Landscape Evolution in the Albany-Fraser Orogen and south Yilgarn Craton, Western Australia

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11. April 2018; Wallaroo

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Acknowledgment

- Ignacio González-Álvarez (CSIRO)
- Jens Klump (CSIRO)
- Tania Ibrahimi (CSIRO)
- Greg Smith (CSIRO) and
- Carmen Krapf (GSSA)

Content

- Introduction
- Geological setting
- Landscape evolution in the South of Western Australia
- Methodology
- Results
- Discussion & Conclusion

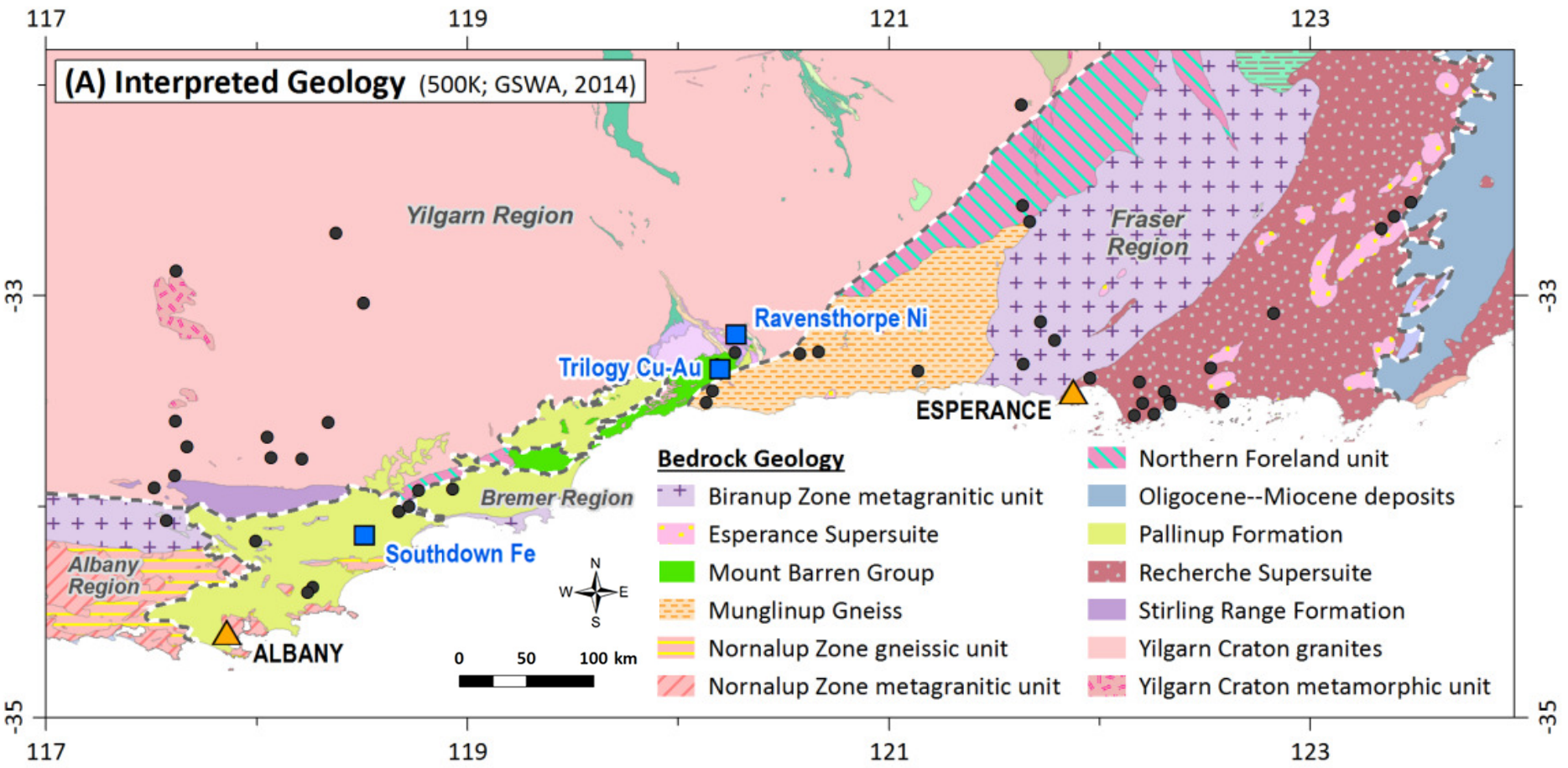
Project objective

- Mapping boundaries and classifying landscapes:
  - Surface geometry
  - DEM and DEM products
  - Machine learning
  - Field observations

