DIGITAL MAPPING TECHNIQUES 2024

The following was presented at DMT '24
May 13 - 16, 2024

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2024)
http://ngmdb.usgs.gov/info/dmt/

Multi-scale Digital Mapping with the StraboSpot Ecosystem

By Youseph Ibrahim (Texas A&M University)

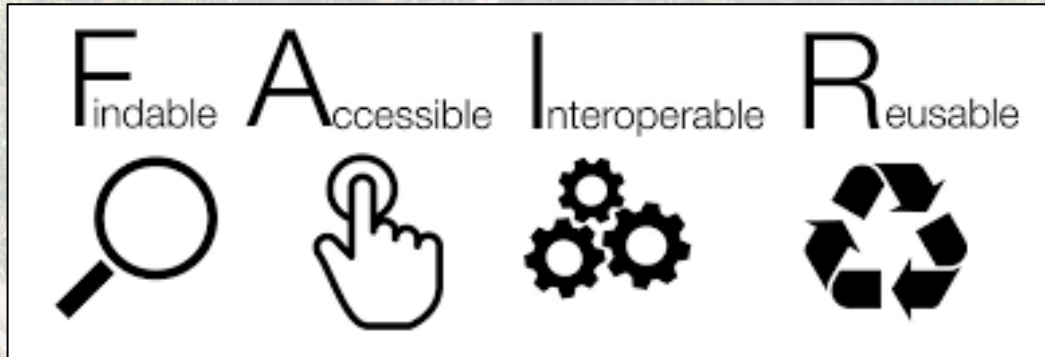
The open-source, community-built StraboSpot ecosystem (www.strabospot.org) provides innovative tools for mapping, data organization, and cataloging from meso- to micro-scales. Here, we illustrate our application of StraboSpot in the remote terrains of Central Australia, investigating the unique juxtaposition of a high-grade gneiss dome and a nappe complex within an intracratonic setting. We describe our workflow beginning with pre-field preparations, through to in-field data collection, where geo-referenced observations, structural measurements, and images were collected. In the post-field phase, StraboSpot enabled a streamlined process to share our complete geo-referenced dataset and to export the data for use in external workflows. The adoption of StraboSpot in our workflow significantly enhanced the efficiency of our data collection and management processes, and provided a robust framework for cataloguing, communicating, and disseminating our dataset. This, in turn, enriched the scientific dialogue on the geological structures and processes at play.

Dome to Duplex Tectonics: Navigating the Research Cycle with StraboSpot in Central Australia

Joe Ibrahim

What Is StraboSpot?

- Software suite designed for geologic field, microstructural, and experimental workflows
- Associated database for collecting, storing, sharing, and querying geologic data
- Built by geologists for geologists
- Open source, open API, community driven and NSF funded



A Collaborative Effort

IGSN

OpenTopography
High-Resolution Topography Data and Tools

EARTHCUBE
TRANSFORMING GEOSCIENCES RESEARCH

THE UNIVERSITY OF UTAH®

EPOS - NL
EUROPEANPLATEOBSERVINGSYSTEM NETHERLANDS

University of Nevada, Reno

IEDA

Pomona College

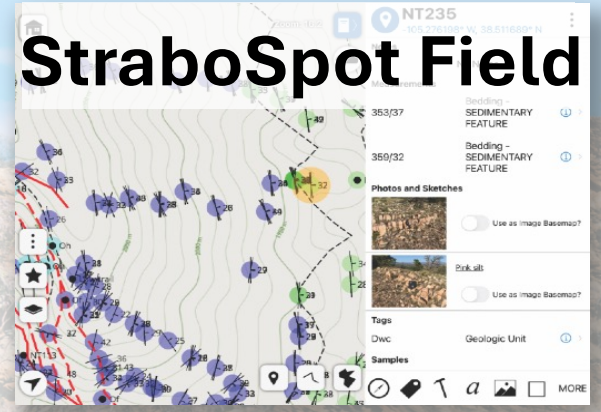
THE UNIVERSITY OF SYDNEY

EARTHCHEM
Search. Synthesize. Contribute.

Geochron

The Strabo Ecosystem

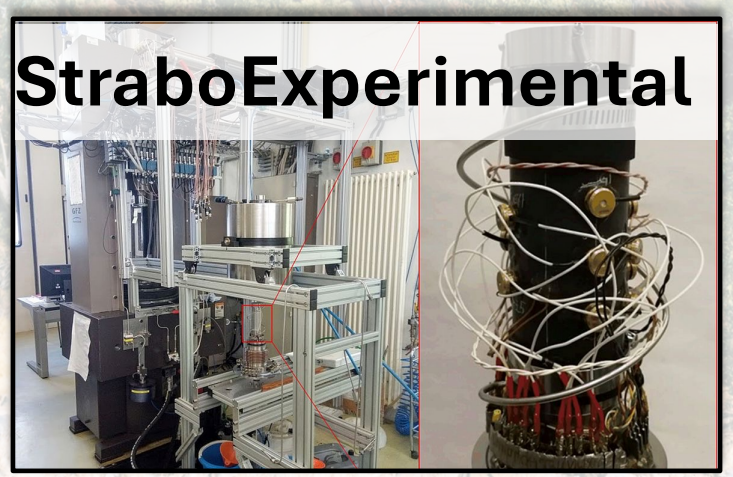
StraboSpot Field



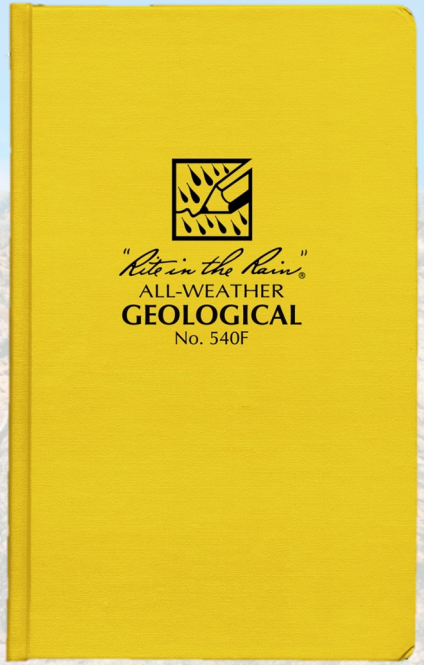
StraboWeb

StraboMicro

StraboExperimental

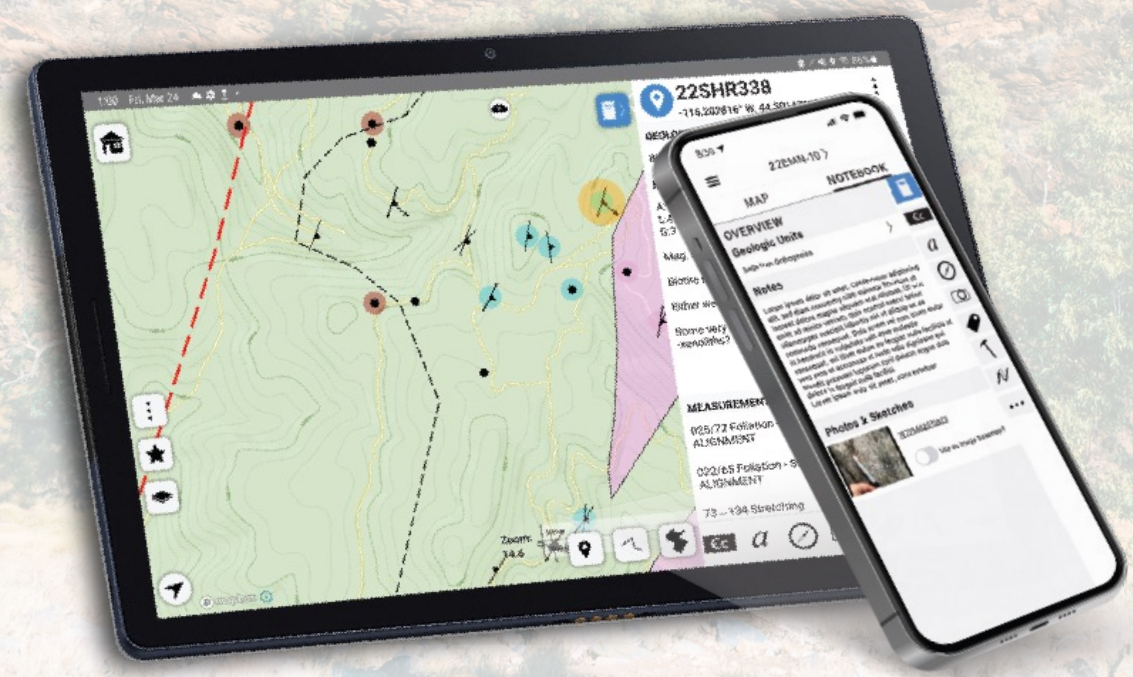


StraboSpot Field



StraboSpot Field

- Take structural measurements
- Download offline maps and base layers
- Draw polygons and lines
- Track location with GPS
- Take notes, tag and describe lithology
- Take photos and annotate
- Community built modules



More Pages

- Geologic Units
- Notes
- Measurements
- Photos & Sketches
- Tags
- Samples
- 3D Structures
- Other Features
- Data
- Site Safety Summary

