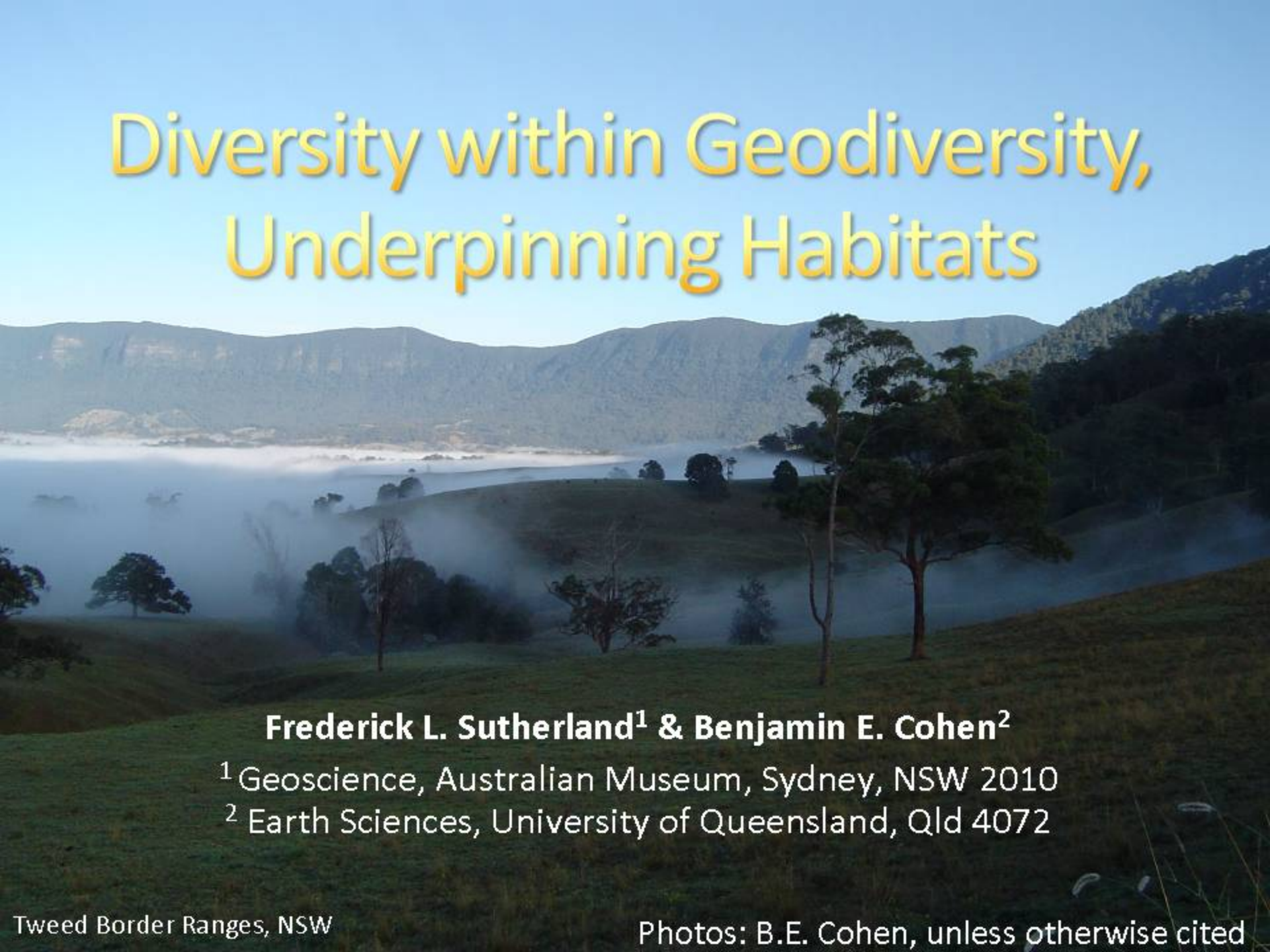
Diversity within Geodiversity, Underpinning Habitats