- Understanding of:
  - Processes affecting the landscape evolution

    -> Potential surface geometry

Geological setting



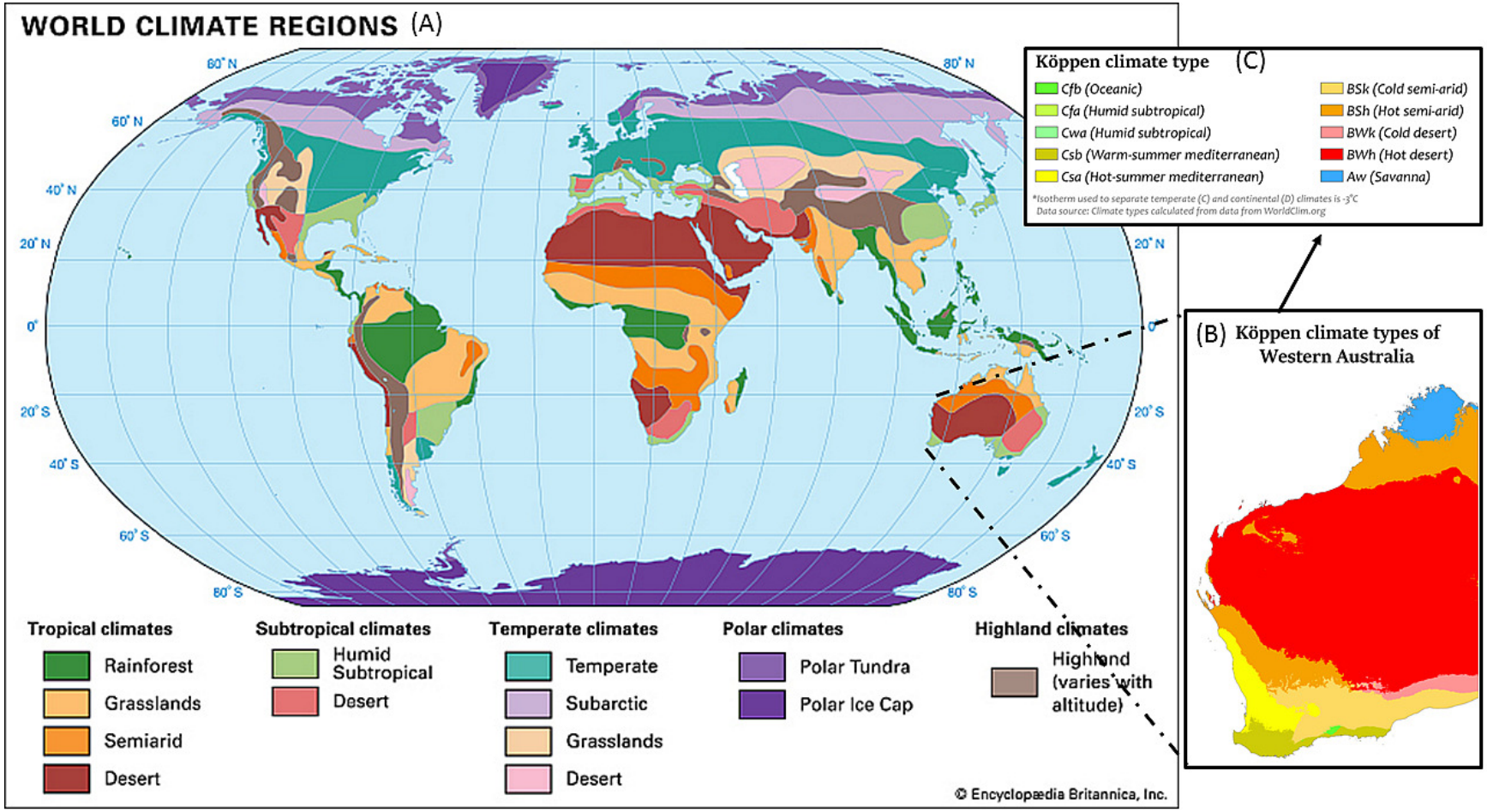
Landscape

- Definition:
  - Visible features of a land
  - Natural and man-made features

    -> Interacting of geology, vegetation and climate
- Geomorphology:
  - Landform history and dynamics → Why landscapes look the way they do