SEDIMENTOLOGY

- Strat Section
- Lithologies
- Bedding
- Structures
- Diagenesis
- Fossils

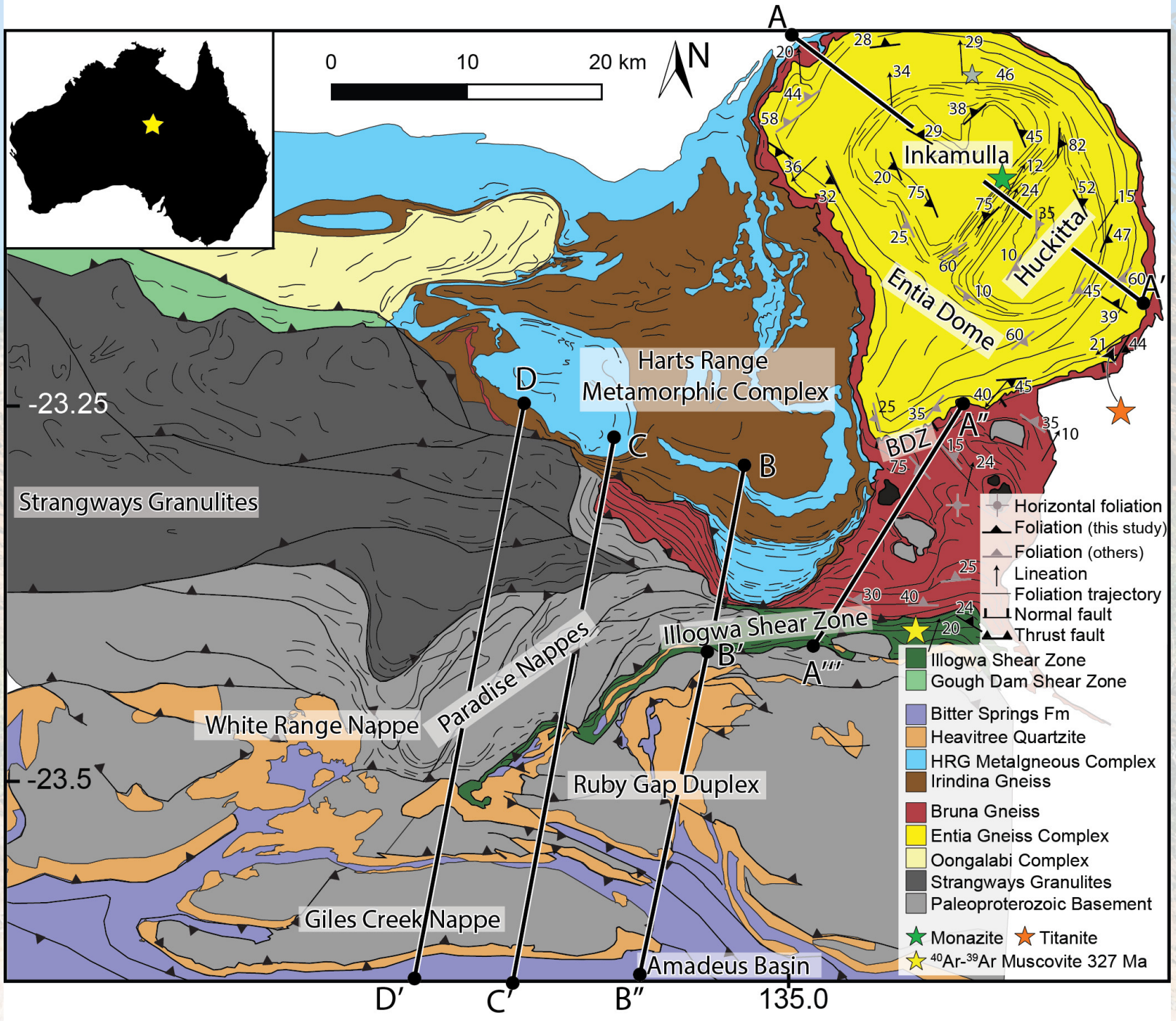
ROCKS & MINERALS

- Alteration, Ore Rocks
- Fault & Shear Zone Rocks
- Igneous Rocks
- Sedimentary Rocks
- Metamorphic Rocks
- Minerals

From dome to duplex: Convergent gravitational collapse explains coeval intracratonic doming and nappe tectonics, central Australia

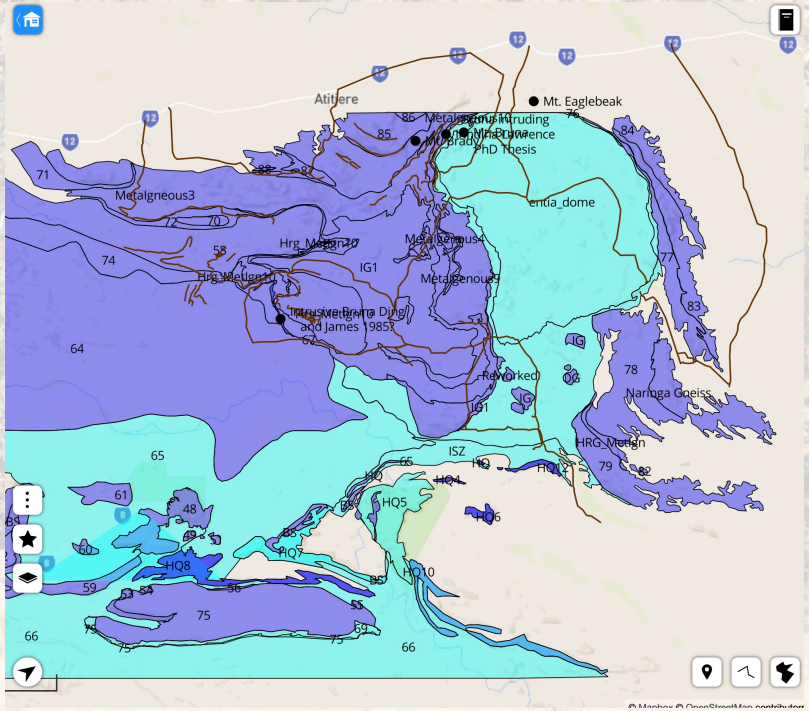
Youseph Ibrahim, Patrice Rey, Donna Whitney, Christian Teyssier, Françoise Roger, Valèrie Bosse, Bènèdicte Cenki

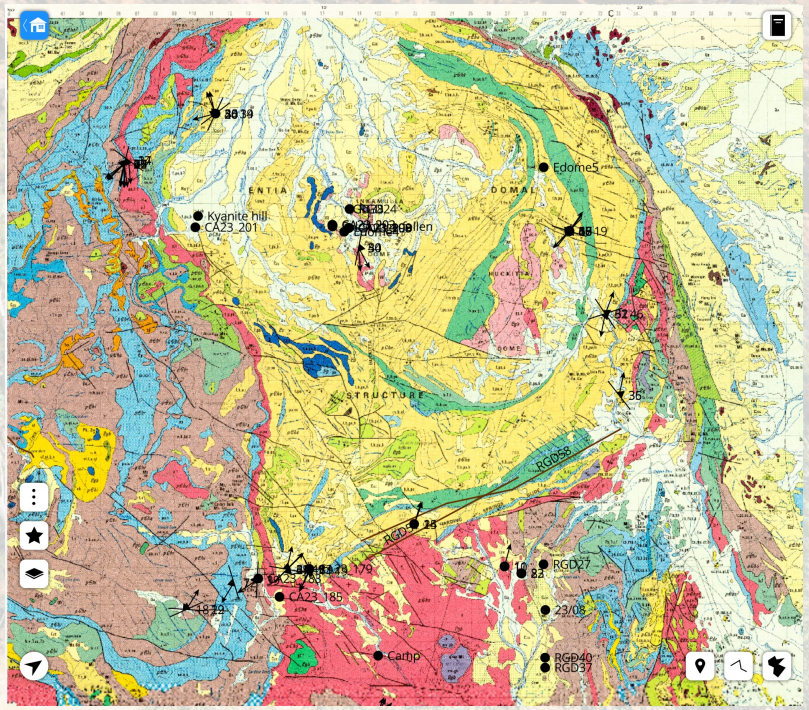
Study Area

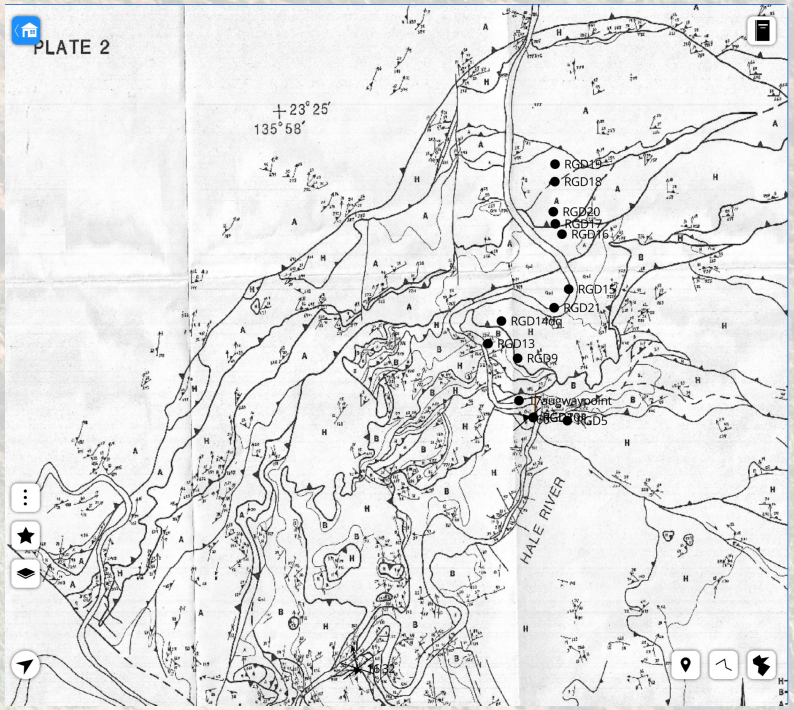

0
10
20 km
N
Inkamulla
Huckitta
Entia Dome
Harts Range
Metamorphic Complex
Strangways Granulites
Illogwa Shear Zone
Paradise Nappes
White Range Nappe
Ruby Gap Duplex
Giles Creek Nappe
Amadeus Basin
BDZ
-23.25
-23.5
135.0
A
A′
A″
A‴
B
B′
B″
C
C′
D
D′
Horizontal foliation
Foliation (this study)
Foliation (others)
Lineation
Foliation trajectory
Normal fault
Thrust fault
Illogwa Shear Zone
Gough Dam Shear Zone
Bitter Springs Fm
Heavitree Quartzite
HRG Metalgneous Complex
Irindina Gneiss
Bruna Gneiss
Entia Gneiss Complex
Oongalabi Complex
Strangways Granulites
Paleoproterozoic Basement
Monazite
Titanite
40Ar-39Ar Muscovite 327 Ma