Frederick L. Sutherland[1] & Benjamin E. Cohen[2]

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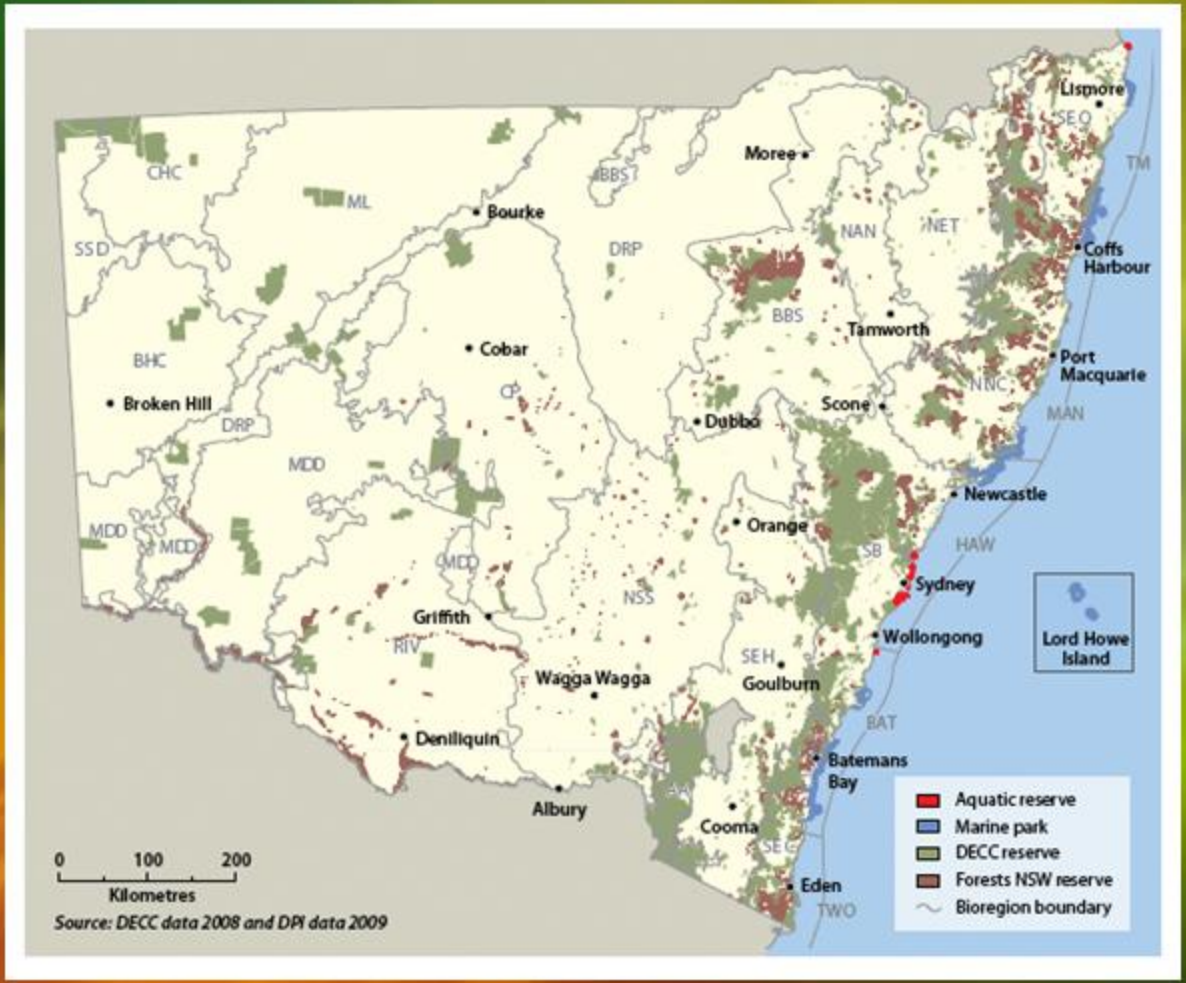
Tweed Border Ranges, NSW