→Landscape evolution stores the past climate and dynamics of sedimentary systems

Landscape evolution in the S of WA



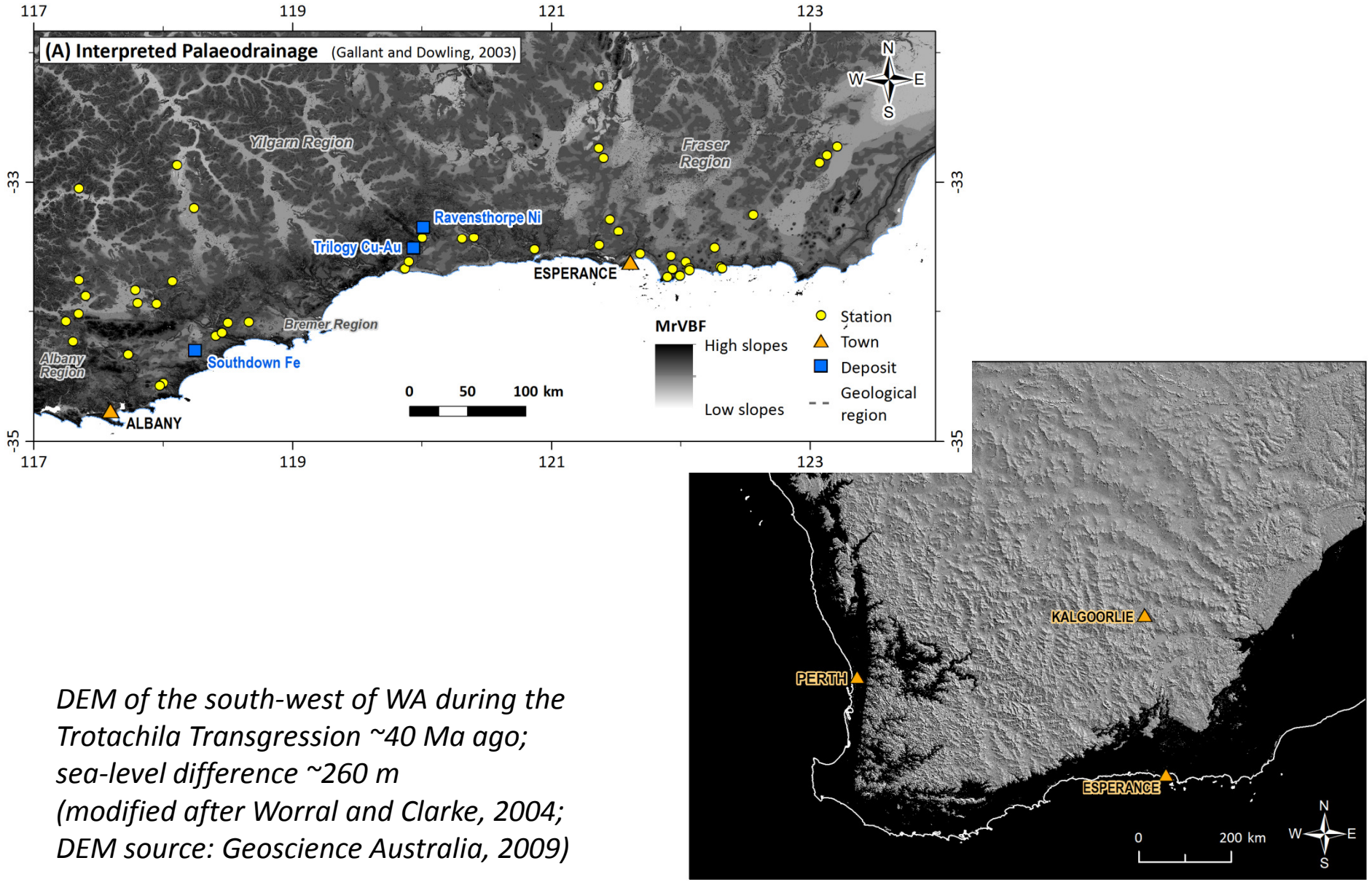
(A) World climate regions (Encyclopædia Britannica, Inc., 2017); (B) climate types of Western Australia after Köppen (Peel et al., 2007); and (C) legend to (B) after Köppen (Peel et al., 2007).

