

Paleo- to Mesoproterozoic tectonic evolution of the Coober Pedy Domain (northern Gawler Craton)

Rashed Abdullah | 27.11.2025

with Mark Pawley and Liz Jagodzinski



**GEOLOGICAL
SURVEY OF**
South Australia

DISCOVERY DAY



The Coober Pedy Domain (northern Gawler Craton)

- The Gawler Craton in South Australia has a complex geological history since the Mesoarchean.
- This complexity is particularly apparent in the northern Gawler Craton, which preserves evidence for Paleo- to Mesoproterozoic tectonic processes.
- The Coober Pedy Domain occupies a key position in the northern Gawler Craton. However, very little is known about its basement geology, tectonic processes and mineral systems.

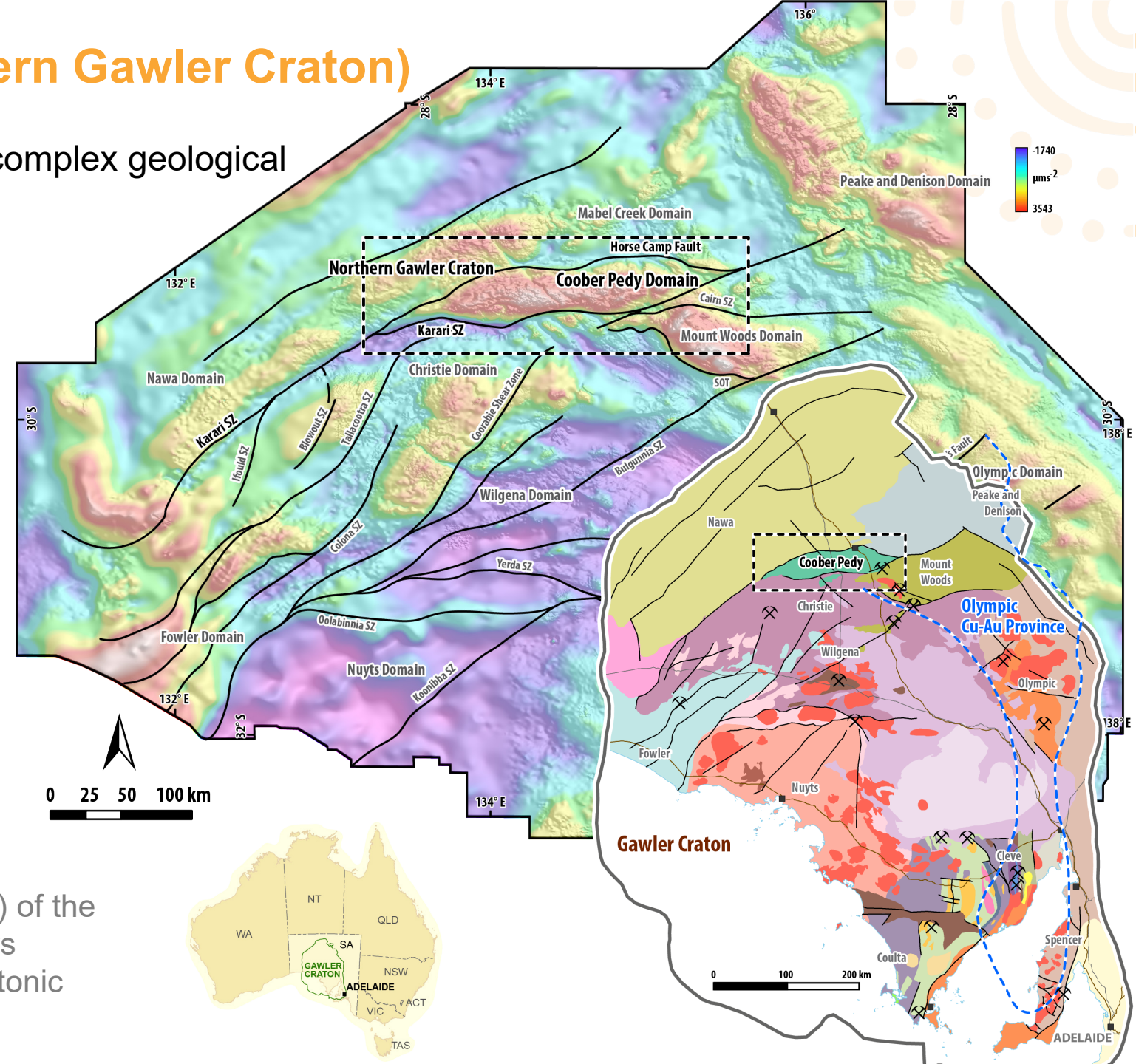


Figure 1. Bouguer gravity image (50% transparent) of the Gawler Craton Airborne Survey (GCAS) area shows location of the Coober Pedy Domain and major tectonic subdivisions of the Gawler Craton.

Questions?

- What is the timing of sedimentation, magmatism and metamorphism in the Coober Pedy Domain?
- What are the kinematics and 3D geometry of the major structures or shear zones?
- How did these structures or shear zones evolve in time and space?

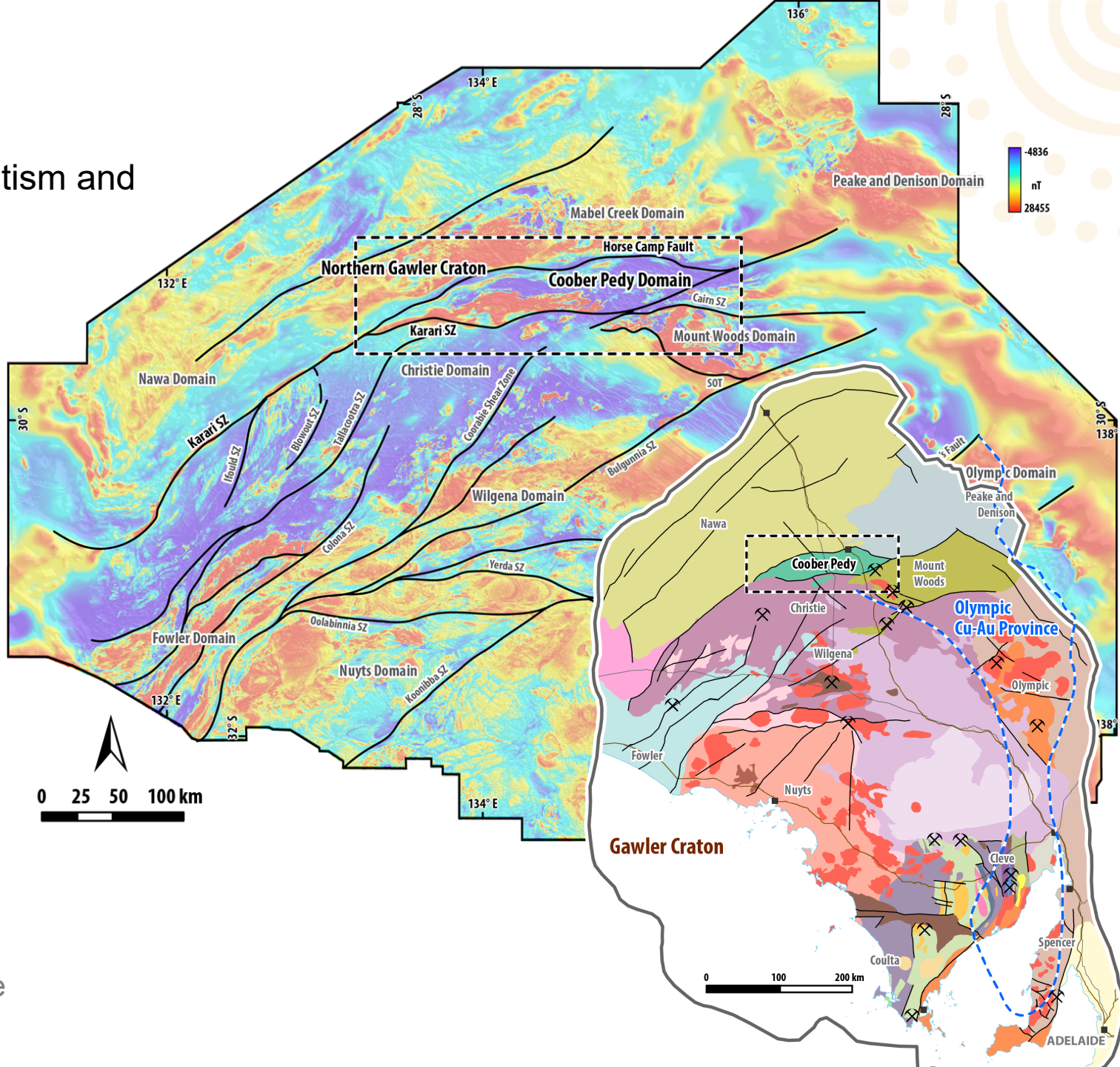
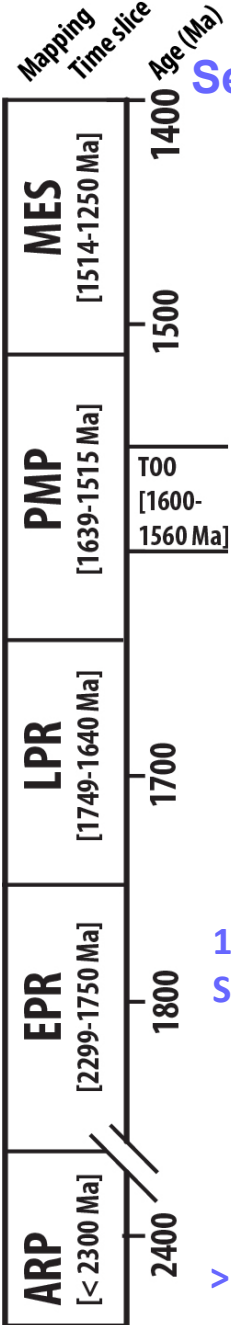


Figure 2. RTP aeromagnetic image (50% transparent) of the GCAS area shows the Coober Pedy Domain and major tectonic subdivisions of the Gawler Craton.

Simplified tectono-stratigraphic history of the Gawler Craton



Sedimentation

Magmatism and Volcanism

Metamorphism and deformation

1515 Ma Magmatism

1595-1565 Ma Hiltaba Suite
1590-1580 Ma Gawler Range Vol.