Prepping for the Field

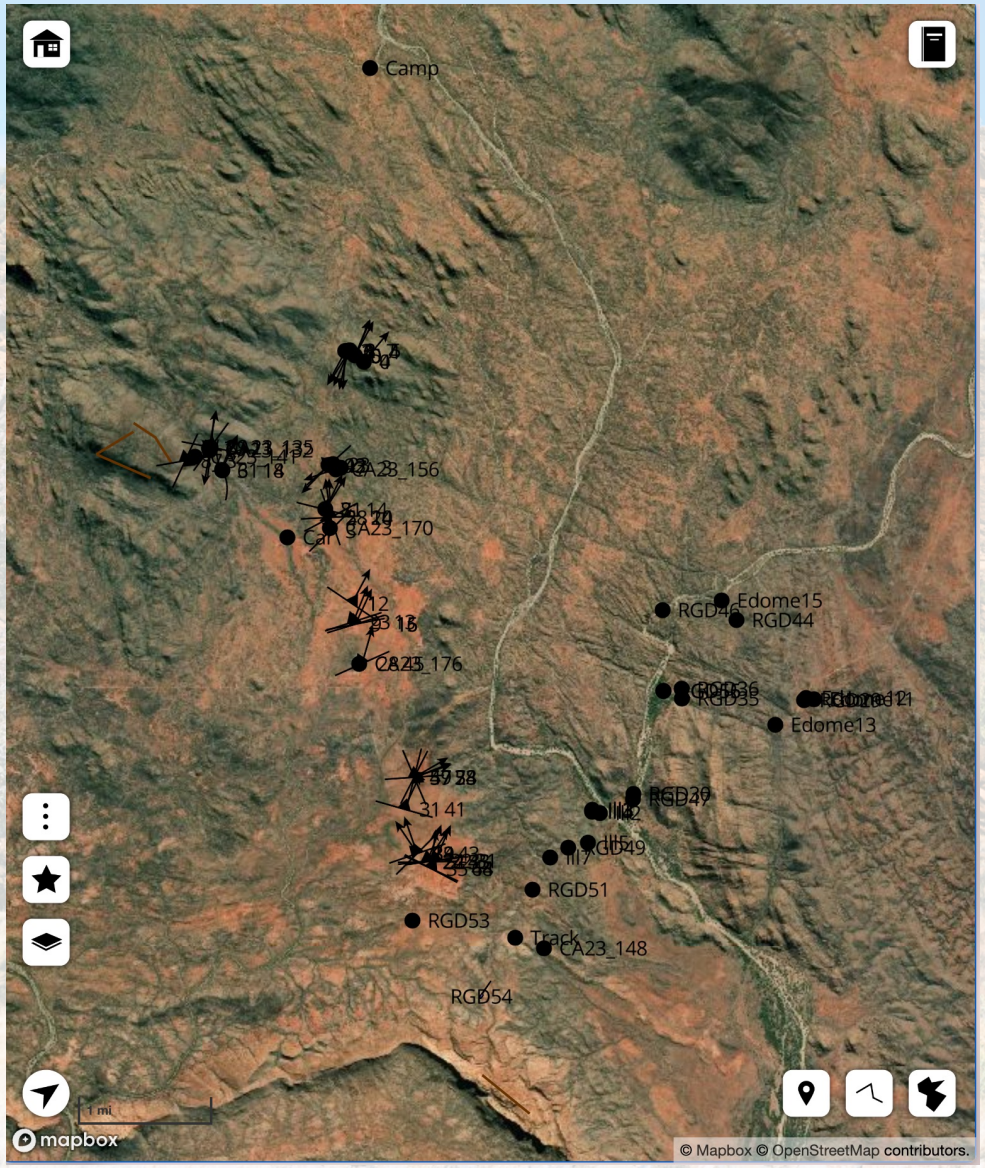
Loading in shapefiles, custom maps, and downloading for offline use in the field

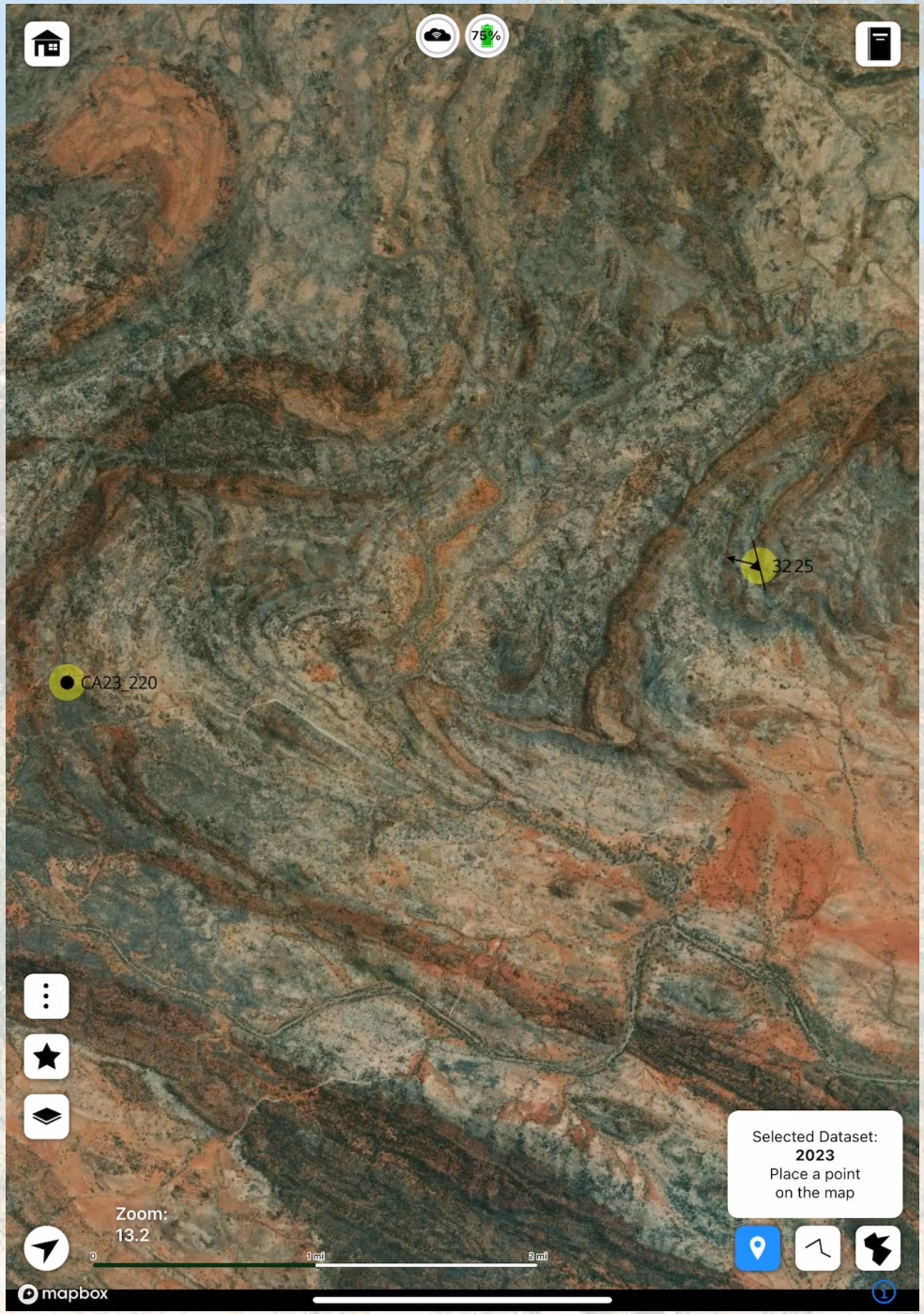






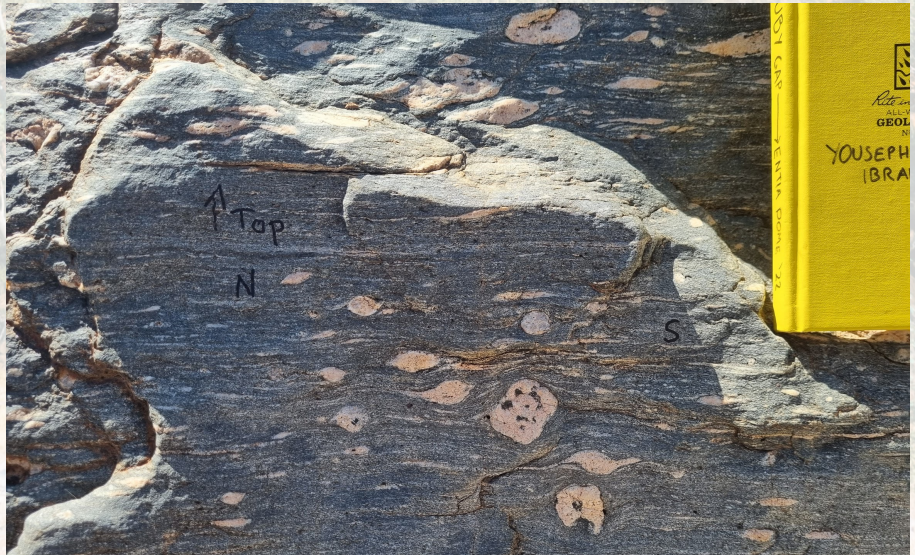
In the Field


Camp
CA23_156
CA23_170
CA23_176
Edome15
RGD46
RGD44
RGD35
Edome13
RGD39
RGD47
RGD49
RGD51
RGD53
Track
CA23_148
RGD54
1 mi
mapbox
© Mapbox © OpenStreetMap contributors.