Landscape features

Albany-Fraser Orogen

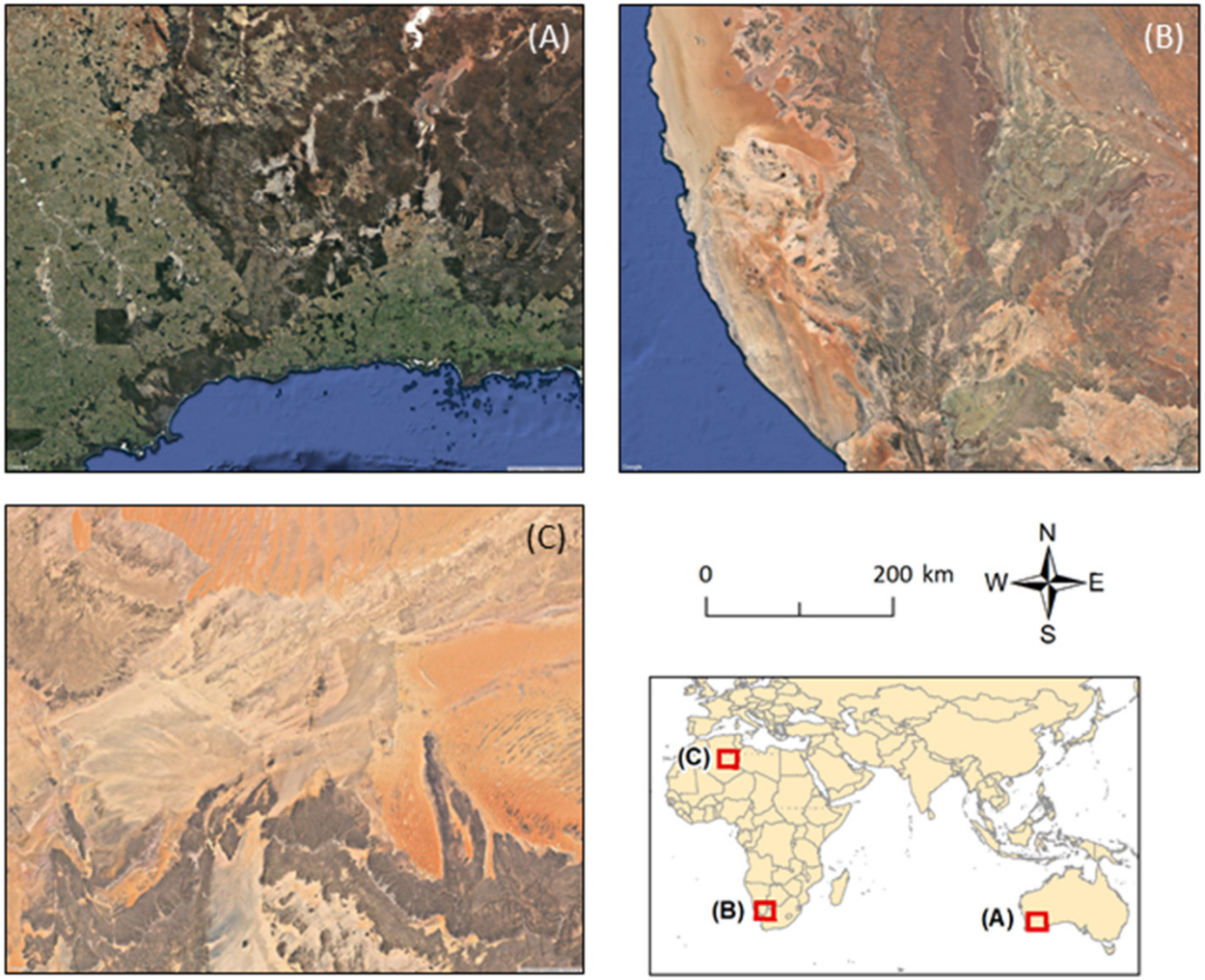
Time	Climatic-tectonic	Sedimentary processes
Perm (298.9–251.9 Ma)	Glaciation	Removing and modifying of pre-existing landscape
Triassic – Jurassic (251.9–145.0 Ma)	Onset of seafloor spreading	Establishment of physiography and palaeodrainage setting
Cretaceous (145.0–66.0 Ma)	Drifting and rifting	Precursor valleys
Palaeocene – Early Eocene (66.0–47.8 Ma)	Uplift	Incision of inset-valleys
Late Eocene (47.8–33.9 Ma)	Relaxation	Deposition and weathering

Sedimentary dynamics and changes in the S of WA from Pert to Late Eocene (mod. after Magee, 2009)