Photos: B.E. Cohen, unless otherwise cited

New South Wales National Parks, state conservation and forests reserves, lie in diverse geological settings which underpin a range of biological regions



Many of these parks and reserves are established on the former Cenozoic volcanic fields, which include large eroded shields and scattered lava fields

Many of these Cenozoic basaltic volcanoes formed in a similar manner to the Hawaiian Island volcanoes

Lava fountain, Kilauea

Mauna Loa Shield

Lava flow, Kilauea

Photos: United States Geological Survey

Cenozoic volcanic areas, Australia

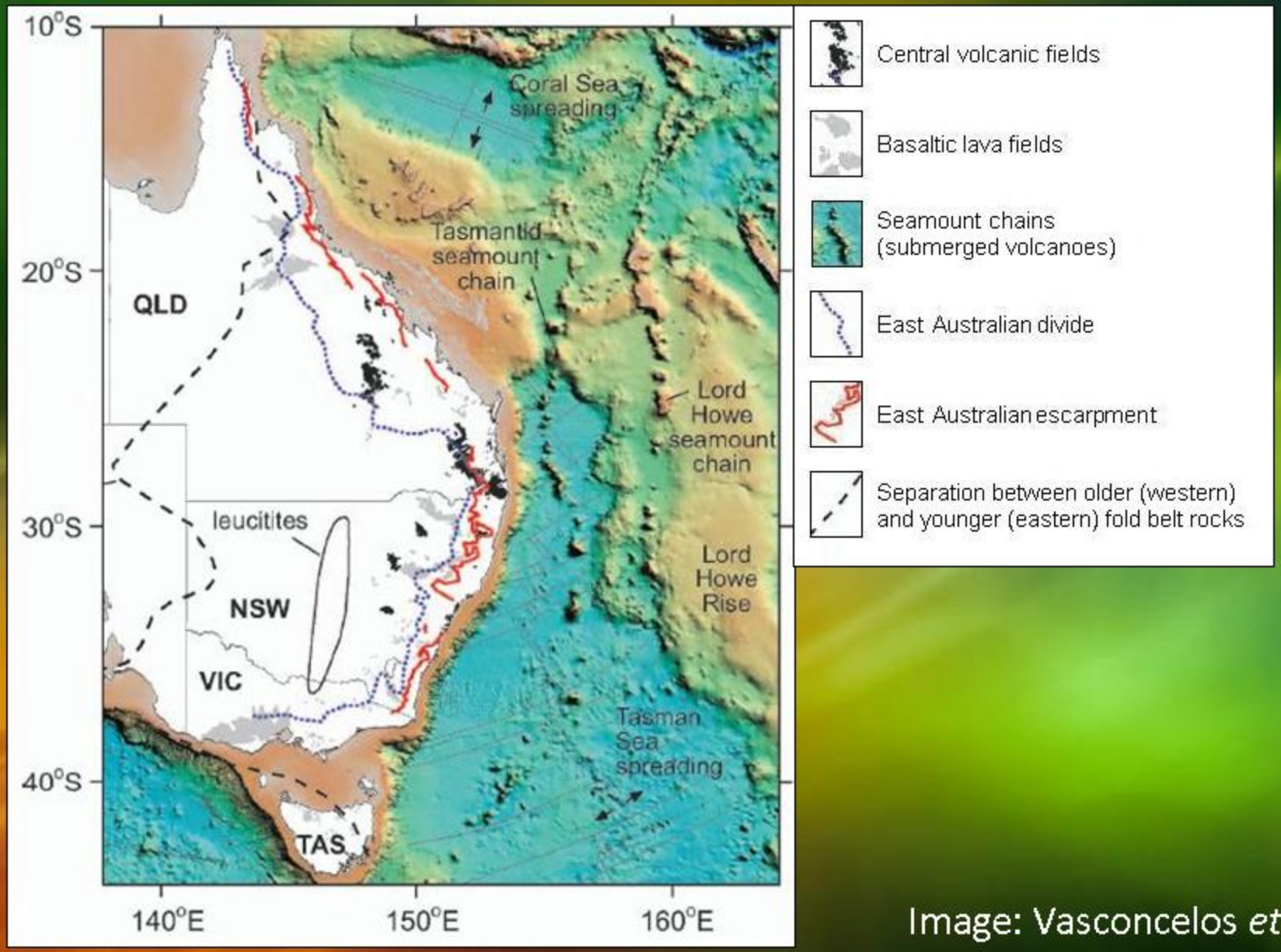
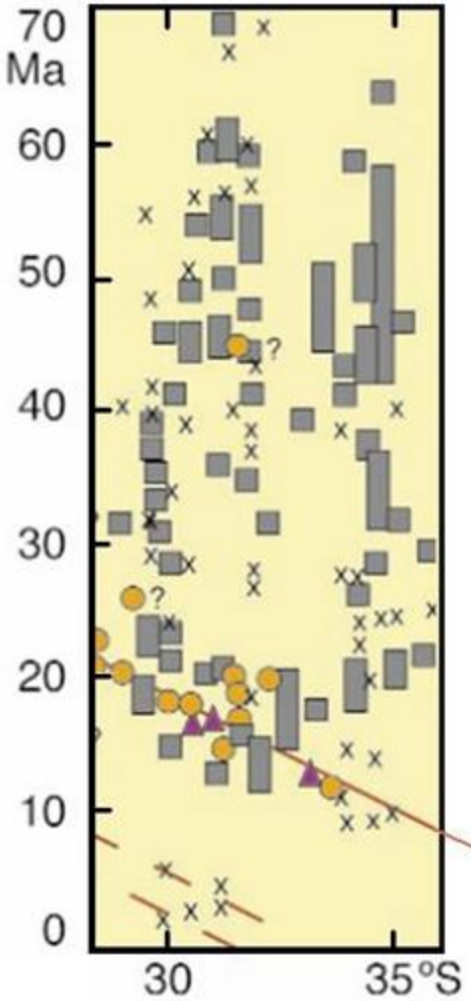
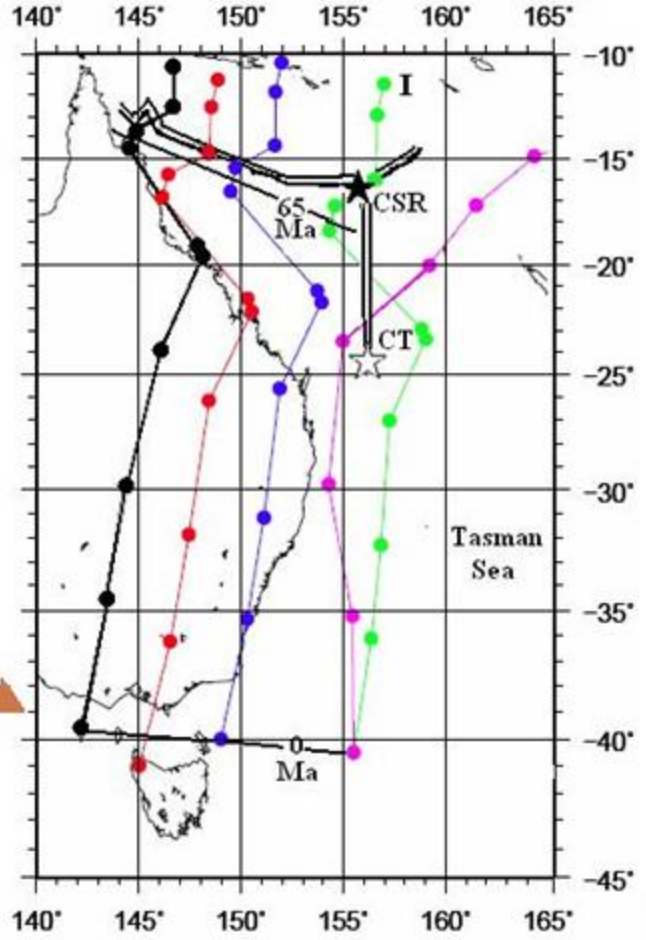