75%
3225
CA23_220
Selected Dataset:
2023
Place a point
on the map
Zoom:
13.2
0
1 mi
2 mi
mapbox

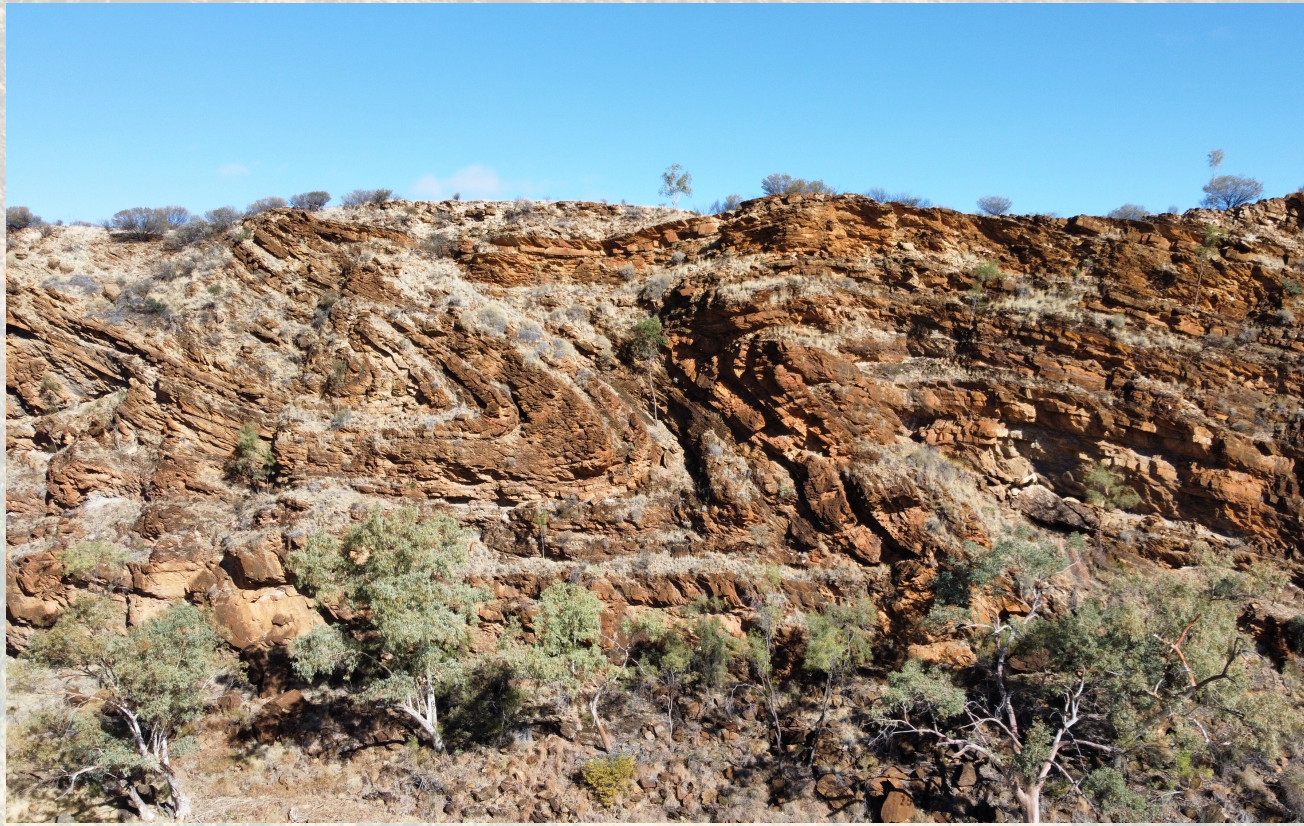
In the Field

Entire set of geotagged images associated with spots



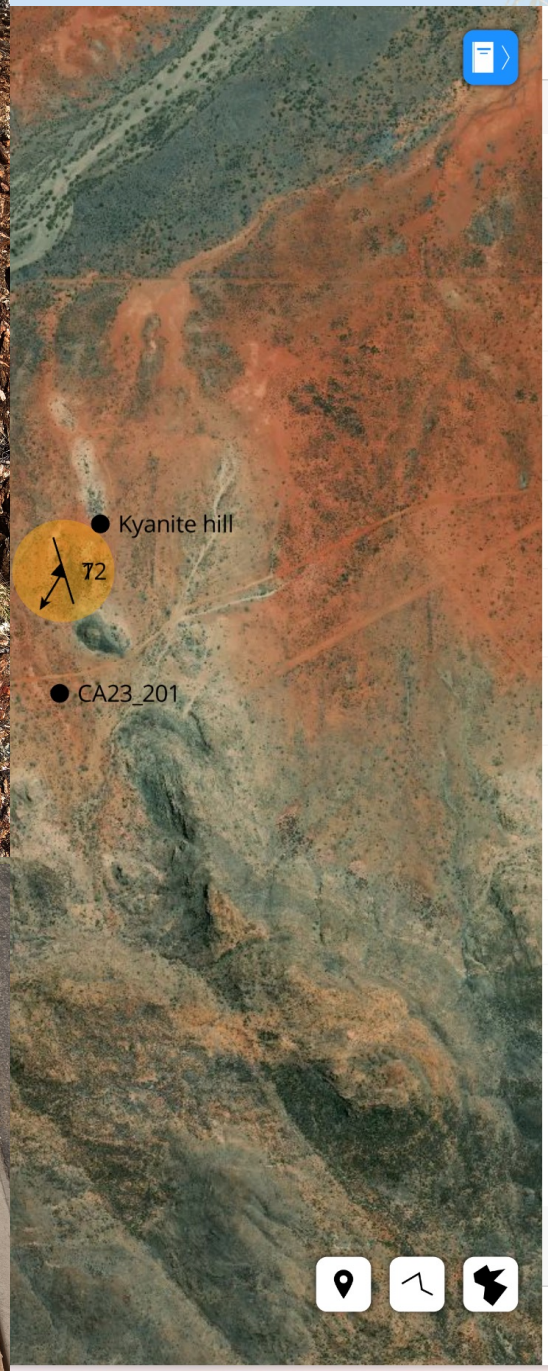
In the Field

Import Drone Images to Spots



In the Field

Samples associated with spots



CA23_220
135.099276° E, -23.097007° S

Cancel Save

Label
ILL_33

Sample Specific ID/Name
ILL_33

Main Sampling Purpose
fabric / microstructure

Deposit Thickness

Sample Description
Biotite Kyanite Schist

Material Type
intact rock

Inplaceness of Sample
5 - definitely in place

Oriented Sample
Yes

Sample Orientation Notes
Dipping west. Foliation and lineation recorded in the spot. Sample is marked

Sample Size
Hand-sample

Degree of Weathering
4

Sample Notes
Biotite Kyanite Schist. In place.