DEM of the south-west of WA during the Trotachila Transgression ~40 Ma ago; sea-level difference ~260 m (modified after Worral and Clarke, 2004; DEM source: Geoscience Australia, 2009)

Inconsistency with climate region



(A) the south of WA (759507, 6500619; 50J);

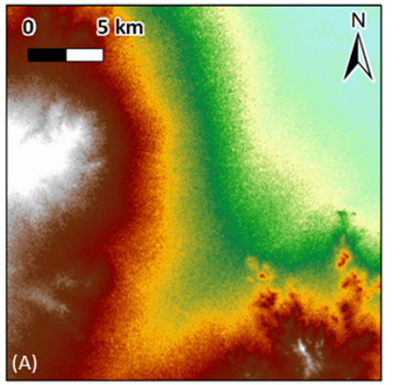
(B) South Africa (353675, 6884350; 34J);

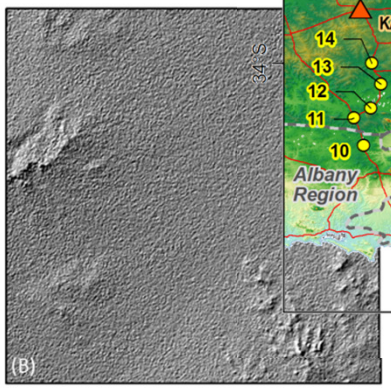
(C) North Africa (773218, 3110705; 31R).

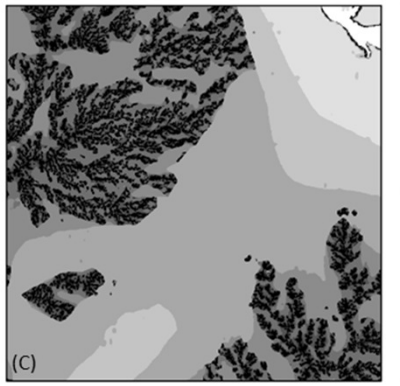
Satellite images from Google©2018.