1630-1605 Ma St Peter Suite

1690-1670 Ma Tunkillia Suite
Magmatism

1730-1710 Ma Peter Pan
Super Suite

1850-1750 Ma
Sedimentation

Magmatism and volcanism

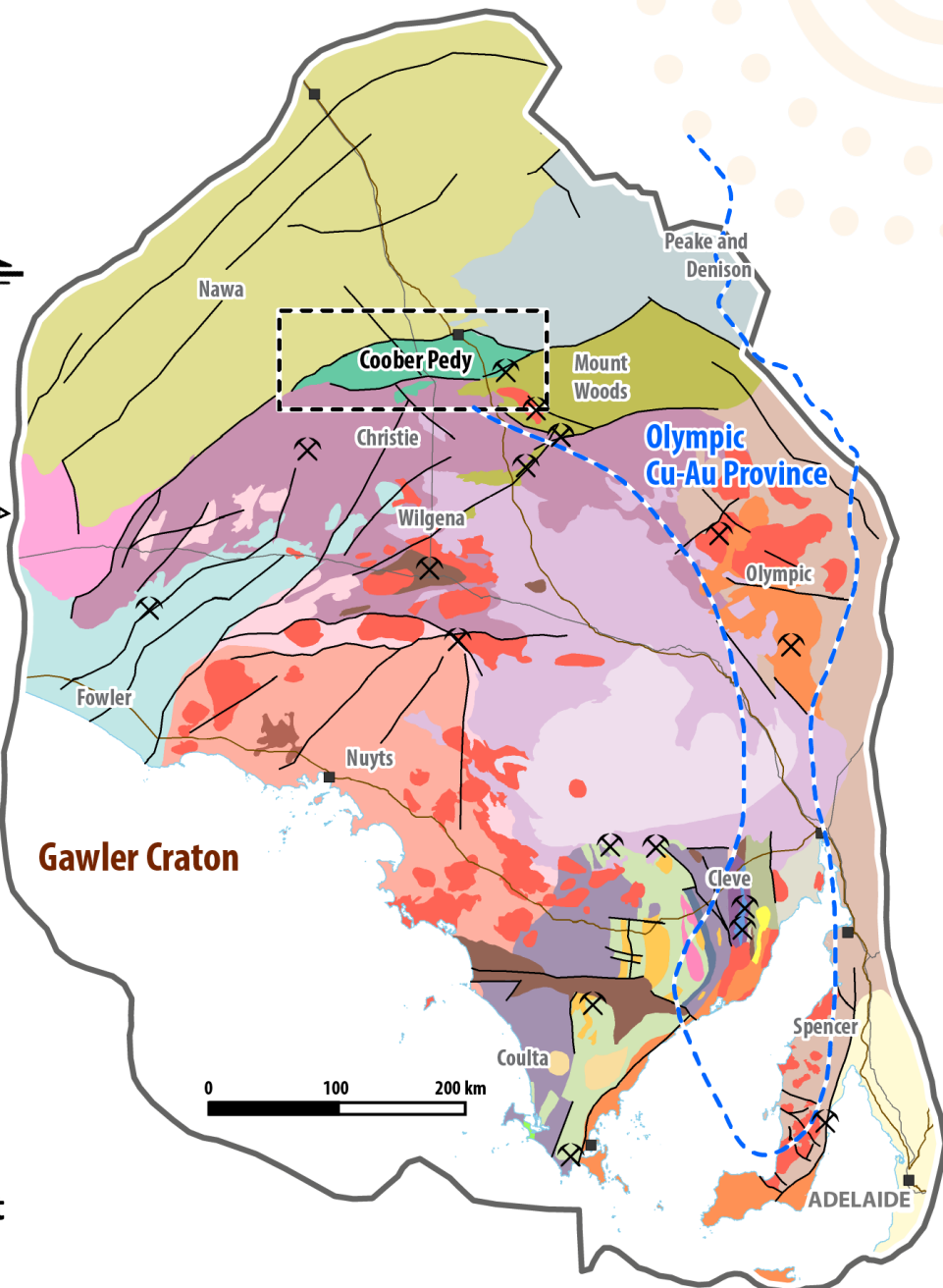
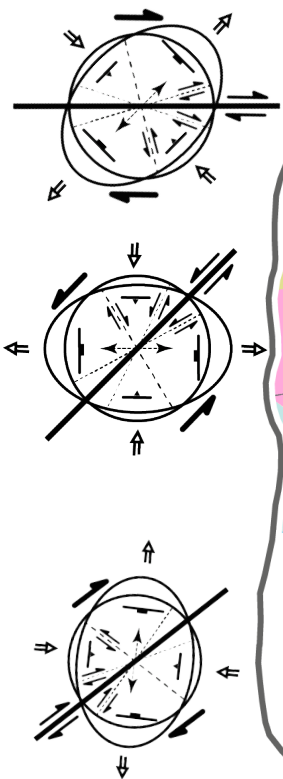
> 2470 Ma sedimentation

1470-1450 Ma
Coorabie Event

1590-1560 Ma
Kararan/Olarian
Event

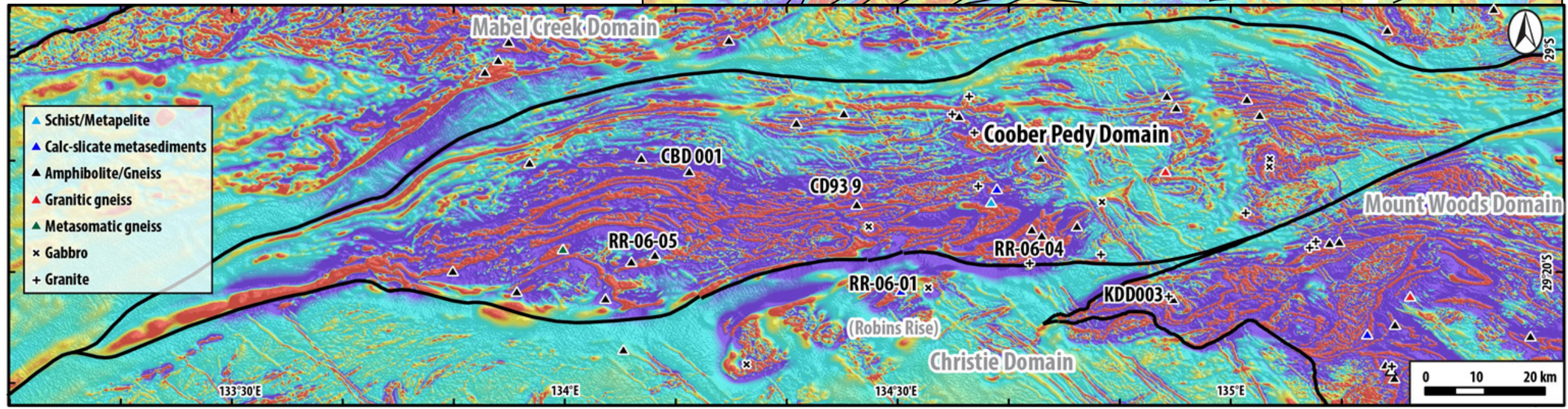
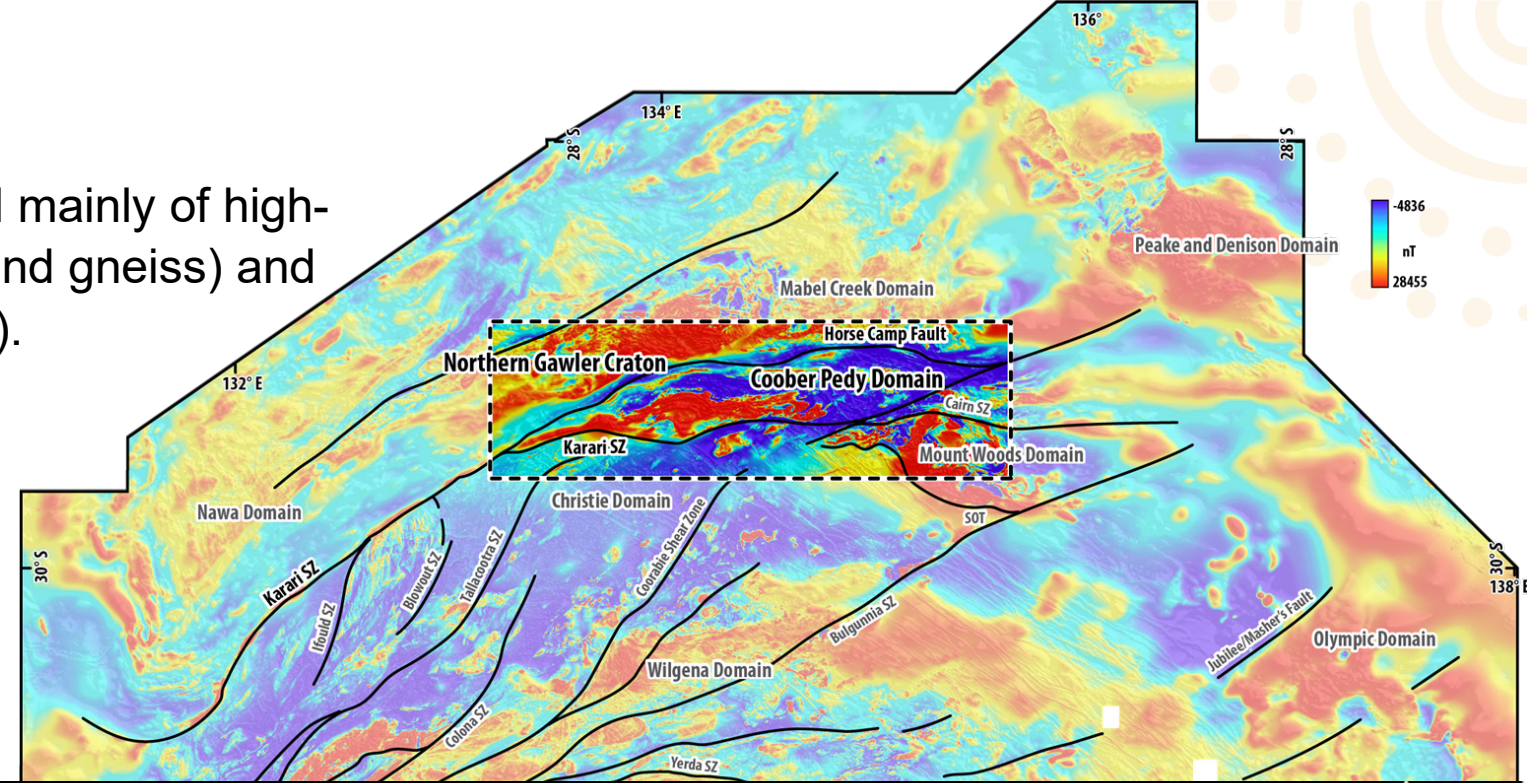
1735-1690 Ma
Kimban Event