Delete Sample

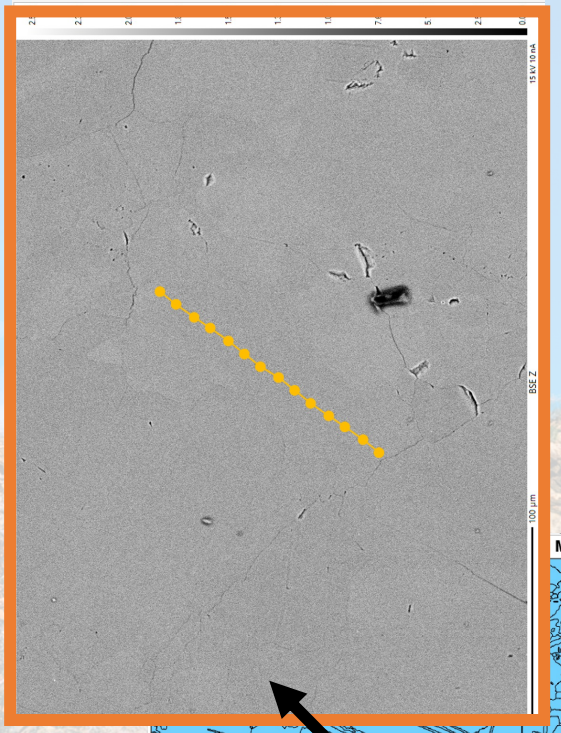
MORE

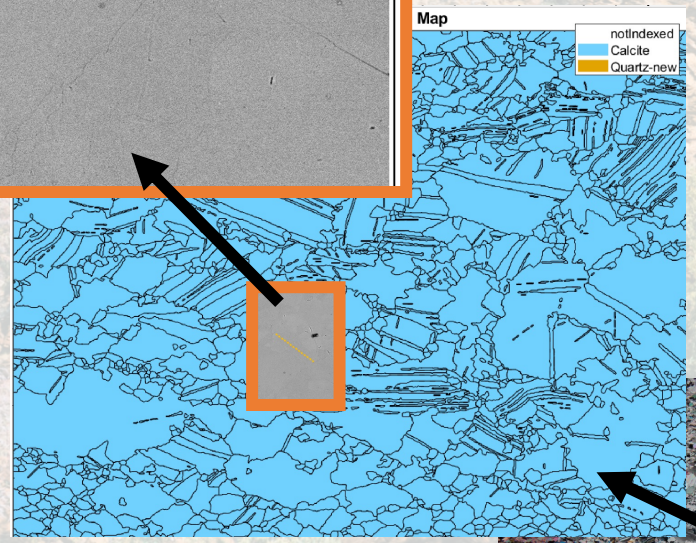
Nested Spots and Spatial Hierarchies

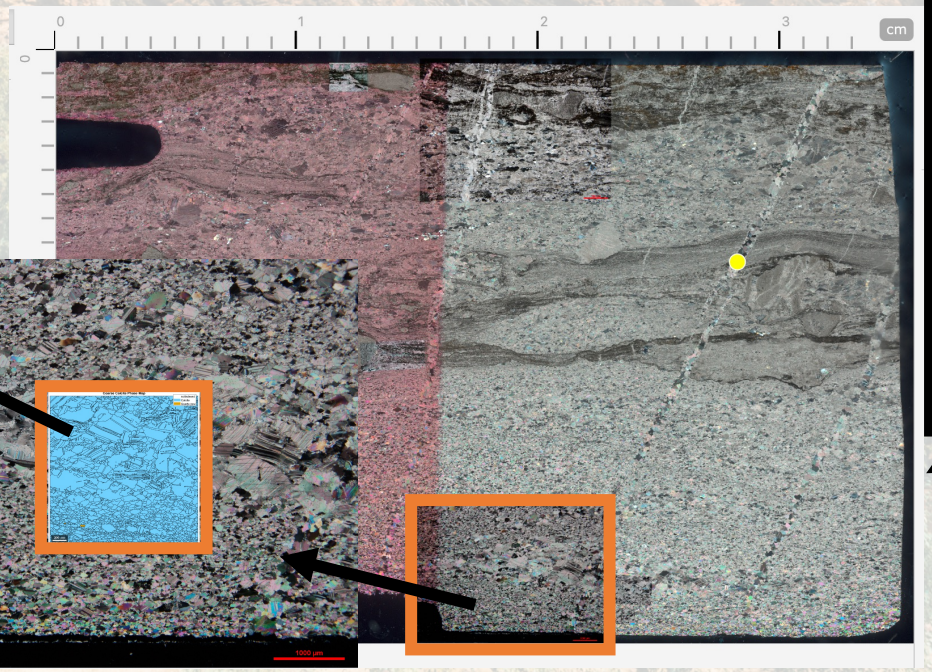
Take image of outcrop, set as baselayer

Mark spot on tablet

Take measurements, notes etc.. and bring back sample





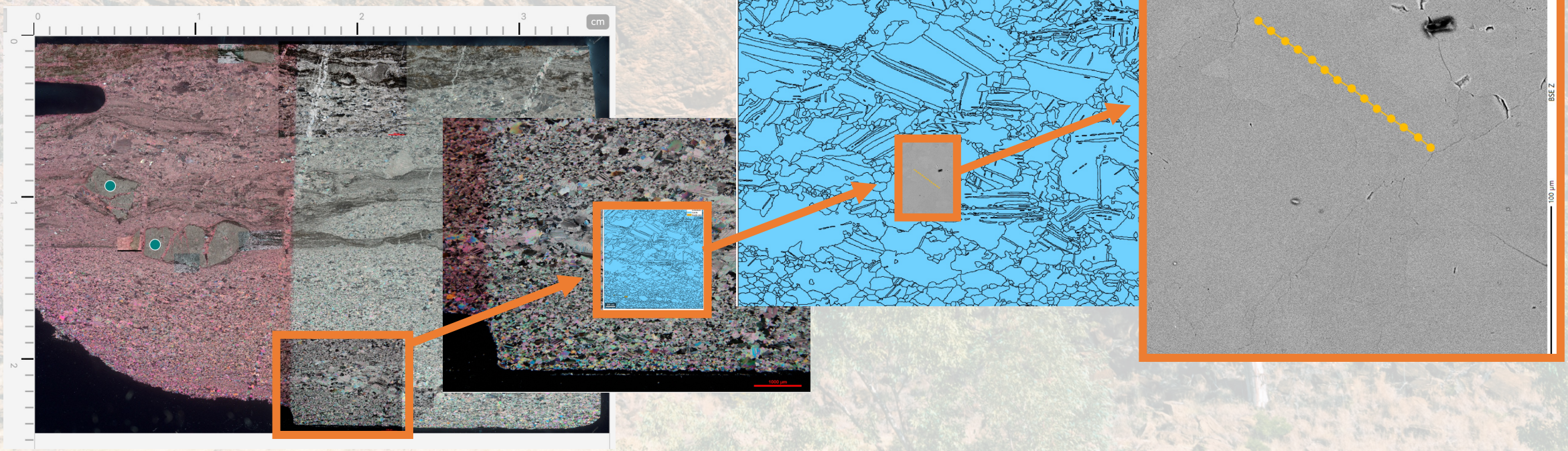


Collect sample &
make thin-section

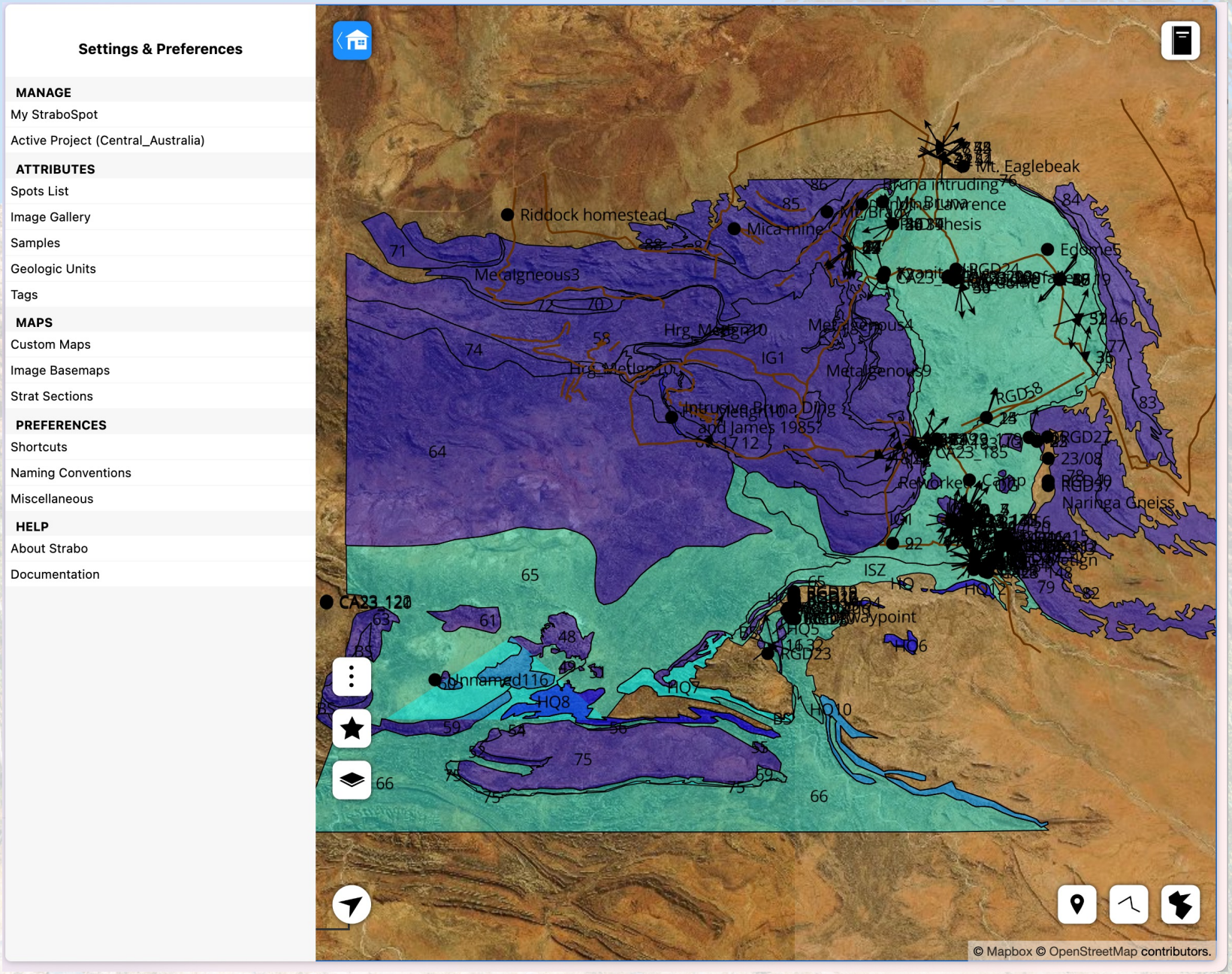
StraboMicro

- Links with the field app

- Connect images and data from multiple instruments while maintaining contextual information



Web Viewer to Interrogate Dataset



Export Data to Various Formats

To work with your existing workflows

Central_Australia

Last Uploaded: April 24, 2024, 8:47 pm UTC +00:00 Open with Strabo1 Web | Open with Strabo2 Web | Delete | JSON | Public?

	Download	Dataset Name	Num Features		Last Modified
Delete Edit	Download: Select...	2022	53	Move to...	March 19, 2024, 5:17 pm UTC +00:00
Delete Edit	Download: Select...	CentralAus_Geology.shp	87	Move to...	March 15, 2024, 9:03 pm UTC +00:00
Delete Edit	Download	2023	94	Move to...	March 15, 2024, 9:03 pm UTC +00:00
Delete Edit	Download	Tracks.shp	58	Move to...	April 24, 2024, 8:47 pm UTC +00:00

- ✓ Select...
- Shapefile
- KMZ
- XLS
- Stereonet Mobile
- Field Book
- Strat Section(s)
- Download Photos
- Landing Page
- Sample List

Cronese

Last Uploaded: April ...TC +00:00 Open with Strabo1 Web | Open with Strabo2 Web | Delete | JSON | Public?

		Dataset Name	Num Features		Last Modified
Delete Edit	Download: Select...	2024 April	96	Move to...	April 23, 2024, 5:16 pm UTC +00:00