Image: Vasconcelos *et al.* 2008

New South Wales volcanism



Positions of Australian plate relative to fixed hotspots, from 90 million to O million years (10 Ma intervals top to bottom)



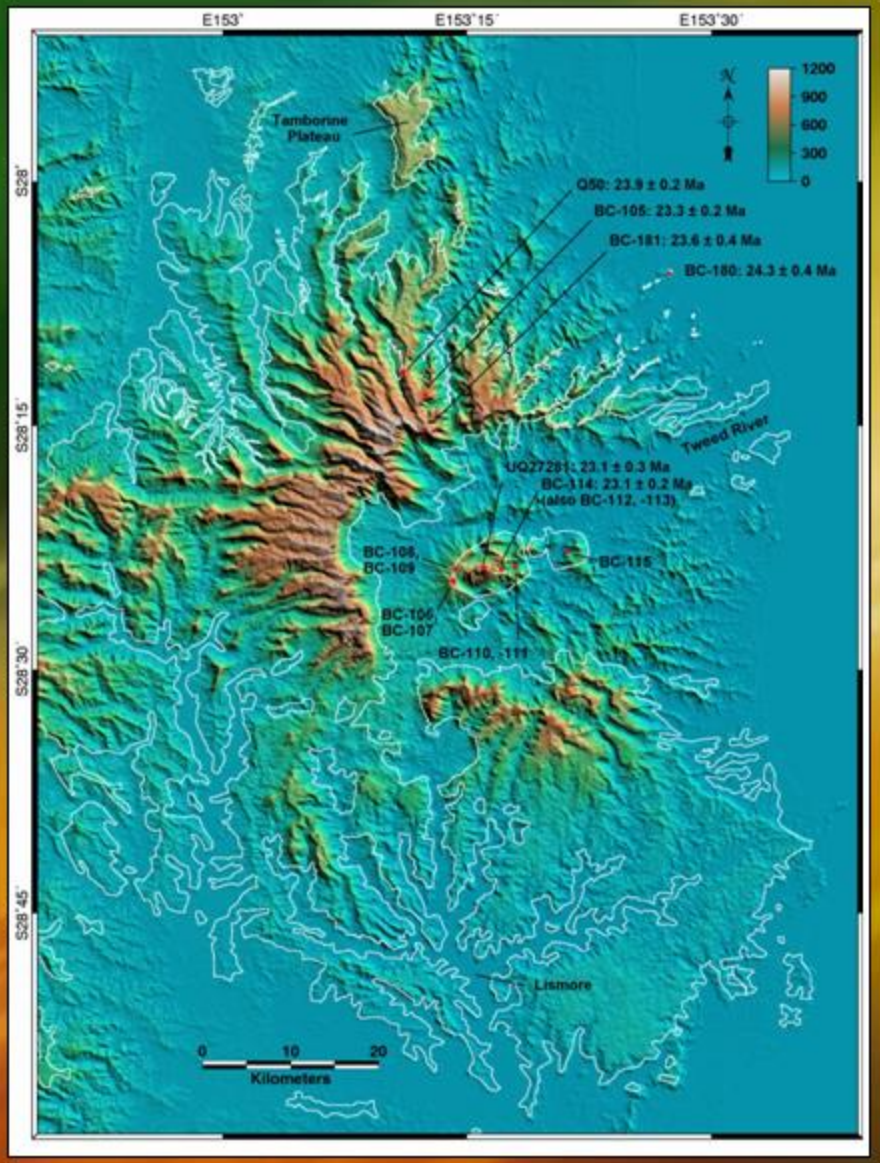
From Sutherland (2003) & Sutherland *et al*. 2010

