma)	Wonga batholith (1742 Ma)
Speewah + Kimberley Basins (1835–1790 Ma)	Halls Creek Orogeny (1835–1805 Ma)		Tanami Orogeny (1840–1790 Ma)	Mount Stafford tectonic event (1820 Ma)		
	 Koongie Park: Pb-Zn					
	 Sally Malay: Ni					
	Hooper Orogeny (1865–1850 Ma)	Nimbuwah event (1880–1860 Ma)	Granites–Tanami Complex	Northern Arunta Inlier	 Tennant Creek: Cu–Au	
	Hooper + Lamboos Complexes	 Rum Jungle, Ranger: U South Alligator + Finnis River Groups (1885 Ma)			Tennant Creek Inlier (1860–1845 Ma)	Kalkadoon– Leichhardt belt (1870–1840 Ma)
Kimberley Craton						
		Namoona + Mount Partridge Groups				
			Lucas Craton			
		Rum Jungle + Nanambu Complexes (2500 Ma)	Billabong complex (2500 Ma)			

North Australian Craton