Name	Date	Self	Notes	Real World	Pixel Coorc	Latitude	Longitude	Altitude(m	Planar Orie	Planar Orie	Planar Orie	Planar Orie	Planar Orie	Linear Orie	Linear Orie	Linear Orie	Linear Orie
CA23_144	2023-10-0	https://strabospot.org/		POINT (135.20218885		-23.3937	135.2022	498.5228	foliation	269	35	3	1.7E+12				
CA23_145	2023-10-0	https://strabospot.org/		POINT (135.20218844		-23.3937	135.2022	499.013						stretching	33	22	1.7E+12
CA23_146	2023-10-0	https://strabospot.org/		POINT (135.20220162		-23.3936	135.2022	499.2719	foliation	264	43	3	1.7E+12				
CA23_147	2023-10-0	https://strabospot.org/		POINT (135.20218921		-23.3936	135.2022	499.0578						stretching	21	24	1.7E+12
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CA23_151	2023-10-0	https://strabospot.org/		POINT (135.20260168		-23.3944	135.2026	497.5531	foliation	295	44	3	1.7E+12				
CA23_153	2023-10-0	https://stra	Quatrzofelc	POINT (135.19944879		-23.388	135.1994	490.7584	foliation	286	41	3	1.7E+12	stretching	25	31	1.7E+12
CA23_154	2023-10-0	https://strabospot.org/		POINT (135.20065679		-23.3846	135.2007	520.3213	foliation	14	57	3	1.7E+12	stretching	60	23	1.7E+12