2470-2400 Ma Sleafordian Event



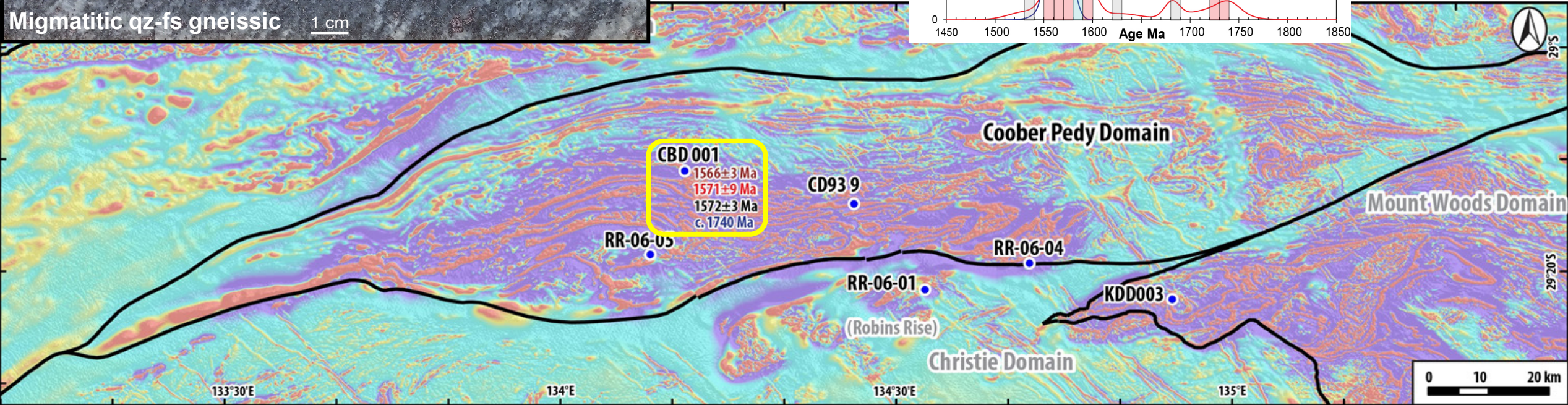
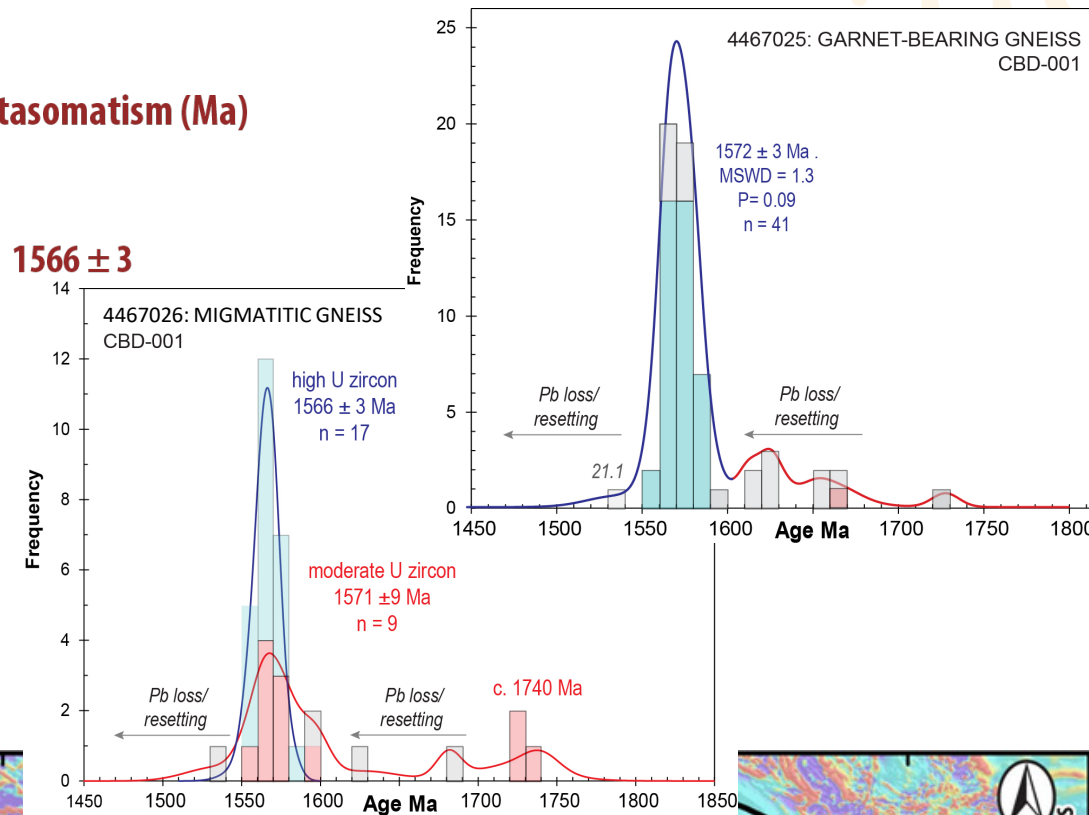
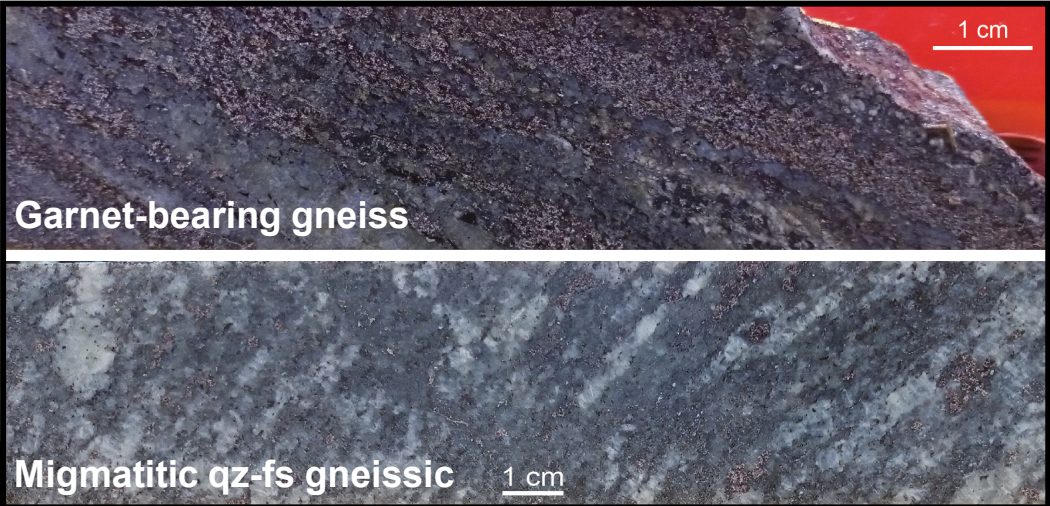
Lithology and Geochronology

- Coober Pedy Domain basement is comprised mainly of high-grade metamorphic rocks (e.g., amphibolite and gneiss) and igneous intrusive rocks (both felsic and mafic).
- Samples from six drillholes were selected for geochronology (five for SHRIMP U-Pb dating and one for LA-ICPMS U-Pb dating).



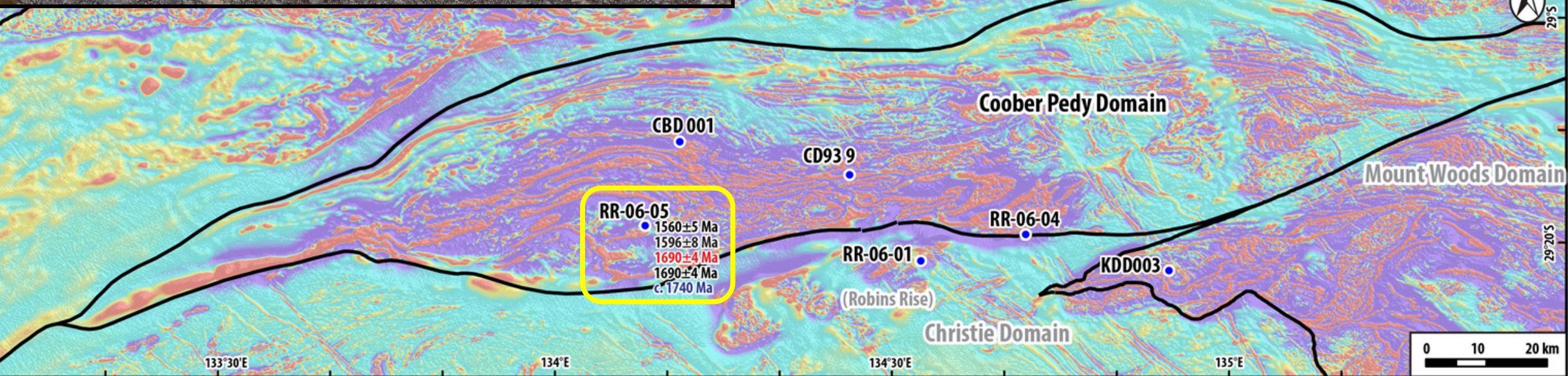
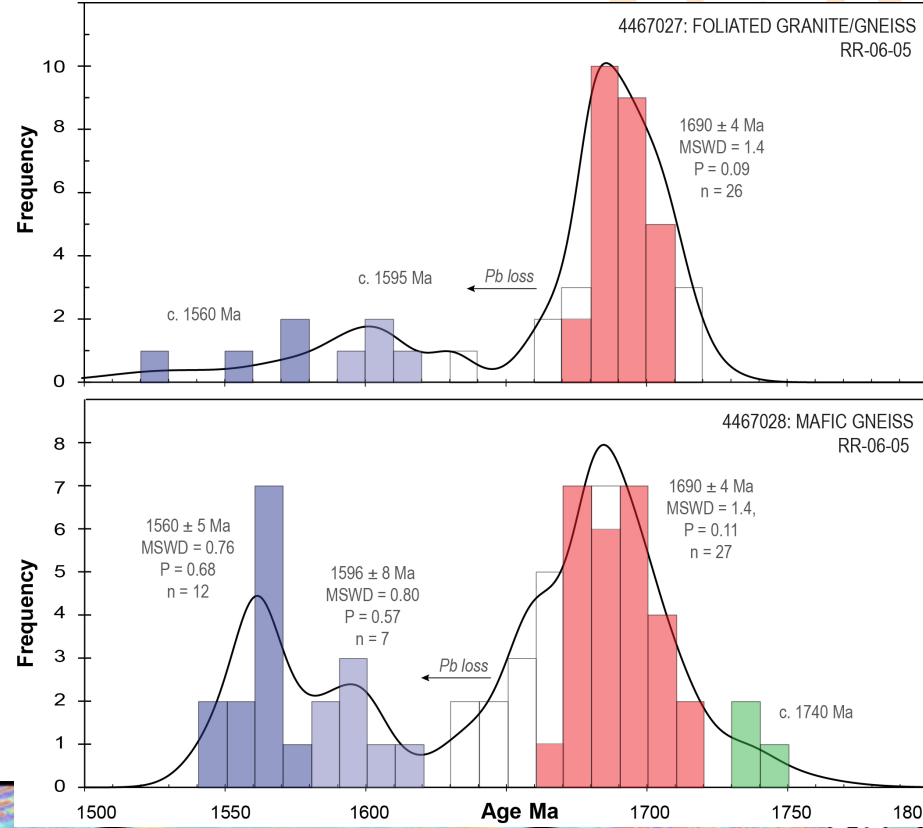
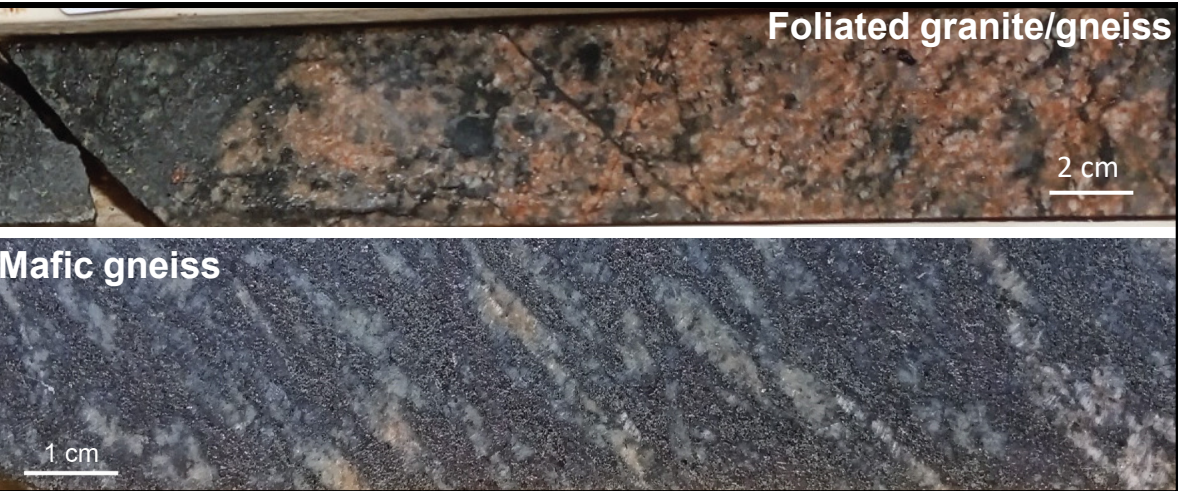
Lithology and Geochronology: CBD001

Depth (m)	Lithology	Protolith (Ma)	Magmatic age (Ma) (migmatitic melt)	Metamorphic age (Ma)	Metasomatism (Ma)
81.1-83.0	Garnet-bearing gneiss	c. 1740	-	1572 ± 3	
152.0-153.9	Migmatitic qz-fs gneiss	c. 1740	1571 ± 9	-	