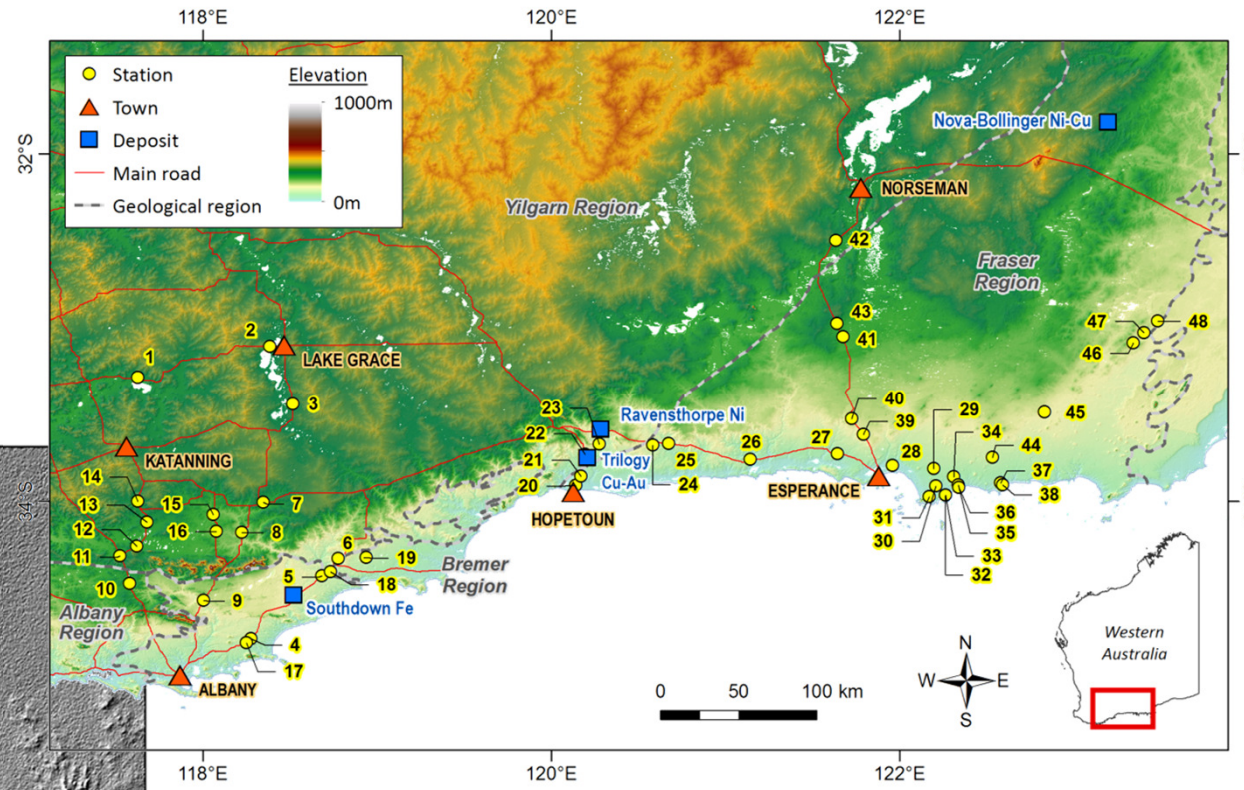
Methodology

- Field observations
- Remote sensing







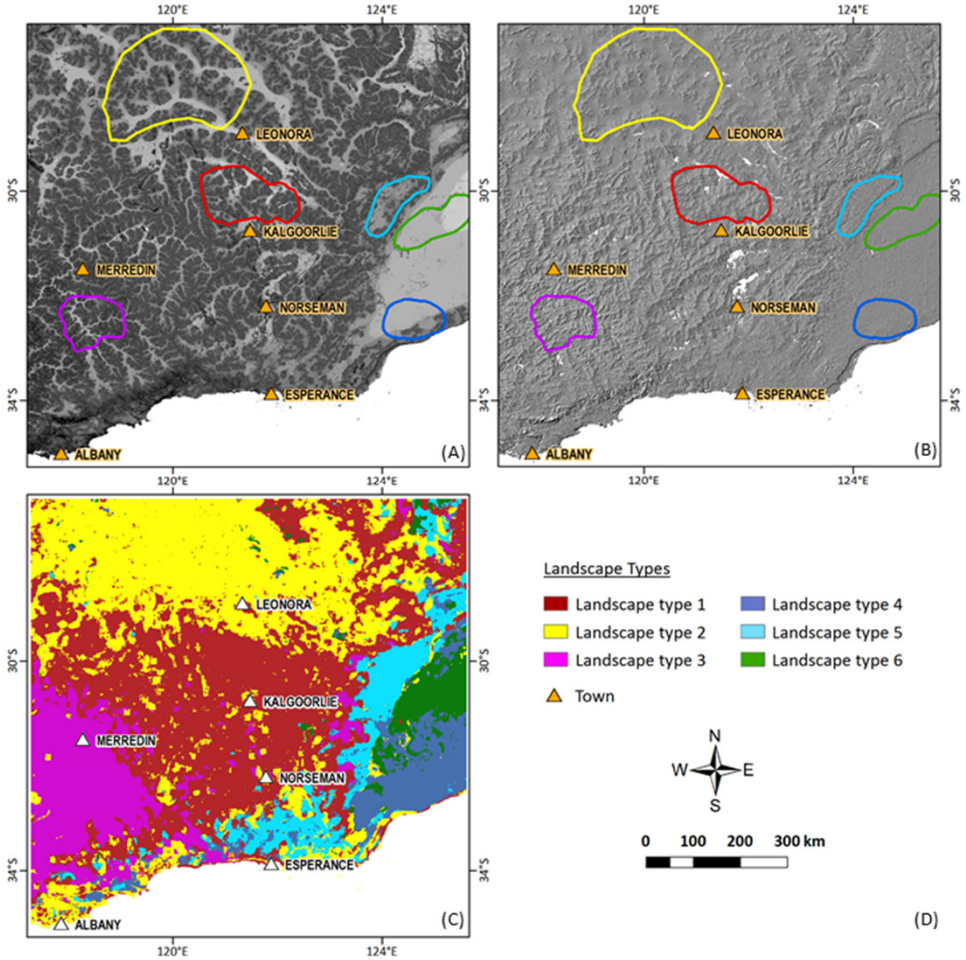


DEM source: Geoscience Australia, 2009

Landscape type 1 (Location: 374487E; 6689572N 51H):
(A) DEM (Geoscience Australia 2009);
(B) DEM Hillshade (Geoscience Australia 2009);
(C) Flatness map (MrVBF; Gallant and Dowling 2003); and
(D) Satellite Image of Bing ©2018.