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CA23_154	2023-10-0	https://strabospot.org/		POINT (135.20065679		-23.3846	135.2007	520.3213	foliation	266	58	3	1.7E+12				
CA23_155	2023-10-0	https://strabospot.org/		POINT (135.19061672		-23.351	135.1906	515.2623		163	42		1.7E+12		224	9	1.7E+12
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CA23_171	2023-10-0	https://strabospot.org/		POINT (135.19332830		-23.3659	135.1933	502.5803	foliation	304	12	3	1.7E+12	stretching	28	1	1.7E+12
CA23_173	2023-10-0	https://strabospot.org/		POINT (135.19350164		-23.3678	135.1935	501.6202	foliation	252	13	3	1.7E+12	stretching	22	23	1.7E+12
CA23_174	2023-10-0	https://strabospot.org/		POINT (135.19374781		-23.3681	135.1937	501.372	foliation	253	16	3	1.7E+12	stretching	25	9	1.7E+12
CA23_174	2023-10-0	https://strabospot.org/		POINT (135.19374781		-23.3681	135.1937	501.372	foliation	259	15	3	1.7E+12				
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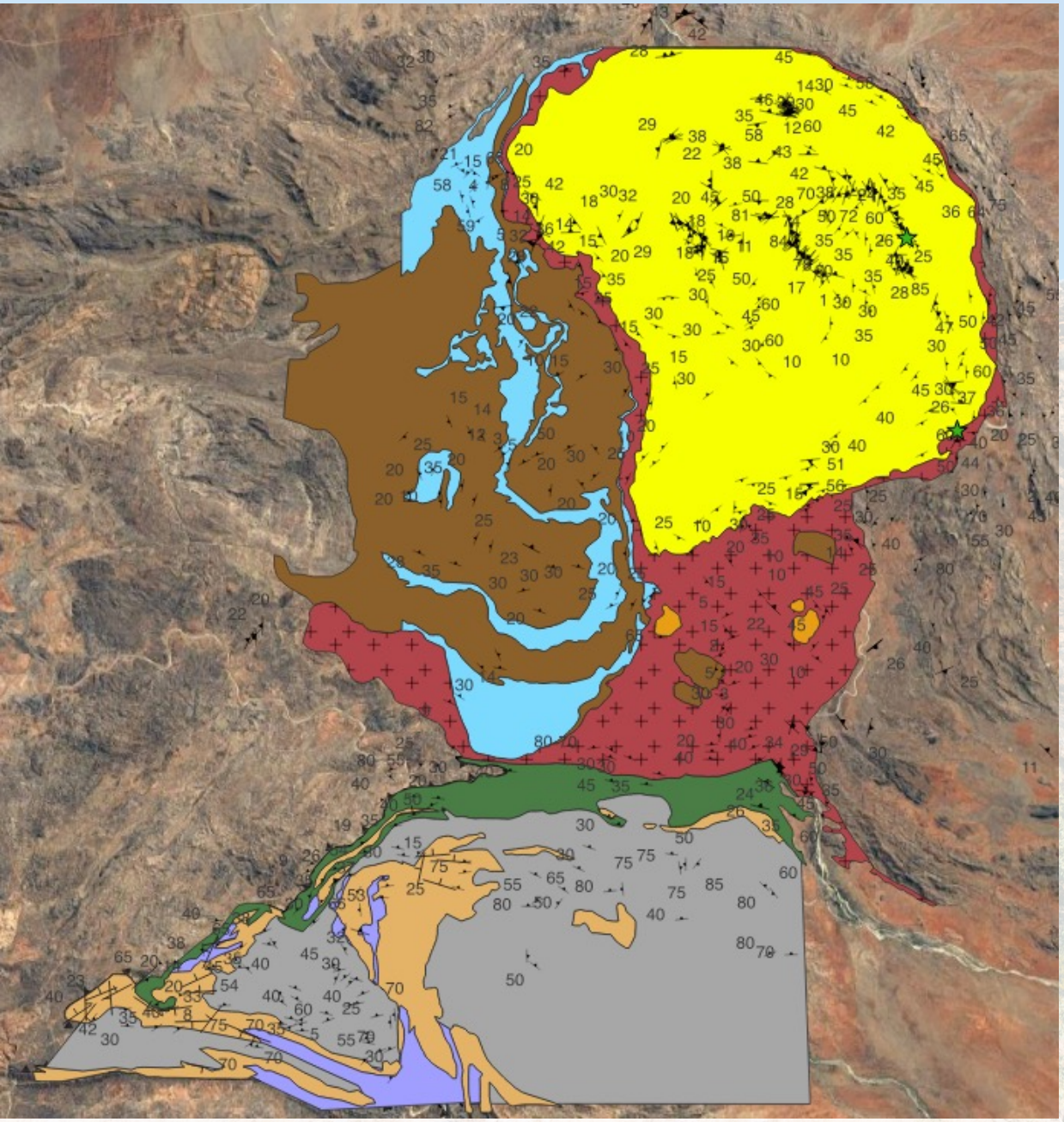
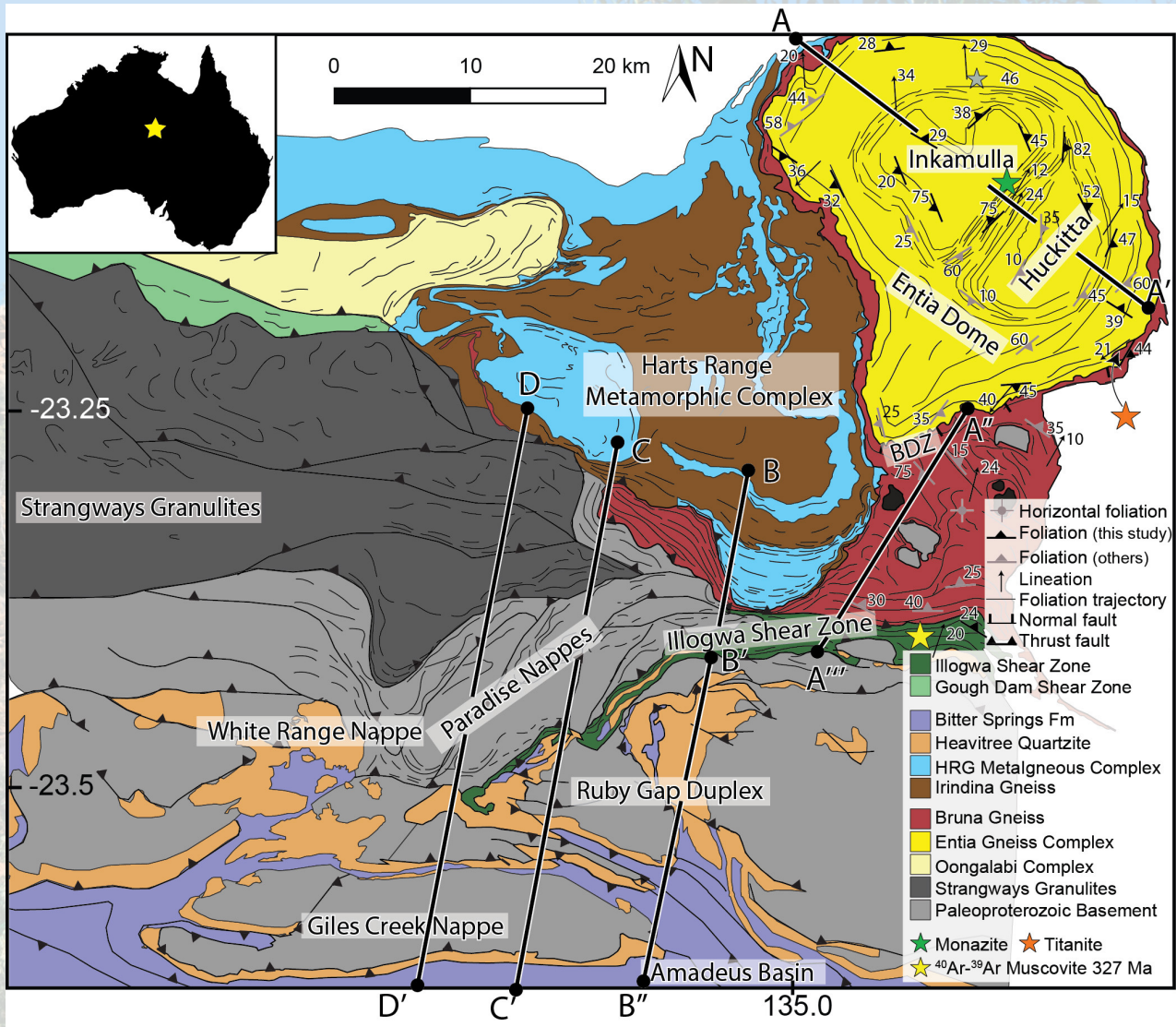
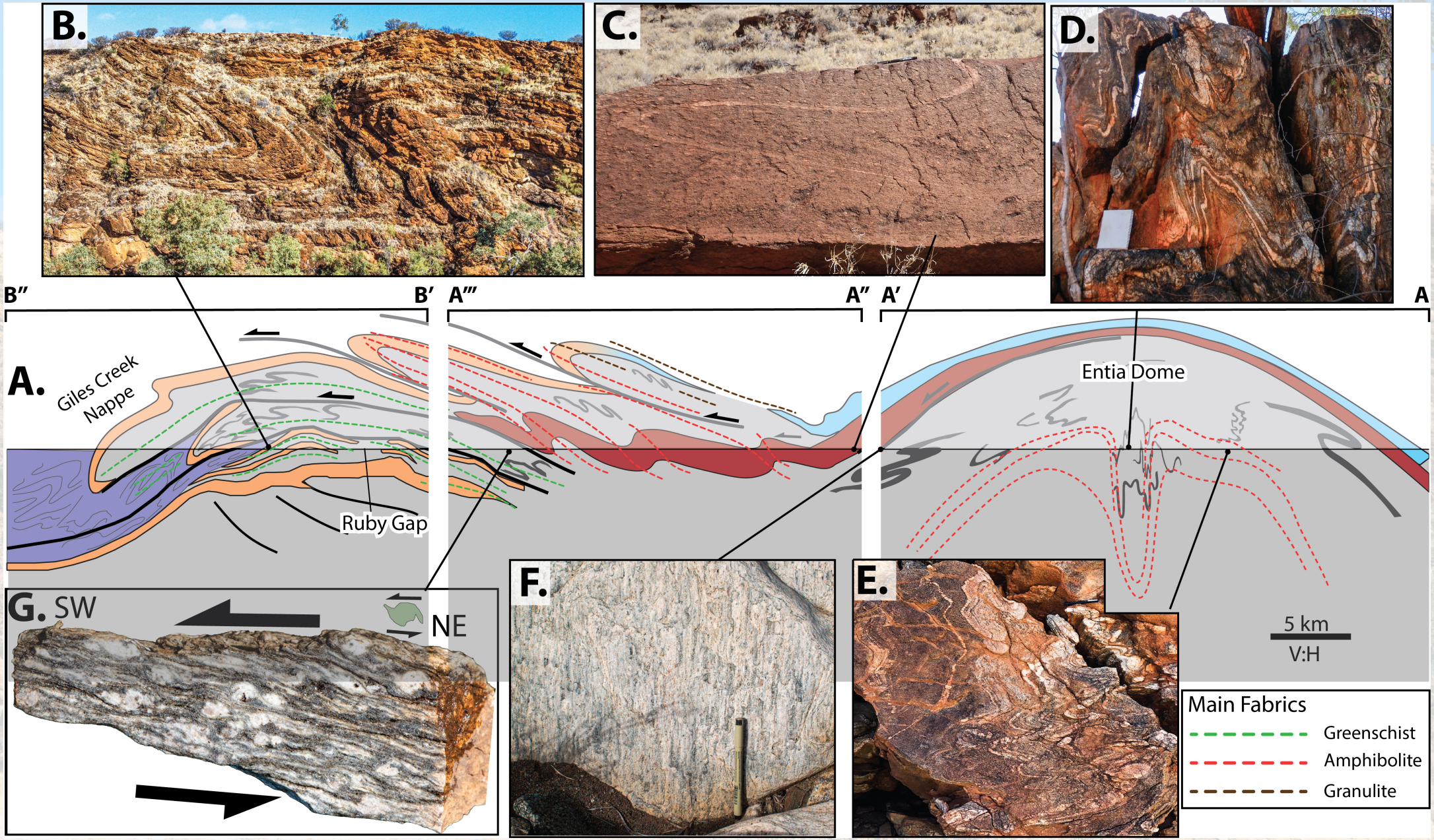
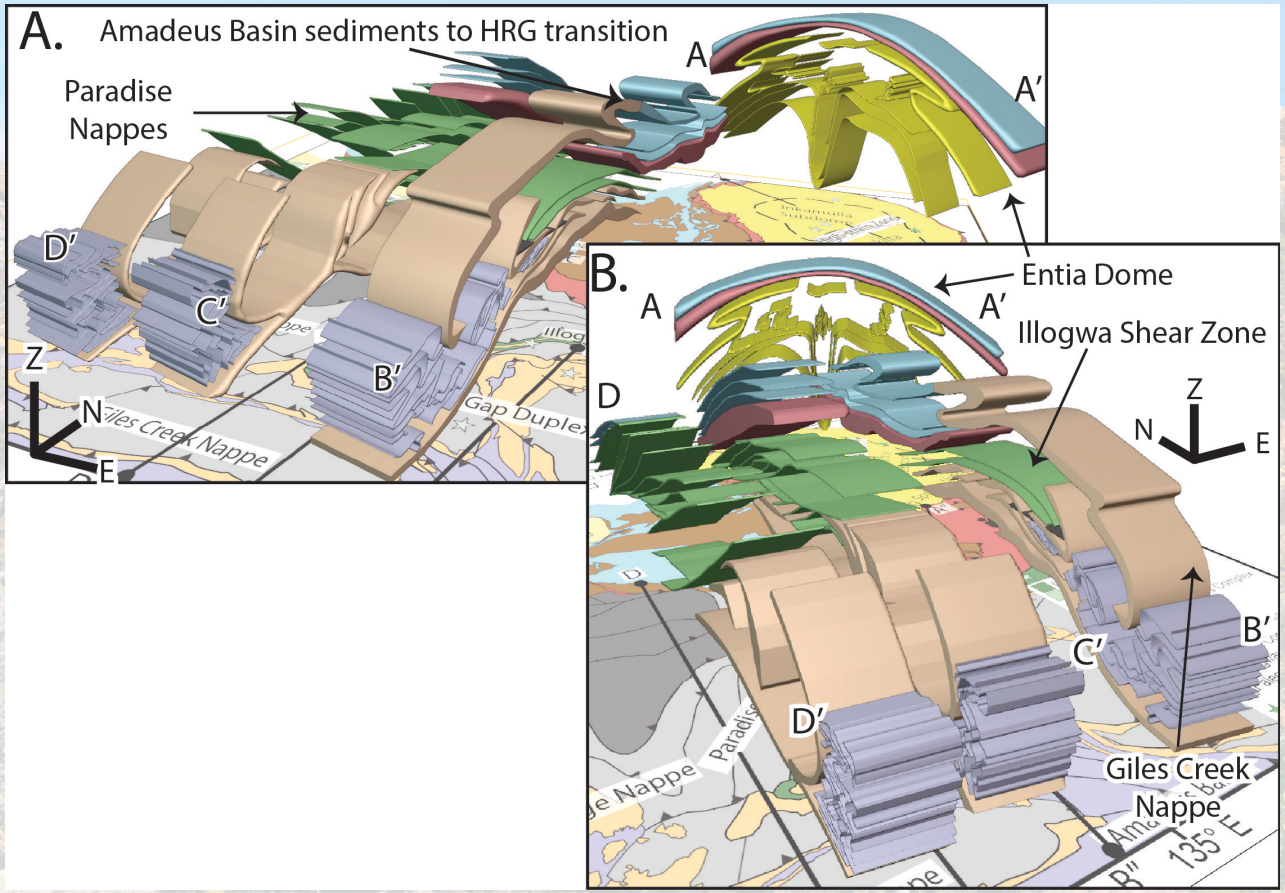
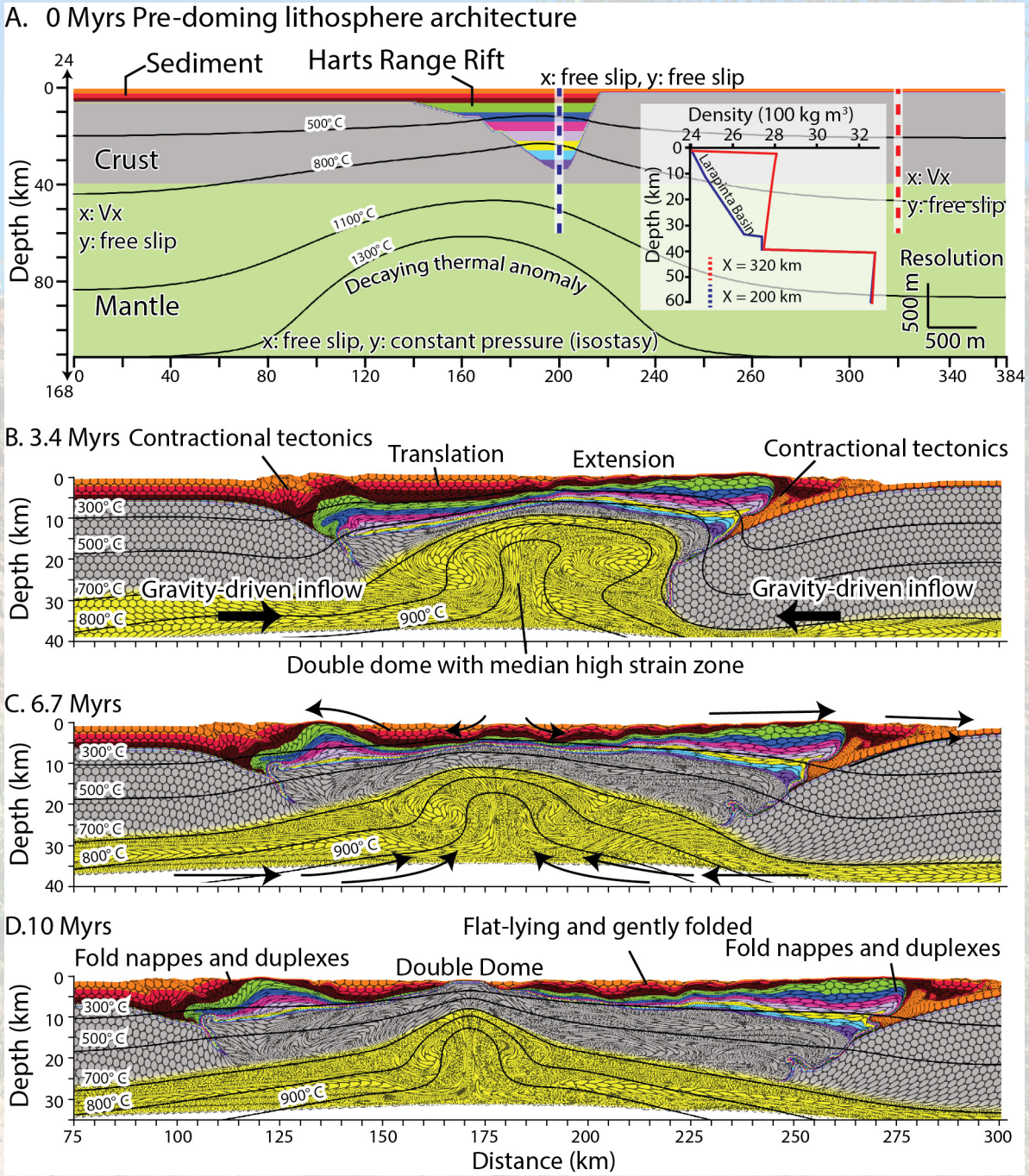