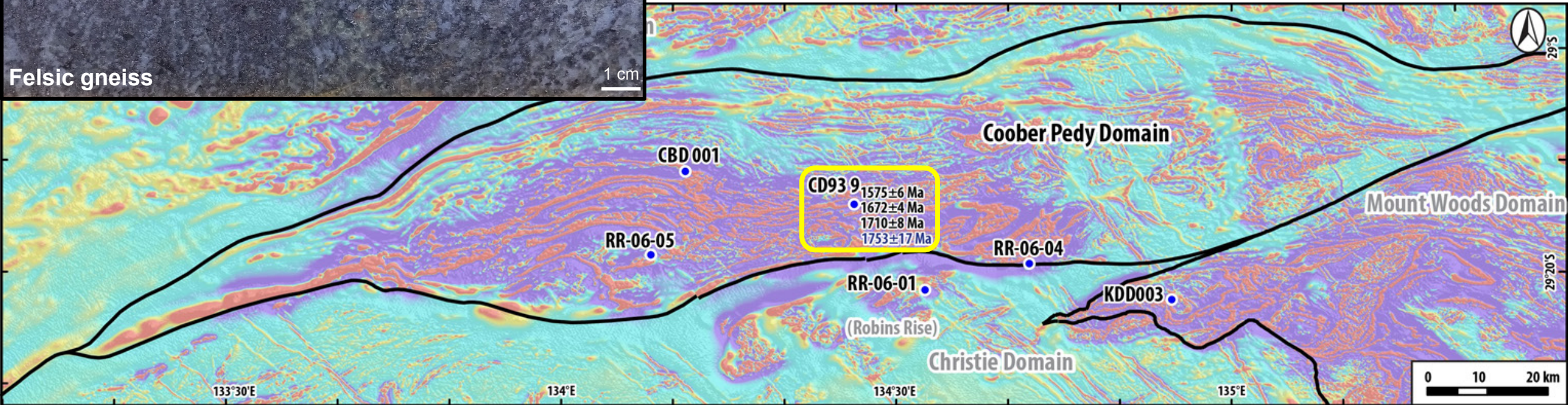
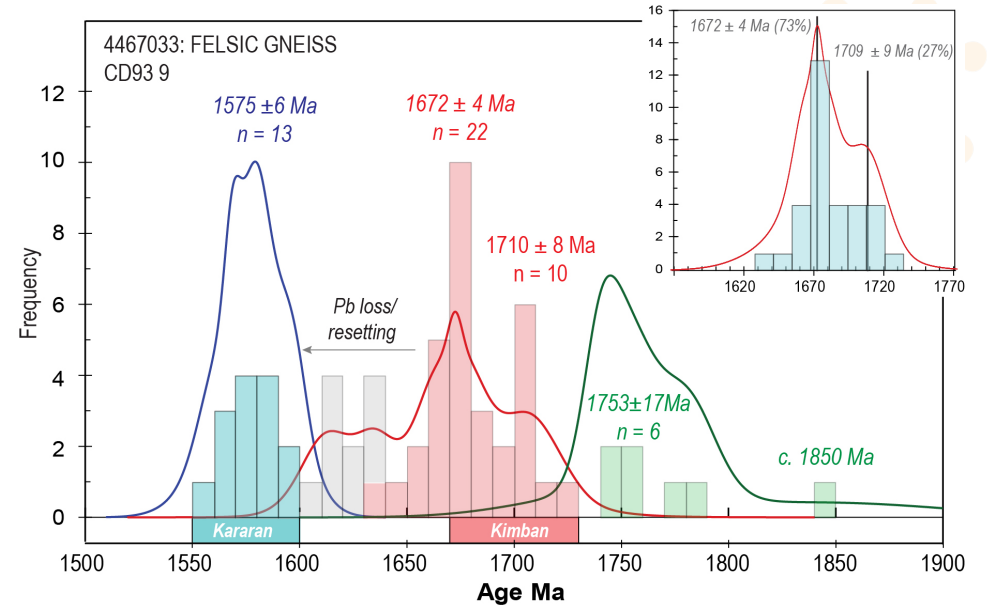
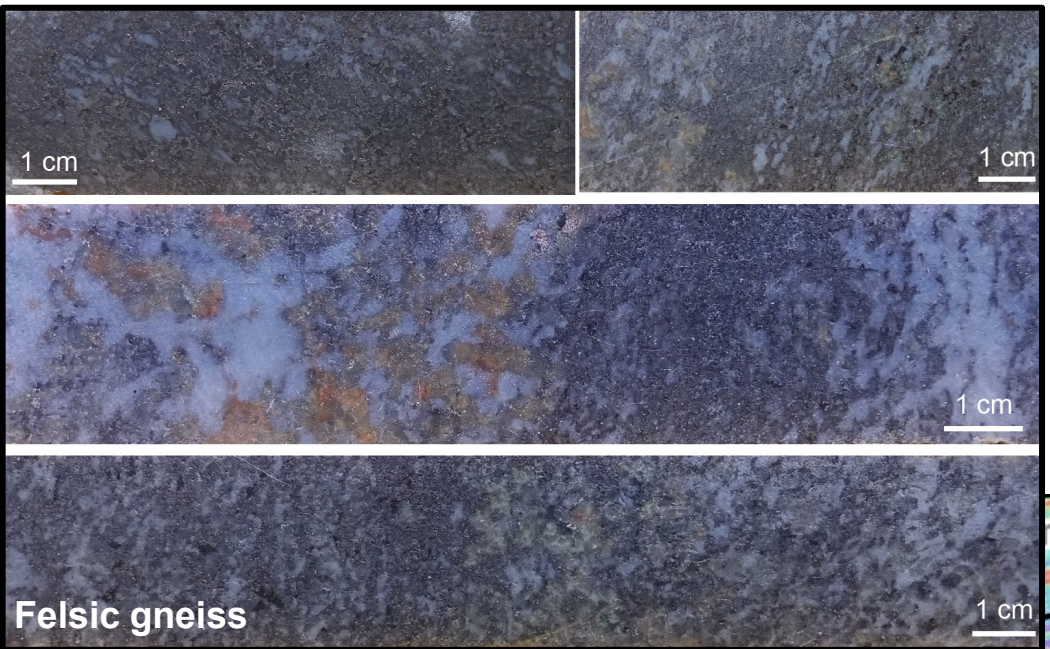
Lithology and Geochronology: RR-06-05

Depth (m)	Lithology	Protolith (Ma)	Magmatic age (Ma)	Metamorphic age (Ma)
187.6-189.0	Foliated granite/gneiss	-	1690 ± 4 (?)	1690 ± 4 (?); c. 1596; 1552 ± 22
191.3-194.0	Mafic gneiss	c. 1740	1690 ± 4 (?)	1690 ± 4 (?); 1596 ± 8; 1560 ± 5



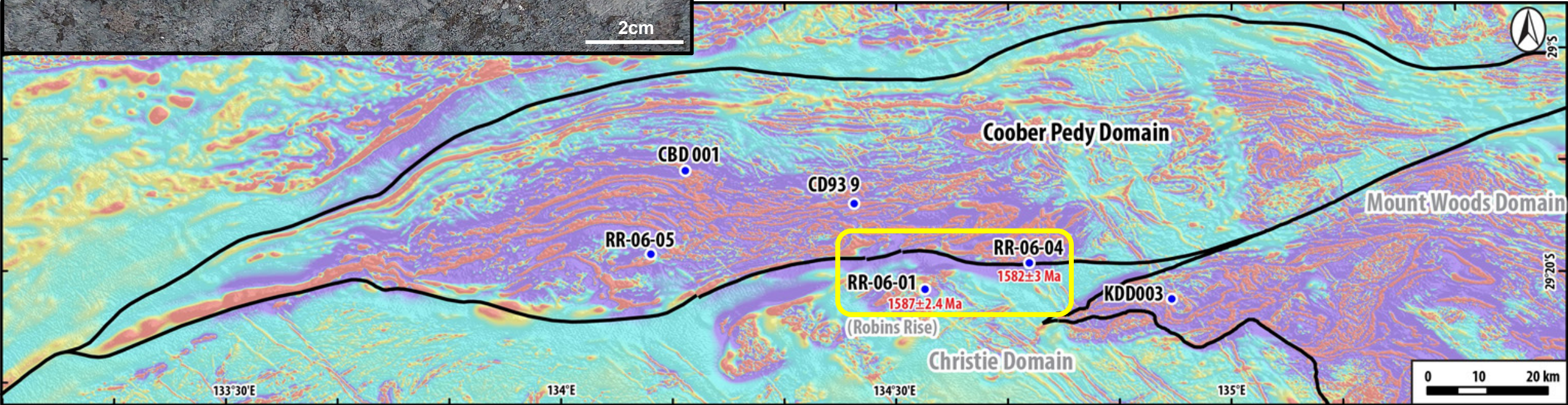
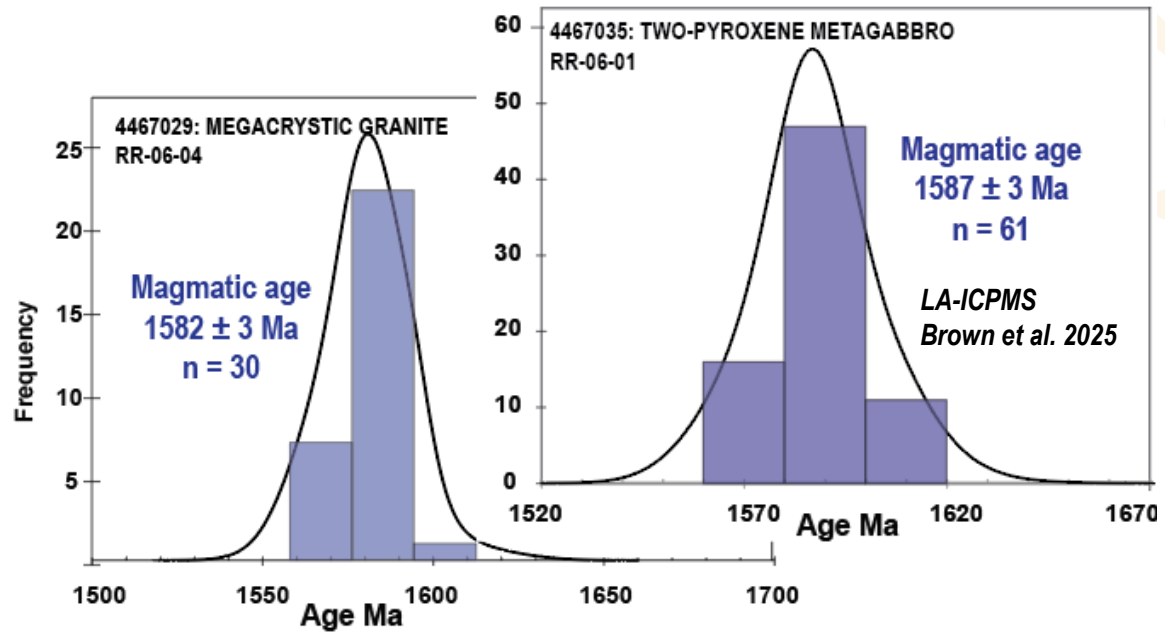
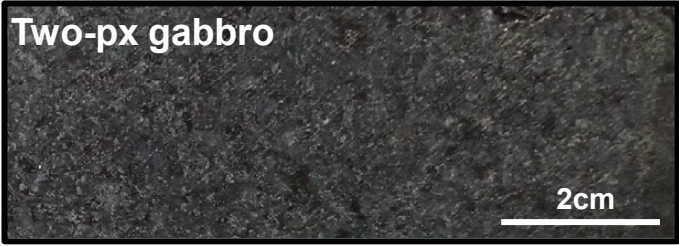
Lithology and Geochronology: CD93 9

Depth (m)	Lithology	Protolith (Ma)	Metamorphic age (Ma)
195.0-204.0	Felsic gneiss	1753 ± 17	1710 ± 8; 1672 ± 4; 1575 ± 6