Hydra-head eruptive concept, NSW long-lived volcanic fields

Source:

From: Sutherland *et al.* (2010)

Tweed volcano, digital space view



Note well developed erosional features in this older central volcano (23-25 million years in age)

- Lava aprons on north, west and south sides
- 'Erosional caldera' rims

  (McPherson Range)
- Basement valley floor

  (Tweed River)
- Isolated central peak

  (Mount Warning)

DEM Image: Cohen (2007)

Tweed volcano environments & habitats

Mt Warning central peak within the ‘erosional caldera’

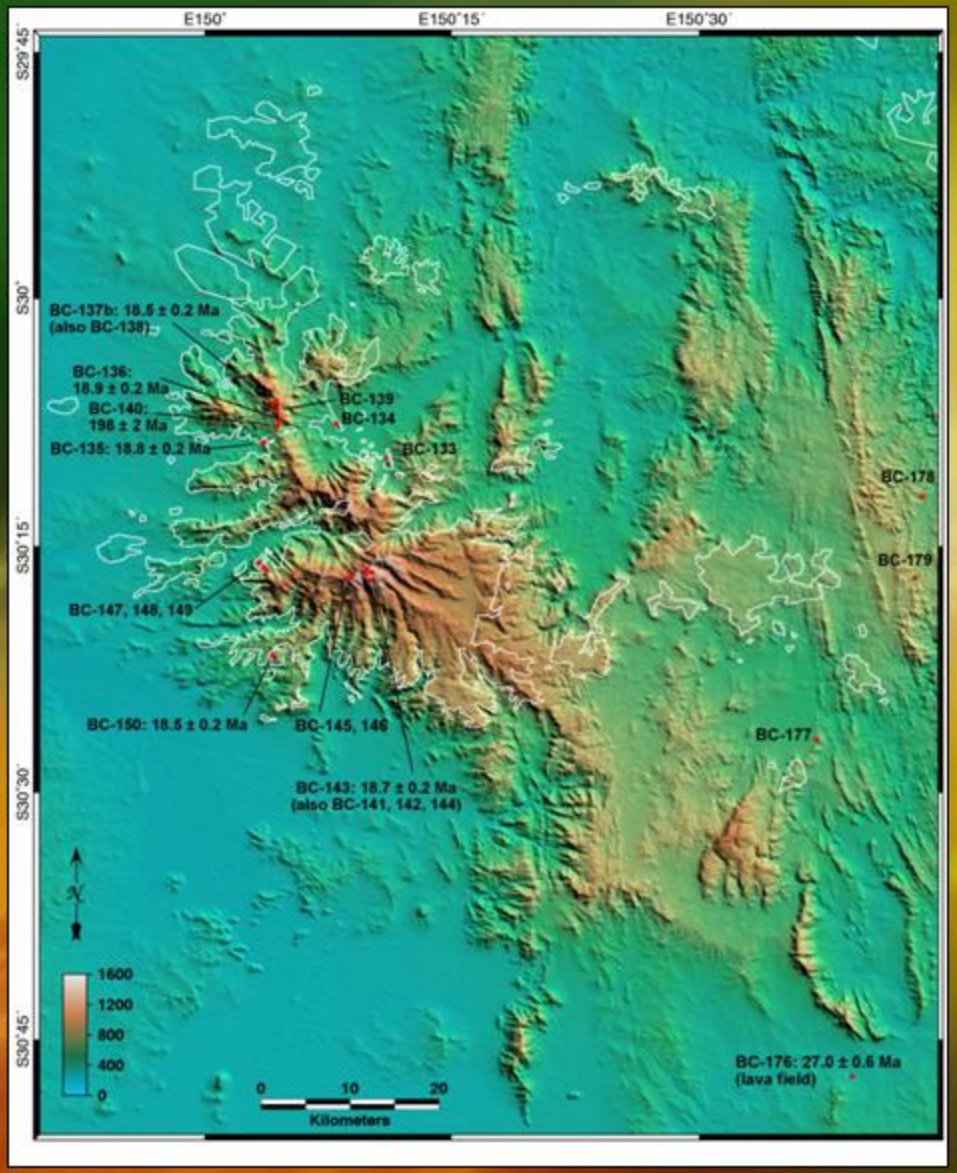
Border Ranges showing the lava rim and basement valley floor