Landscape patterns

Landscape definition strategy



Defining areas for different landscape type domains
(A)MrVBF;
Gallant and Dowling, 2003
(B)Geoscience Australia, 2009
(C)Smith
personal communication, 2017
(D)Legend to (A), (B) and (C)

type	colour
1	Indian Red
2	Gold
3	Magenta
4	Cobalt Blue
5	Deep Sky Blue
6	Green

Results

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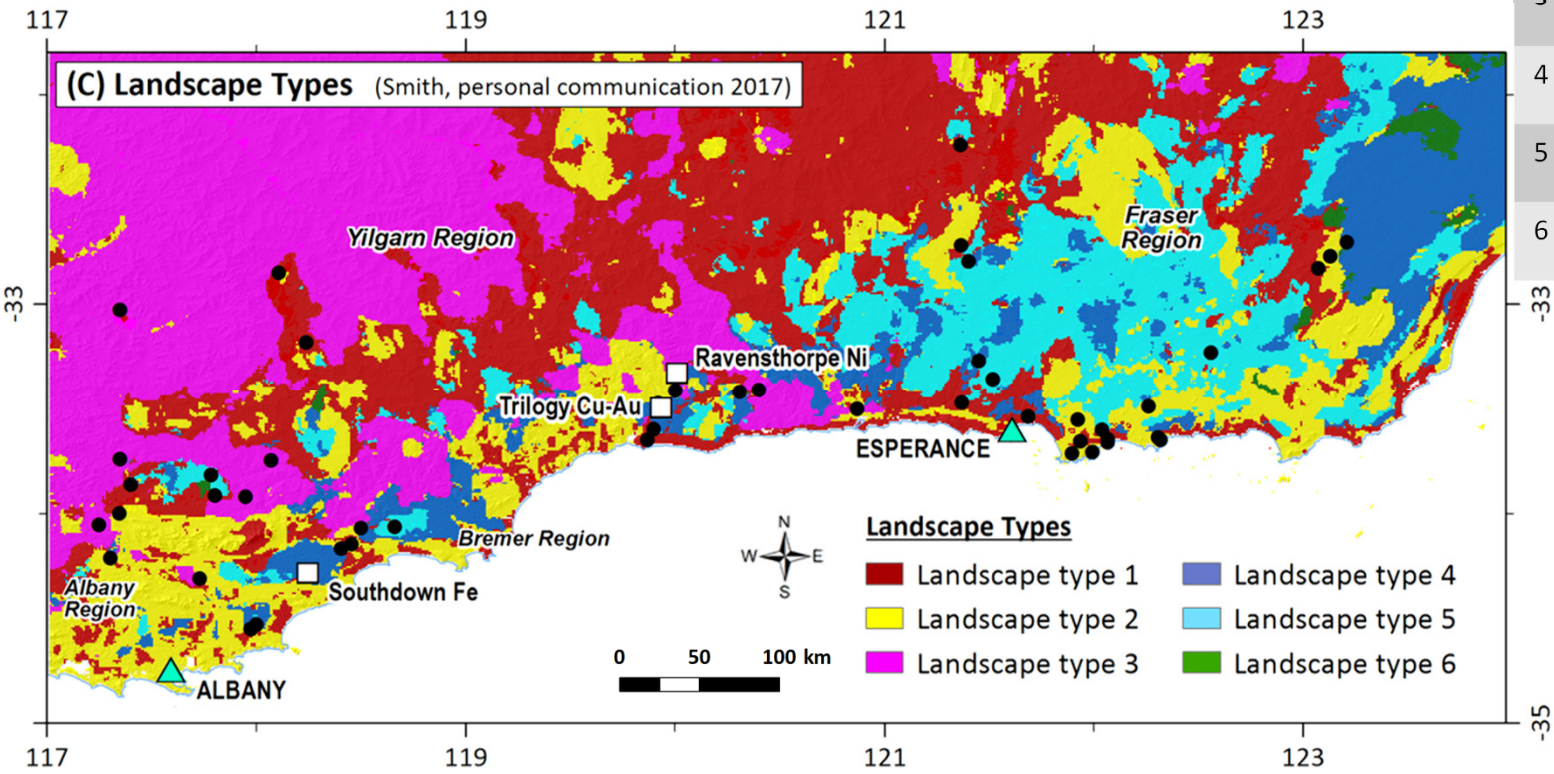

Results

Field observations

type	colour
1	Indian Red
2	Gold
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5	Deep Sky Blue
6	Green