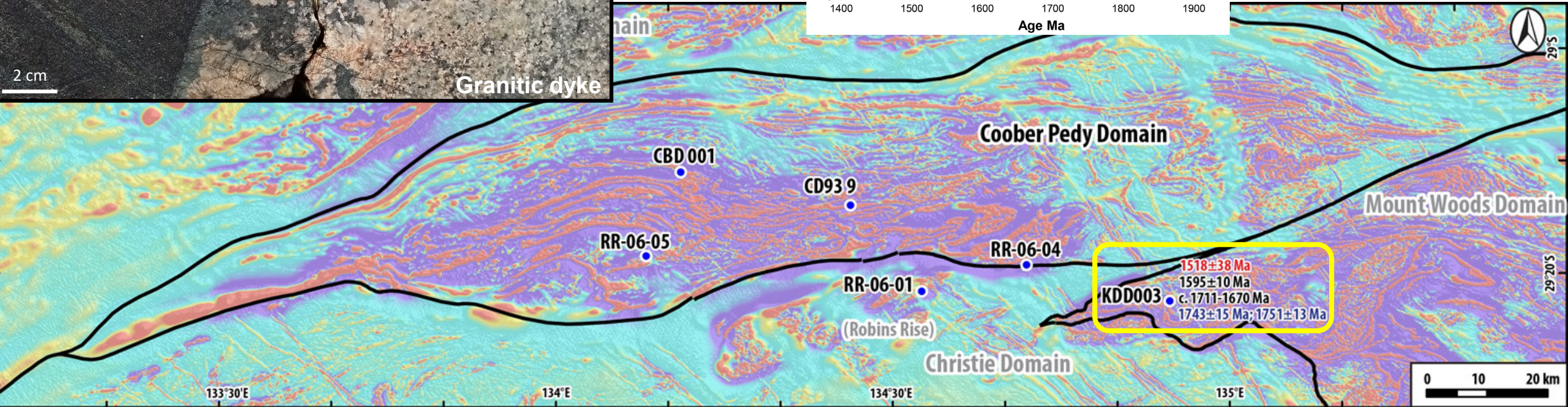
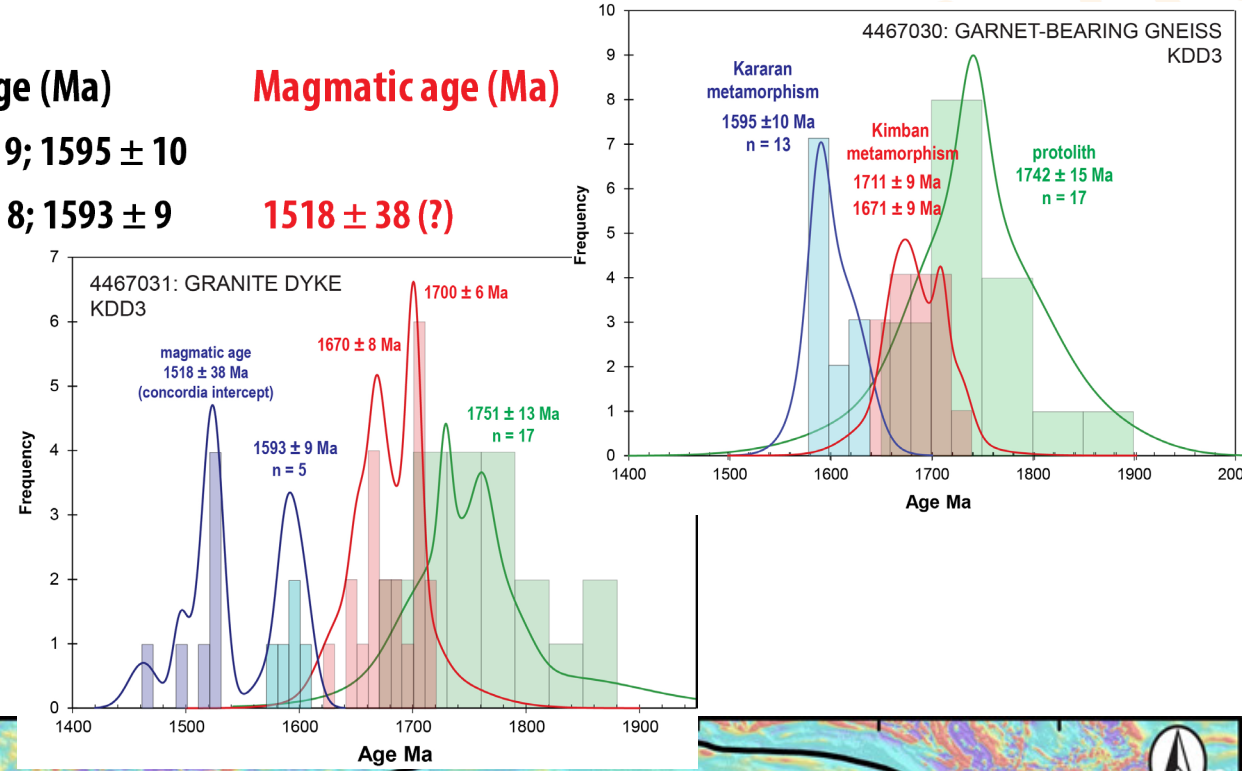
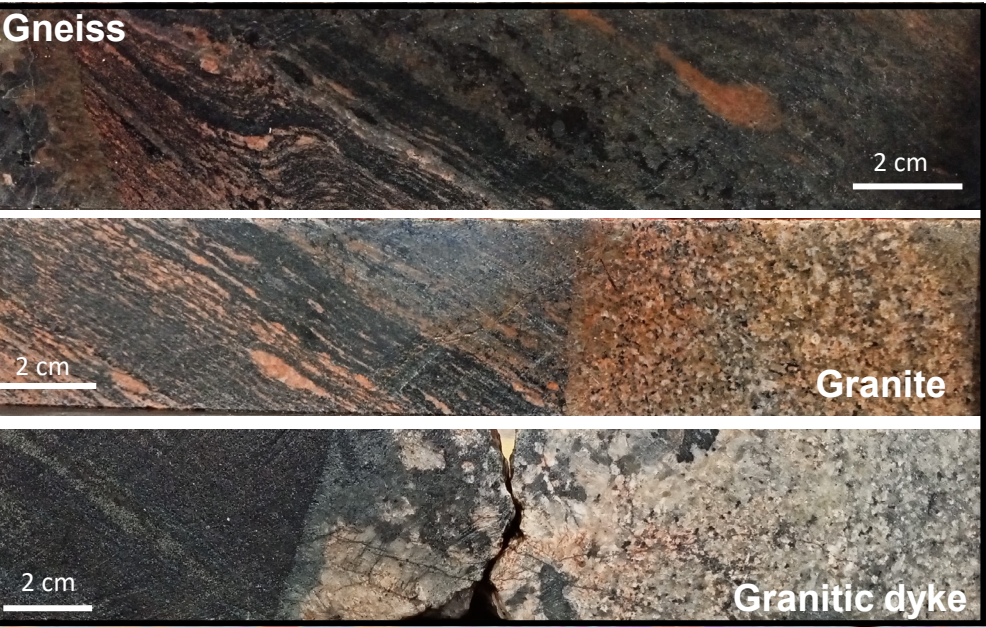
Lithology and Geochronology: RR-06-01 and RR-06-04

Drill hole	Depth (m)	Lithology	Magmatic age (Ma)
RR-06-01	64.6-65.0	Two-pyroxene gabbro	1587 ± 2.4
RR-06-04	127.0-130.0	Megacrystic granite	1582 ± 3



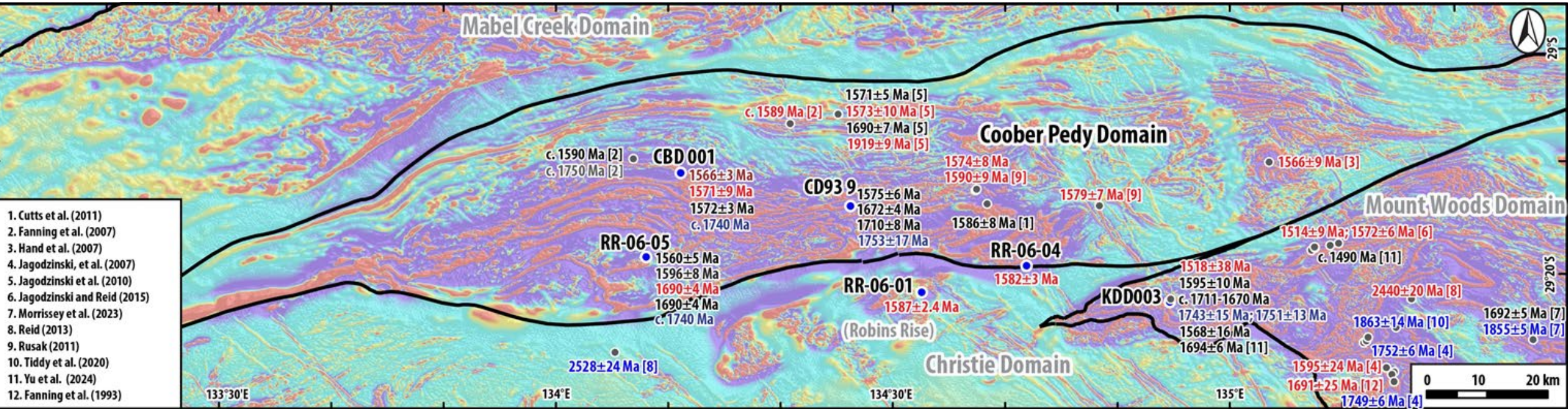
Lithology and Geochronology: KDD003

Depth (m)	Lithology	Protolith (Ma)	Metamorphic age (Ma)	Magmatic age (Ma)
120.0-125.8	Biotite-garnet-bearing gneiss	1742 ± 15	1711 ± 9; 1671 ± 9; 1595 ± 10	
135.5-135.95	Granite dyke into foliated gneiss	1751 ± 13	1700 ± 6; 1670 ± 8; 1593 ± 9	1518 ± 38 (?)