Import structural data into QGIS


B.
C.
D.
B″
B′
A‴
A″
A′
A
A.
Giles Creek
Nappe
Ruby Gap
Entia Dome
5 km
V:H
G. SW
NE
F.
E.
Main Fabrics
Greenschist
Amphibolite
Granulite


A.
Amadeus Basin sediments to HRG transition
Paradise Nappes
A
A′
D′
C′
B′
Z
N
E
Giles Creek Nappe
Gap Duplex
B.
Entia Dome
Illogwa Shear Zone
D
Giles Creek Nappe
135° E

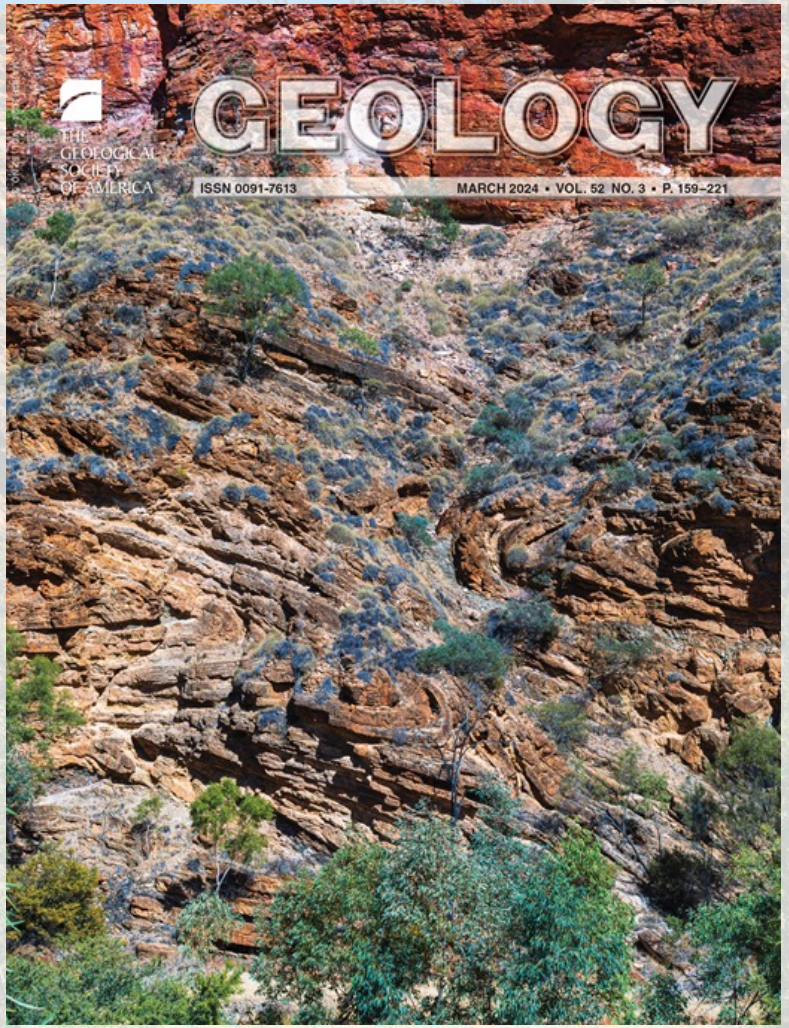

A. 0 Myrs Pre-doming lithosphere architecture
Sediment
Harts Range Rift
x: free slip, y: free slip
Density (100 kg m³)
Crust
Mantle
x: Vx
y: free slip
500° C
800° C
1100° C
1300° C
Decaying thermal anomaly
x: free slip, y: constant pressure (isostasy)
Larapinta Basin
X = 320 km
X = 200 km
Resolution
500 m
Depth (km)
B. 3.4 Myrs Contractional tectonics
Translation
Extension
Contractional tectonics
300° C
500° C
700° C
800° C
900° C
Gravity-driven inflow
Gravity-driven inflow
Double dome with median high strain zone
C. 6.7 Myrs
D.10 Myrs
Flat-lying and gently folded
Fold nappes and duplexes
Fold nappes and duplexes
Double Dome
Distance (km)

The Paper

From dome to duplex: Convergent gravitational collapse explains coeval intracratonic doming and nappe tectonics, central Australia

Youseph Ibrahim[1,*], Patrice F. Rey[1], Donna L. Whitney[2], Christian Teyssier[2], Françoise Roger[3], Valérie Bosse[4], and Bénédicte Cenki[3]

[1]School of Geosciences, University of Sydney, Sydney, NSW 2006, Australia
[2]Department of Earth and Environmental Sciences, University of Minnesota, Minneapolis, Minnesota 55455, USA
[3]Géosciences Montpellier, Université de Montpellier, CNRS, 34095 Montpellier cedex, France
[4]Laboratoire Magmas et Volcans, Campus Universitaire des Cézeaux, 63178 Aubière cedex, France



Cover photo lives inside our StraboSpot dataset. It is geotagged and associated with measurements, field notes etc..

The Supplementary Section

- We uploaded our data as a pdf
- **Soon Strabo will be able to generate a doi for projects**

Table S 5. Foliation measurements and GPS coordinates in decimal degree format.

Lon	Lat	Strike	Dip	Lon	Lat	Strike	Dip
134.96076	-23.4501	230	60	135.07647	-23.26981	298	23
134.97598	-23.477184	288	32	135.26901	-23.07987	340	31
135.177601	-23.103101	10	14	135.26469	-23.07717	18	72
135.177601	-23.103101	314	18	135.26077	-23.07998	14	65
135.28348	-23.07169	330	54	135.26111	-23.07813	278	56
135.24269	-23.37912	285	19	135.25627	-23.07993	33	82
135.22328	-23.38878	0	54	135.25209	-23.08026	38	72
135.22151	-23.38827	324	36	135.24629	-23.08348	44	65
135.22144	-23.3883	327	19	135.23523	-23.08847	242	86
135.22144	-23.3883	315	25	135.32256	-23.18232	315	32
135.31885	-23.33761	67	25	135.32359	-23.18212	82	39
135.27806	-23.32424	54	35	135.32211	-23.1817	334	26
135.27806	-23.32424	50	26	135.29857	-23.11884	344	20
135.27806	-23.32424	50	42	135.2896	-23.11206	29	60
135.25909	-23.36409	325	50	135.29004	-23.11304	90	25
135.25909	-23.36409	324	30	135.29091	-23.11569	355	46
135.247475	-23.37615	1	52	135.29178	-23.11838	14	47
135.246541	-23.376013	350	50	135.29405	-23.11923	280	33
135.37909	-23.37909	316	11	135.29489	-23.11913	35	85
135.23834	-23.36762	323	34	135.2962	-23.11691	328	24
135.229736	-23.366566	14	29	135.29356	-23.11953	335	34

Sample Location	
CA1938 (Monazite)	135.22325, -23.10451
CA1918 (Titanite)	135.32518, -23.20719

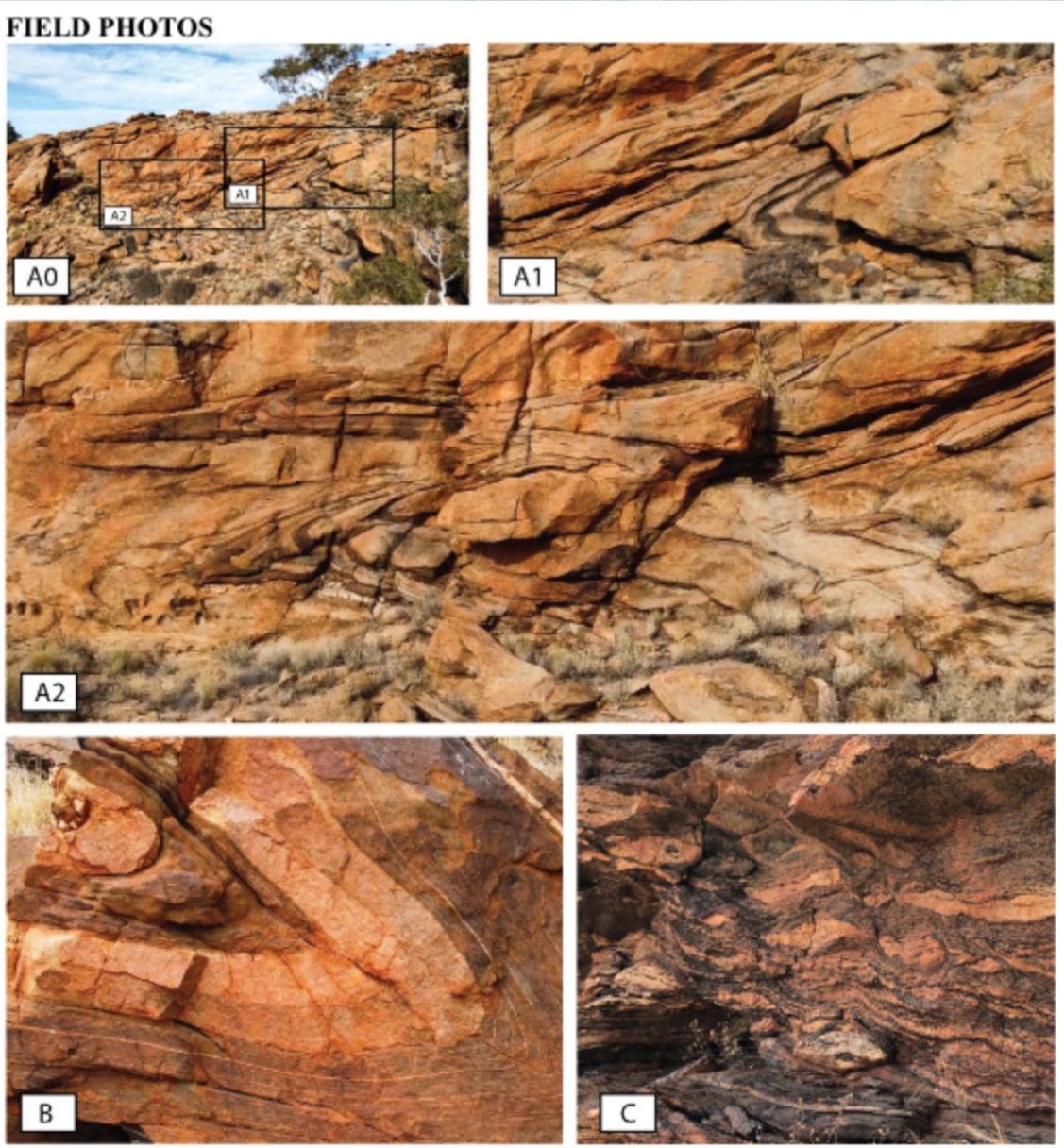


Figure S 1. (A0-2) Isoclinally folded migmatites folding a (B) pre-existing fabric and (C) asymmetric boudinage in migmatites a few meters on top of the Huckitta granodiorite.

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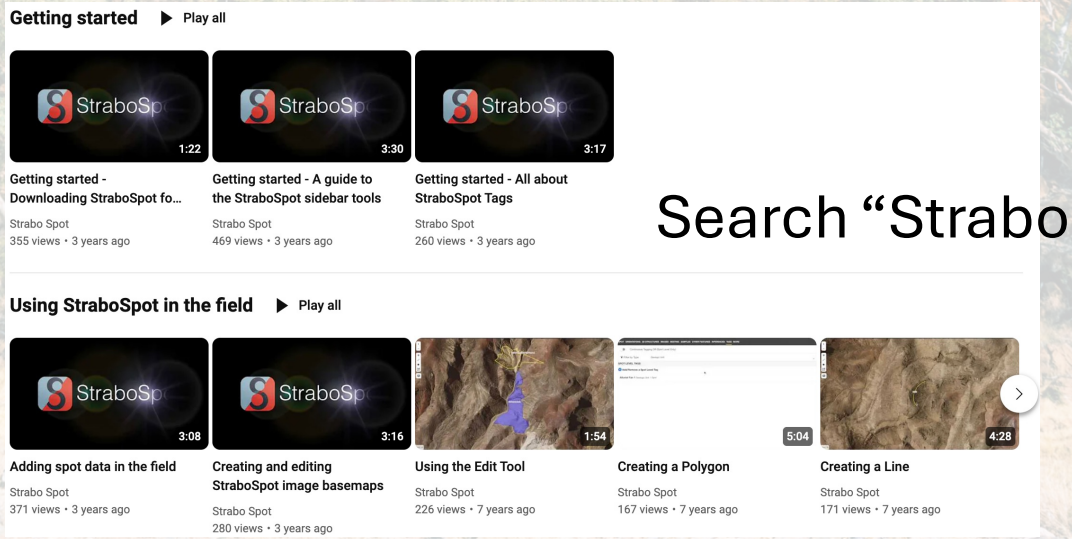

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