Results

Remote sensing

	Indian Red	Gold	Magenta	Cobalt Blue	Deep Sky Blue
Palaeodrainage	*Pronounced drainage channels; Plain wide bottom areas*	*No drainage pattern; Sparely plain areas*	*Pronounced drainage channels; Plain narrow bottom areas*	*Plain Flat*	*Wide channels areas, less pronounced (in the background)*
Hill shade and Drainage	*Waterlines/ -bodies*	*Elevation Outcropping?*	*Rivers, valleys*	*No rivers and flat*	*Waterbodies*
DEM	*± 250-550 m ± 0-125 m (coast)*	*± 0-1000 m*	*± 125-375 m*	*± 125 m*	*± 125-200 m*
Geology	*YC (FR)*	*AFO*	*YC*	*(FR) Oligocene deposits*	*FR*
Regolith	*Lacustrine Coastal Sandplain*	*Exposed Colluvium Sandplain*	*Colluvium Alluvium Sandplain*	*Sandplain Colluvium*	*Sandplain*

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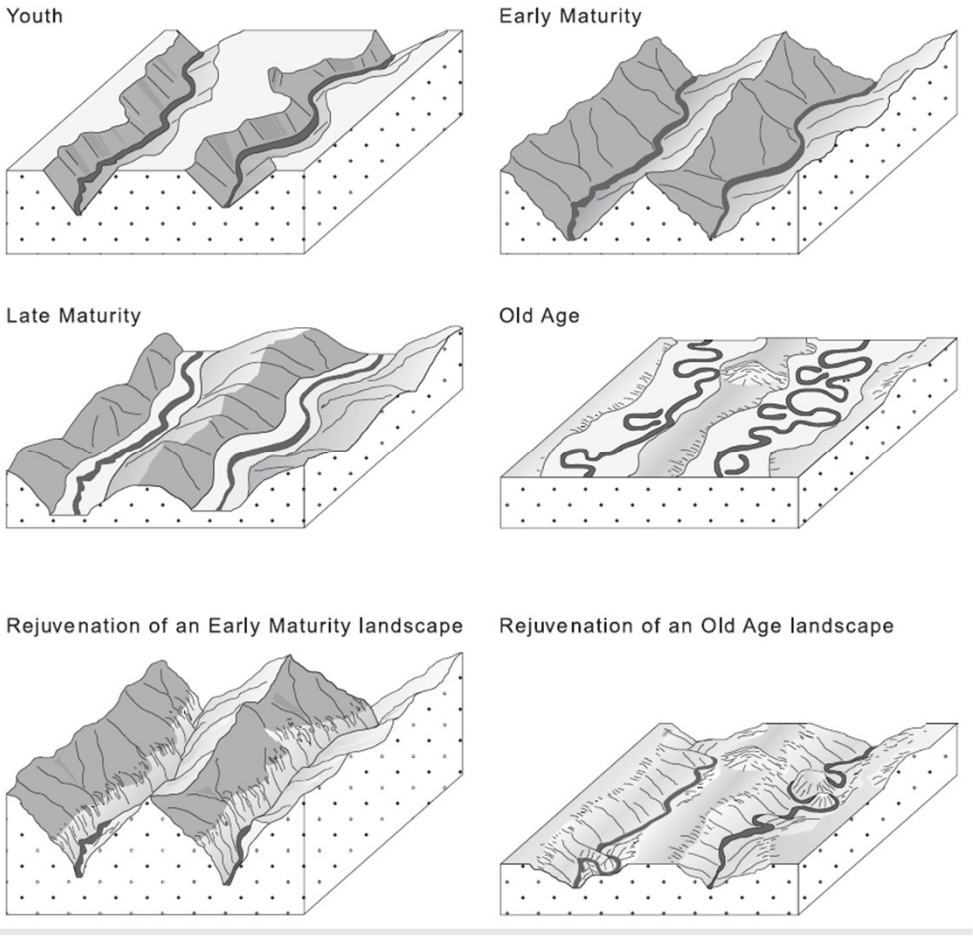
Discussion & Conclusions

- Classification based only on DEM products was not able to capture all landscape variability observed
- Mapping large scale patterns in the field was possible
- Seventh colour: miscellaneous!
- Algorithm interpretations need to be linked with field observations for accurate interpretation of geometrical surface features.

- Mapping in RDT‘s worldwide by the use of surface geometry
- Better understanding of geochemical dispersion of the basement through cover

Outlook



The Davisian cycle of erosion showing the evolution of a landscape in youthful, mature and old age
(Fryirs and Brierely, 2013)

Thank you

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