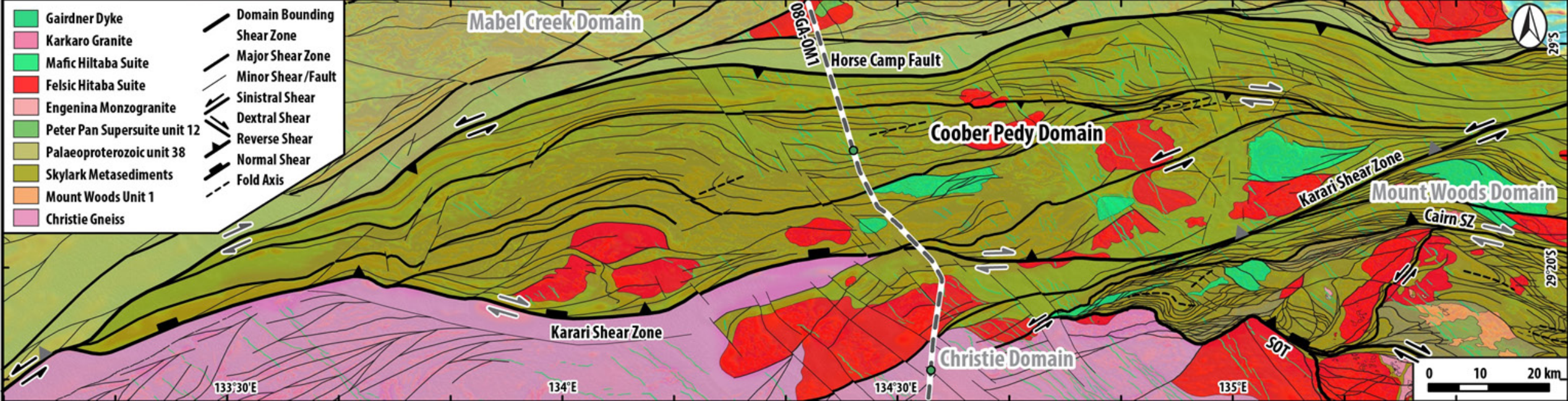
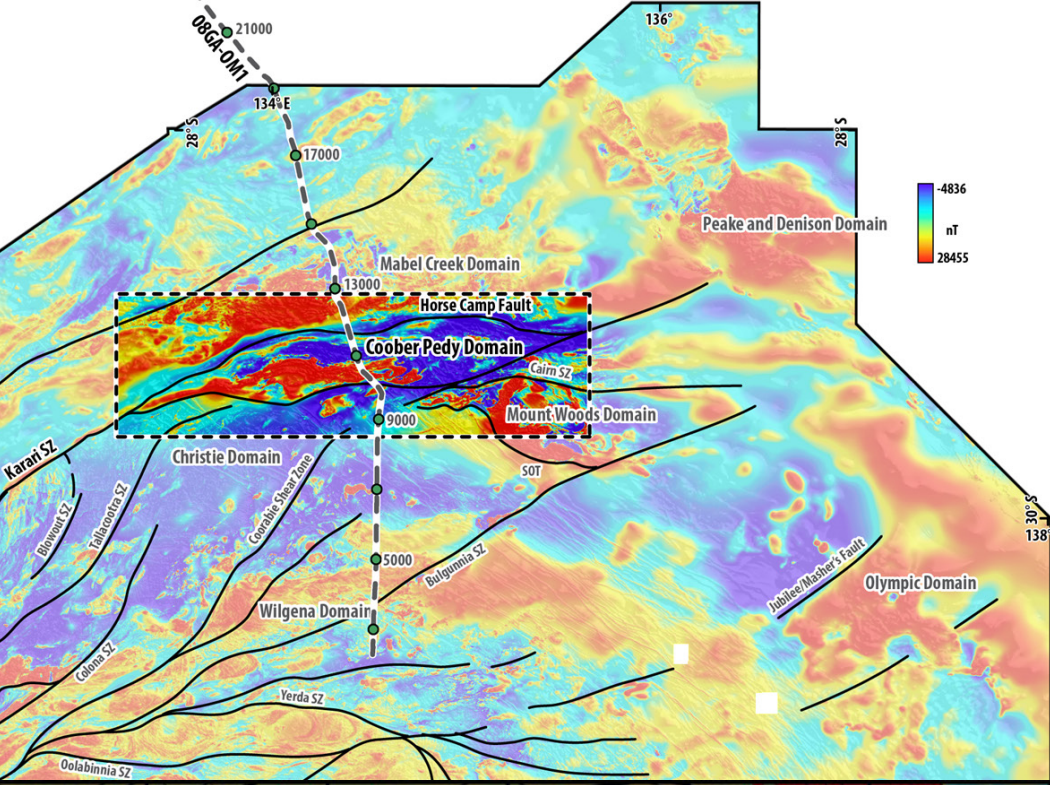
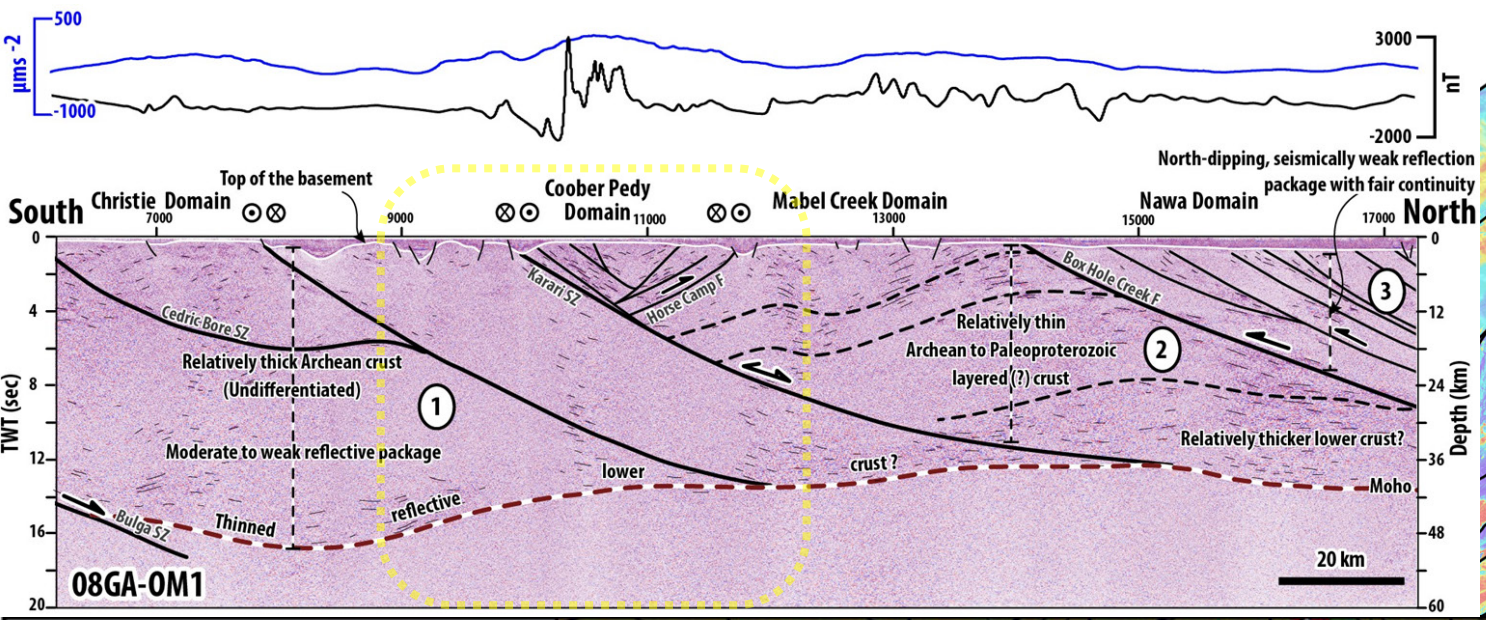


Lithology and geochronology: Overview

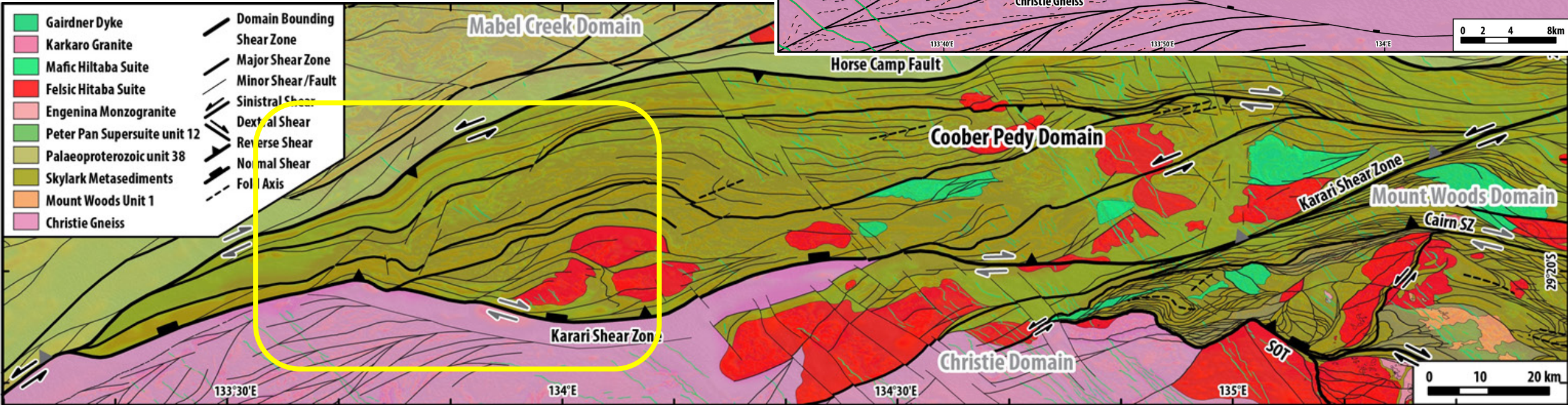
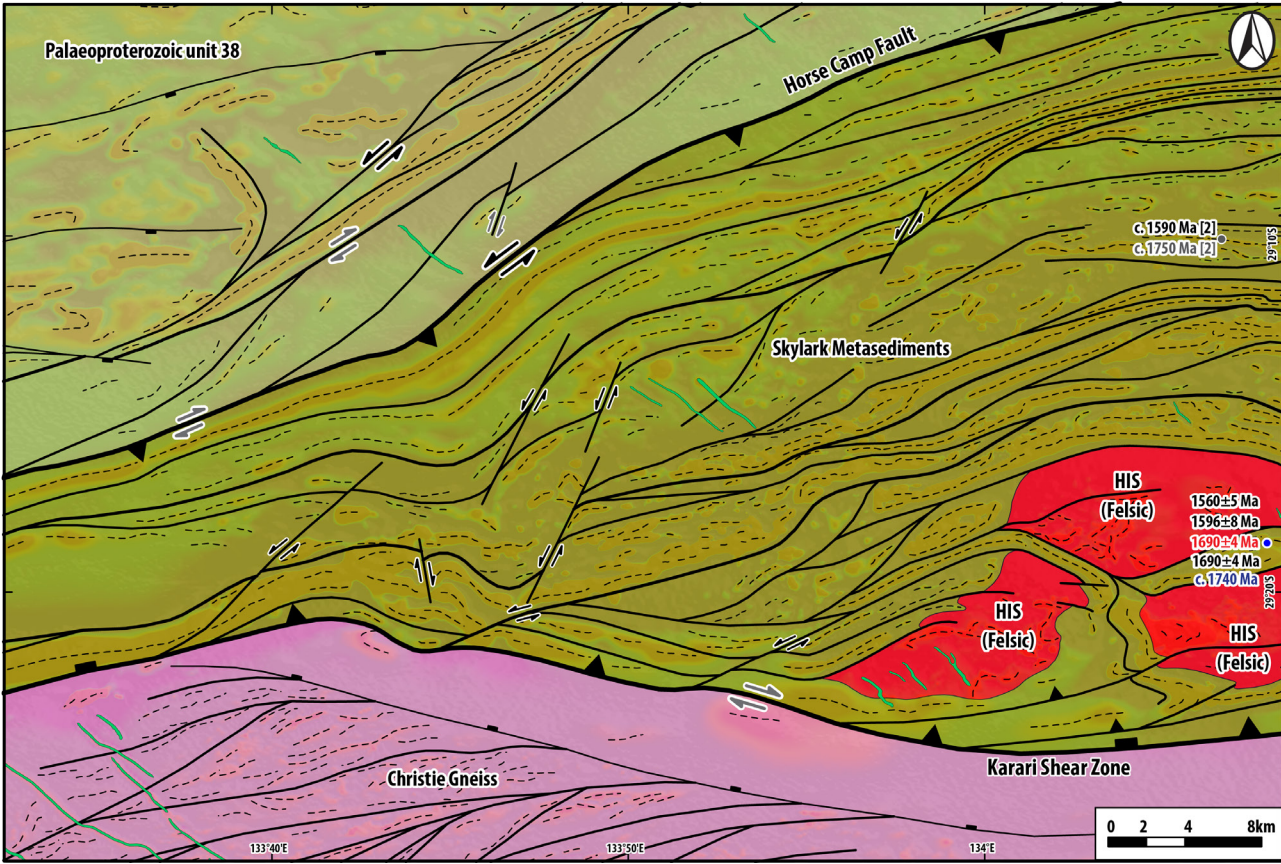
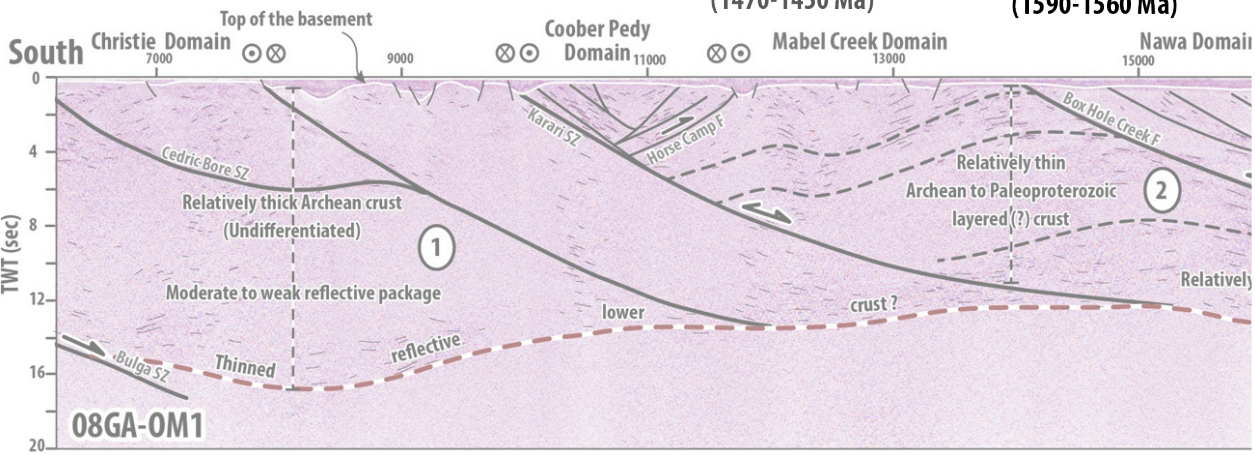
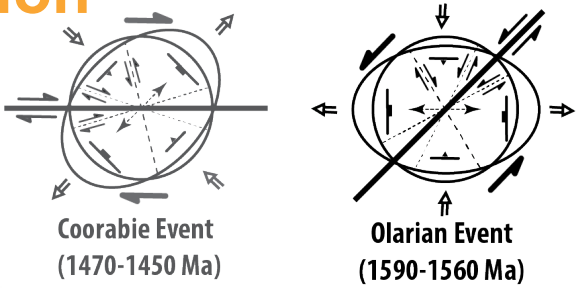
Drill hole	Depth (m)	Lithology	Pre- Kimban		Kimban Event		Hiltaba-aged magmatism		Olarian/Kararan Event		Post-Olarian	
			Protolith (Ma)	Magmatic age (Ma)	Metamorphic age (Ma)	Magmatic age (Ma)	Magmatic age (Ma)	Metamorphic age (Ma)	Magmatic age (Ma)			
CBD001	81.1-83.0	Garnet-bearing gneiss	c. 1740	-	-	-	-	-	1572 ± 3	-	-	-
	152.0-153.9	Migmatitic qz-fs gneiss	c. 1740	-	-	-	1571 ± 9	-	-	-	-	-
RR-06-05	187.6-189.0	Foliated granite/gneiss	-	1690 ± 4 (?)	1690 ± 4 (?)	-	-	-	c. 1596; 1552 ± 22	-	-	-
	191.3-194.0	Mafic gneiss	c. 1740	1690 ± 4 (?)	1690 ± 4 (?)	-	-	-	1596 ± 8; 1560 ± 5	-	-	-
CD93 9	195.0-204.0	Felsic gneiss	1753 ± 17	-	1710 ± 8; 1672 ± 4	-	-	-	1575 ± 6	-	-	-
RR-06-01	64.6-65.0	Two-pyroxene gabbro	-	-	-	-	1587 ± 2.4	-	-	-	-	-
RR-06-04	127.0-130.0	Megacrystic granite	-	-	-	-	1582 ± 3	-	-	-	-	-
KDD003	120.0-125.8	Biotite-garnet-bearing gneiss	1742 ± 15	-	1711 ± 9; 1671 ± 9	-	-	-	1595 ± 10	-	-	-
	135.5-135.95	Granite dyke into foliated gneiss	1751 ± 13	-	1700 ± 6; 1670 ± 8	-	-	-	1593 ± 9	-	1518 ± 38 (?)	-



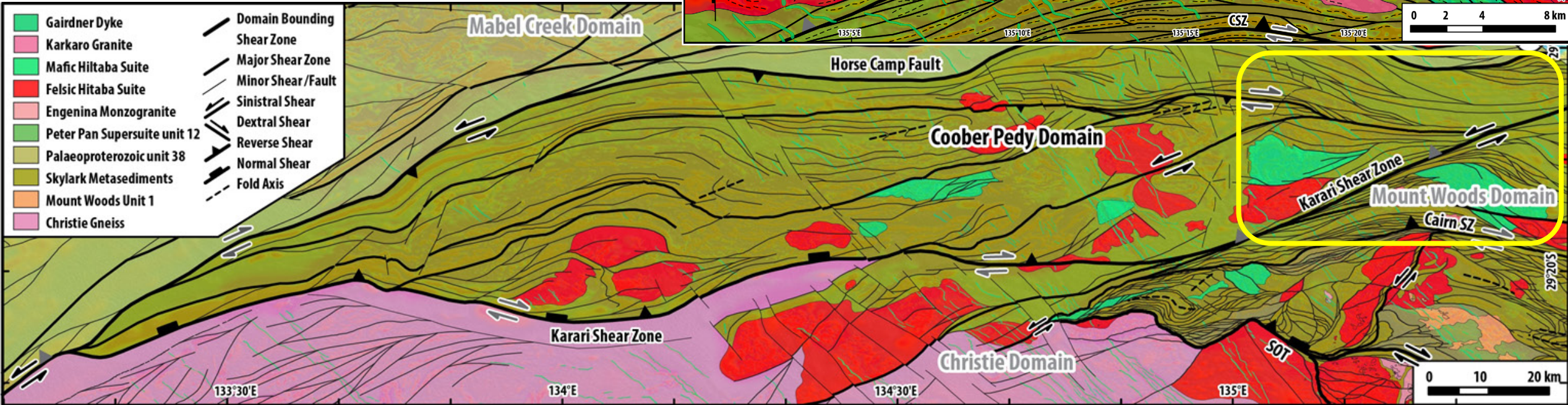
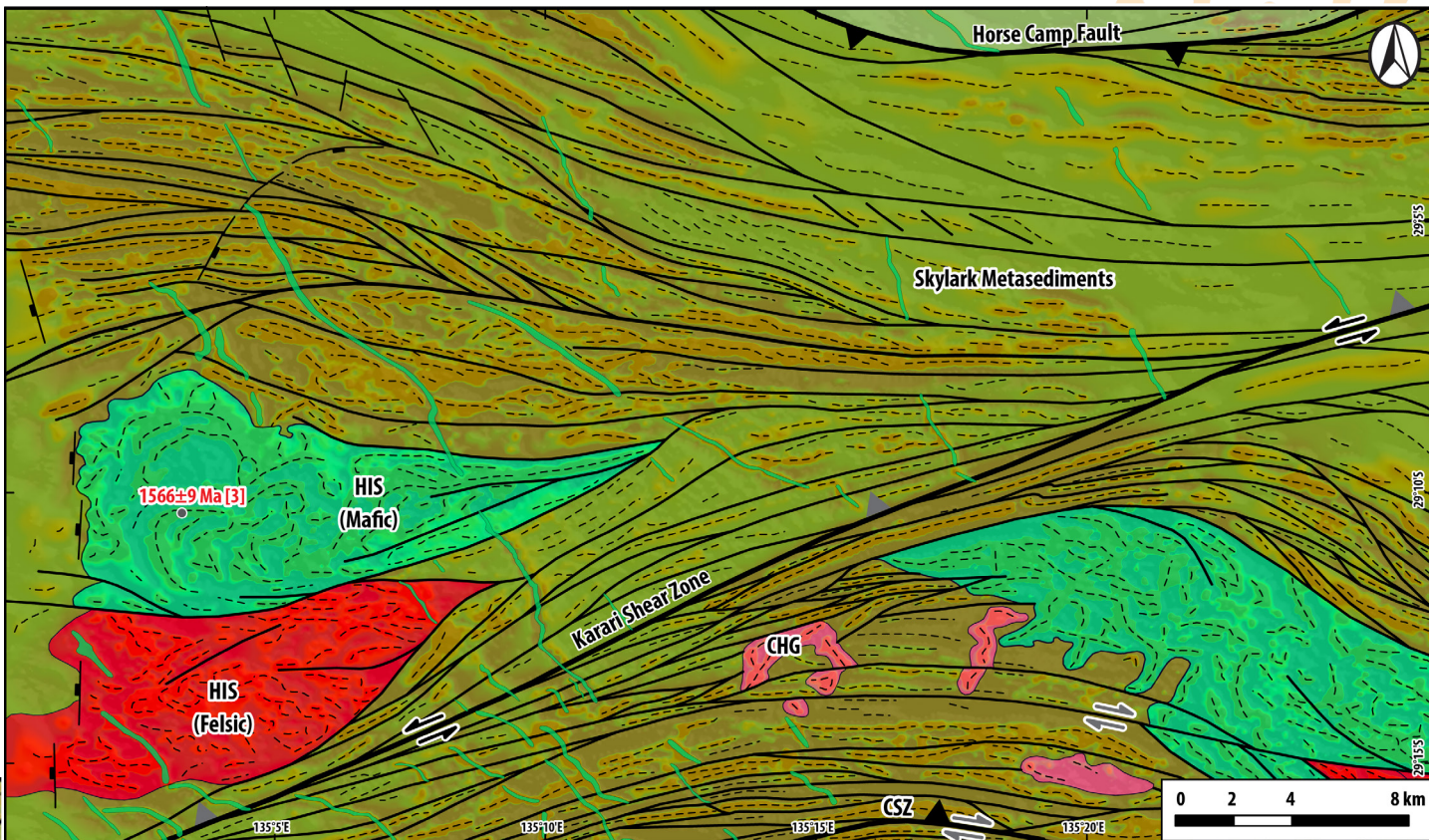
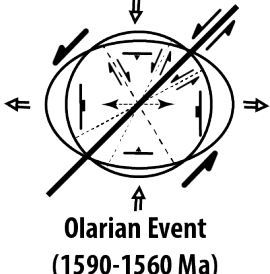
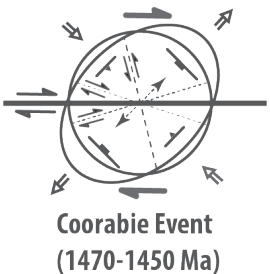
Structural Interpretation



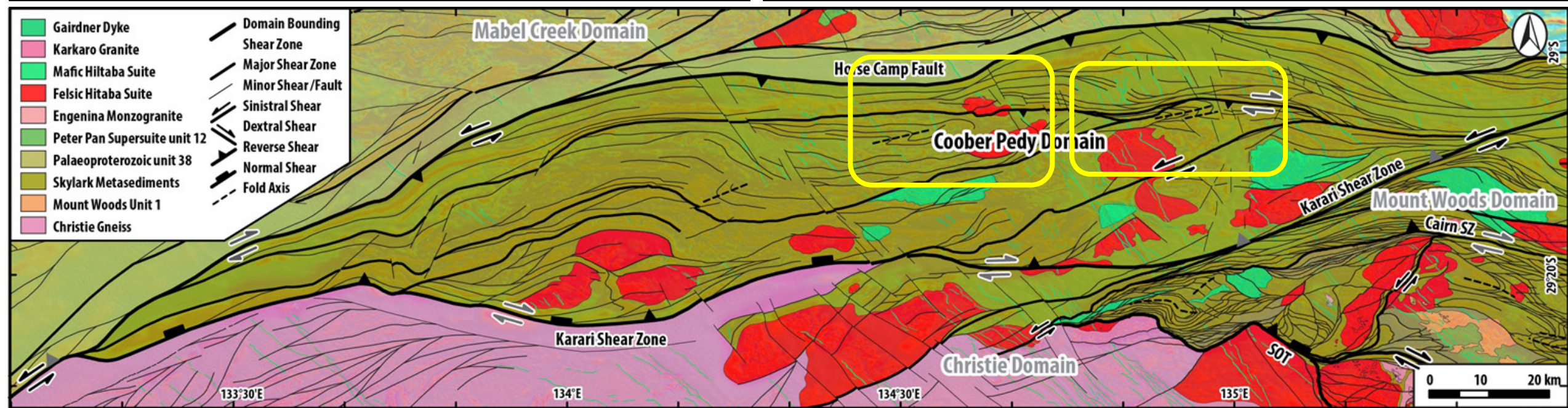
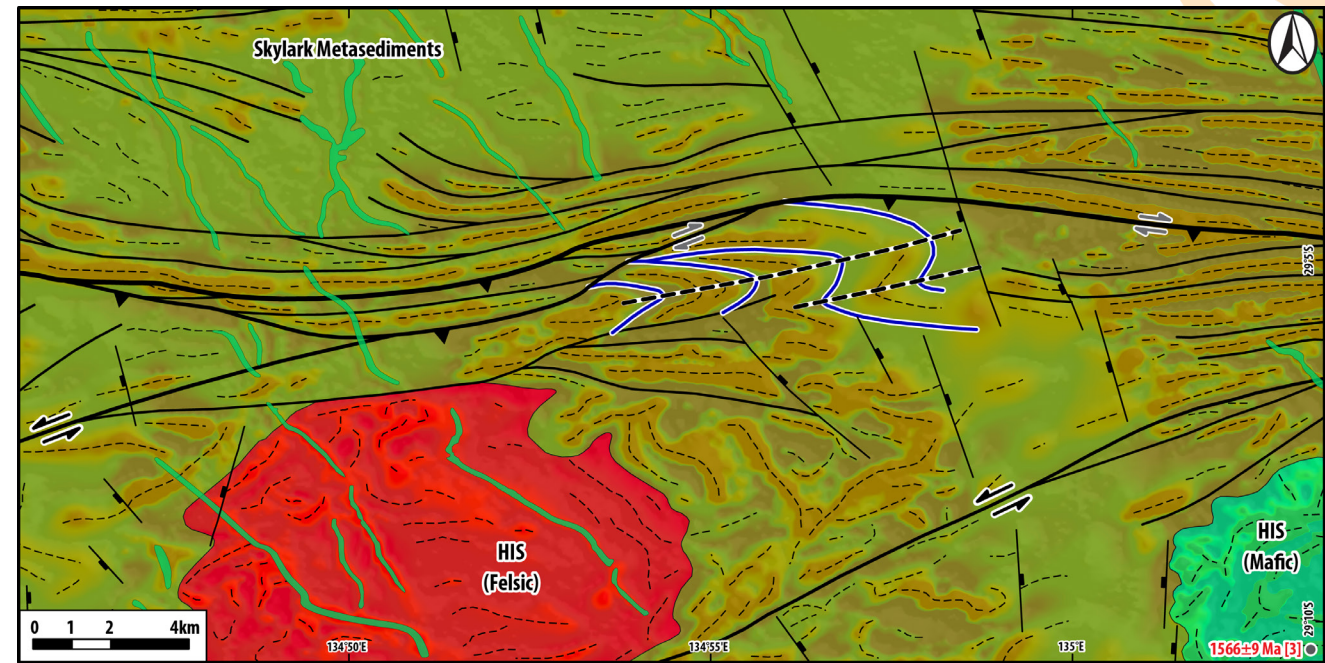
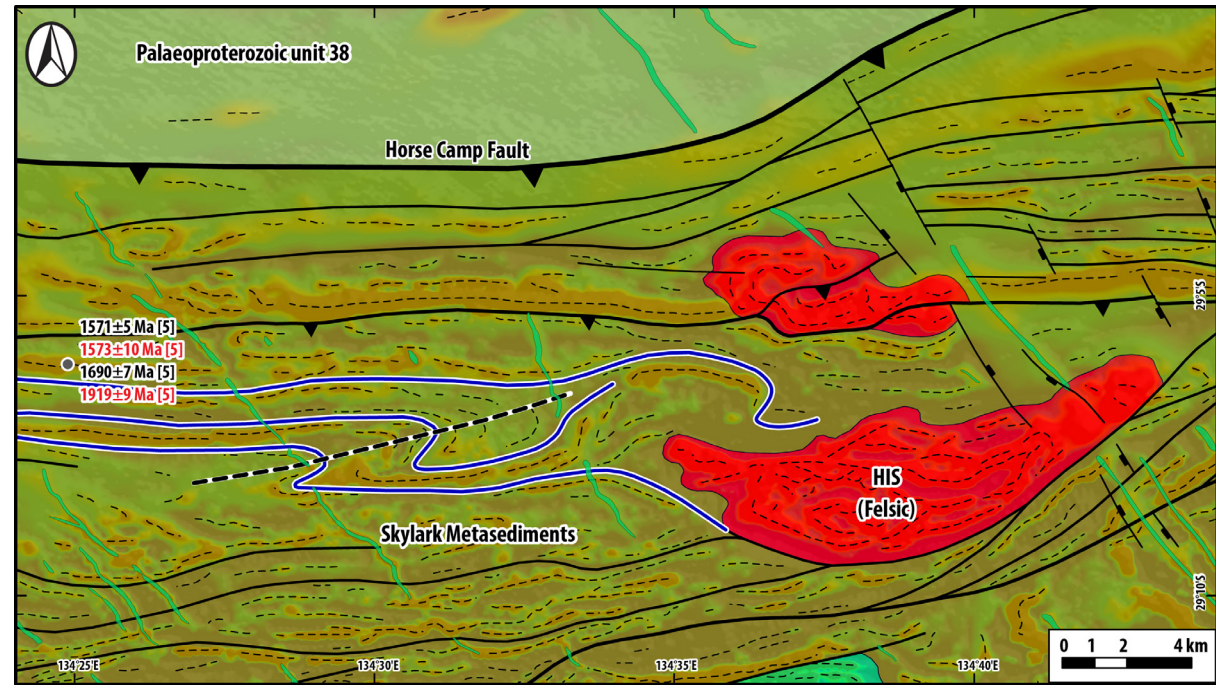
Structural Interpretation



Structural Interpretation



Structural Interpretation

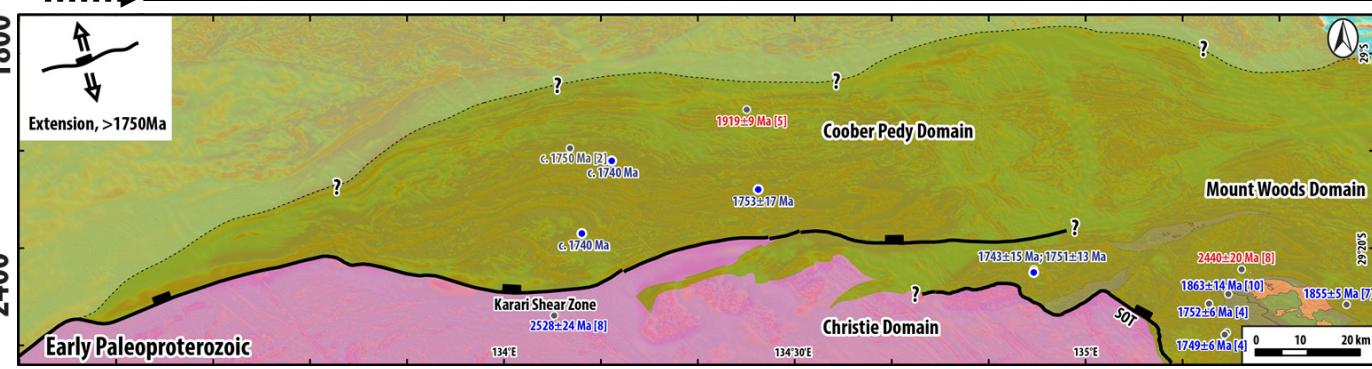
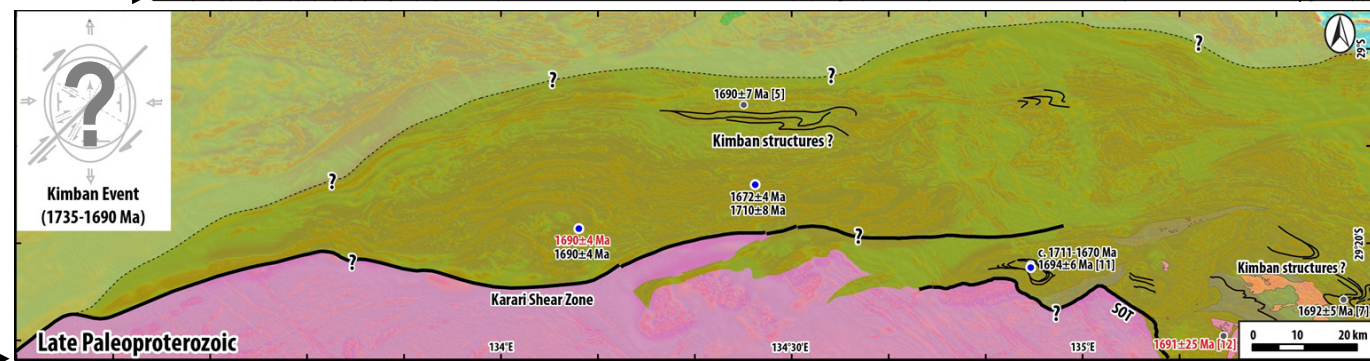
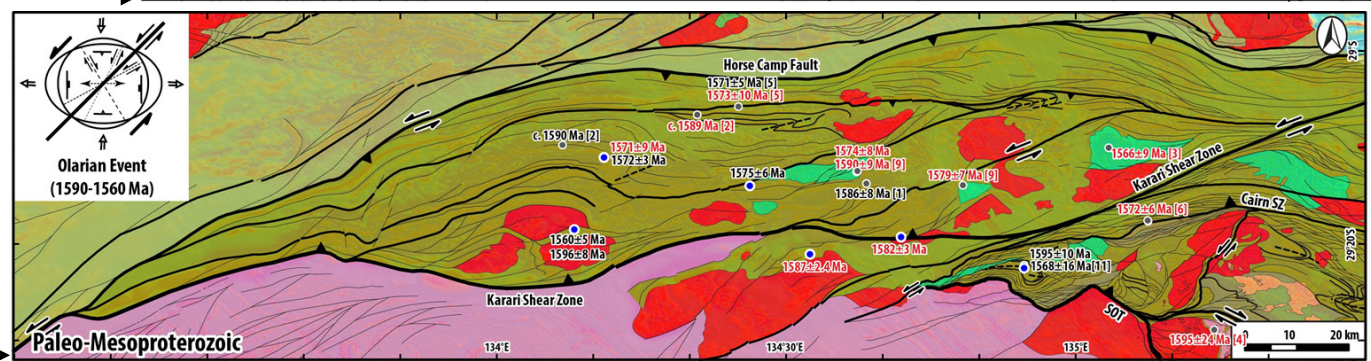
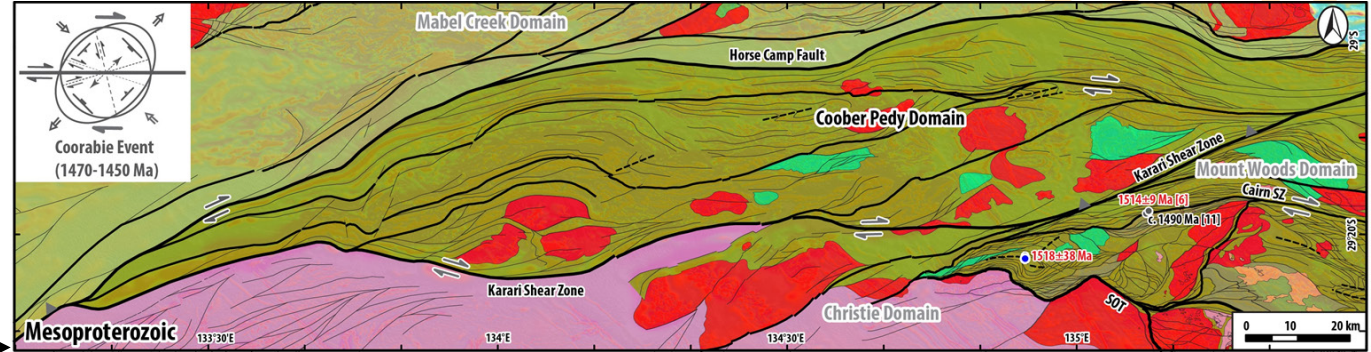


Paleo- to Mesoproterozoic Tectonic evolution of the Coober Pedy Domain (northern Gawler Craton)

Coober Pedy D.	Mount Woods D.	Northern Christie D.
	1470-1450 Ma Coorabie Event Cu-Mineralization (Cairn Hill) Cairn Hill Granite ~1515 Ma	
HIS, 1595-1565 Ma	Balta Granite/HIS 1590-1560 Ma 1630-1540 Ma Olarian Event	Cu-Mineralization (Prominant Hill) HIS 1595-1565 Ma GRV 1590-1580 Ma
	Engenina Adamelite c. 1690 Ma	
	1735-1690 Ma Kimban Event	
Skyllark Metasediments (~1750 Ma) Mount Woods Complex		
		2470-2400 Ma Kenella Gneiss Sleafordian Event Mulgathing Complex Christie Gneiss

Mapping Time slice
Age (Ma)

MES [1514-1250 Ma]	PMP [1639-1515 Ma]	LPR [1749-1640 Ma]	EPR [2299-1750 Ma]	ARP [< 2300 Ma]
1400	1500	1700	1800	2400
T00 [1600-1560 Ma]				



- | | |
|------------------------------|----------------------------|
| Gairdner Dyke | Domain Bounding Shear Zone |
| Karkaro Granite | Major Shear Zone |
| Mafic Hiltaba Suite | Minor Shear/Fault |
| Felsic Hiltaba Suite | Sinistral Shear |
| Engenina Monzogranite | Dextral Shear |
| Peter Pan Supersuite unit 12 | Reverse Shear |
| Paleoproterozoic unit 38 | Normal Shear |
| Skyllark Metasediments | Fold Axis |
| Mount Woods Unit 1 | |
| Christie Gneiss | |

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Acknowledgement of Country

As guests here on Kurna land, the Department for Energy and Mining (DEM) acknowledges everything this department does impacts on Aboriginal country, the sea, the sky, its people, and the spiritual and cultural connections which have existed since the first sunrise. Our responsibility is to share our collective knowledge, recognise a difficult history, respect the relationships made over time, and create a stronger future. We are ready to walk, learn and work together.



DISCOVERY DAY