Mt Warning rocky scenes

Snake on guard

Dyke base showing brecciated intrusion (boot for scale)

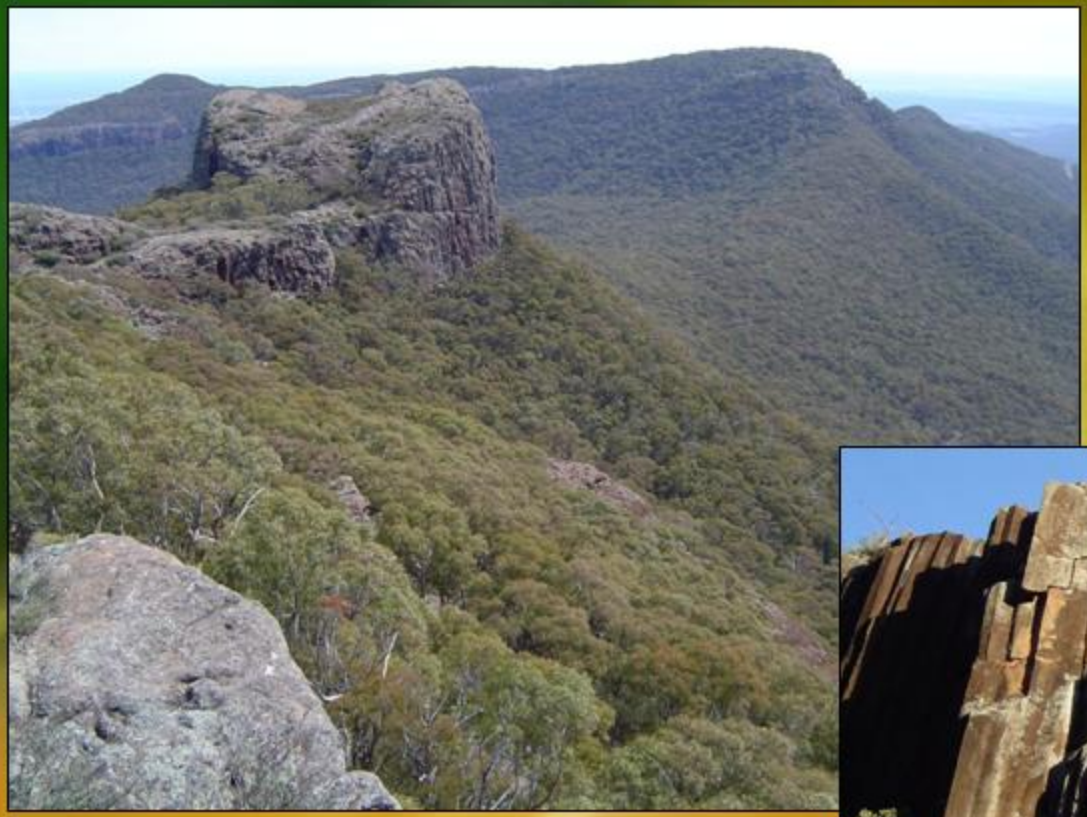
Nandewar volcano, digital space view



Note lack of 'erosional caldera' on this central volcano (18-19 million years of age). However it shows relatively dissected nature particularly on its northern end, with radial drainage evident on its southern end

DEM Image: Cohen (2007)

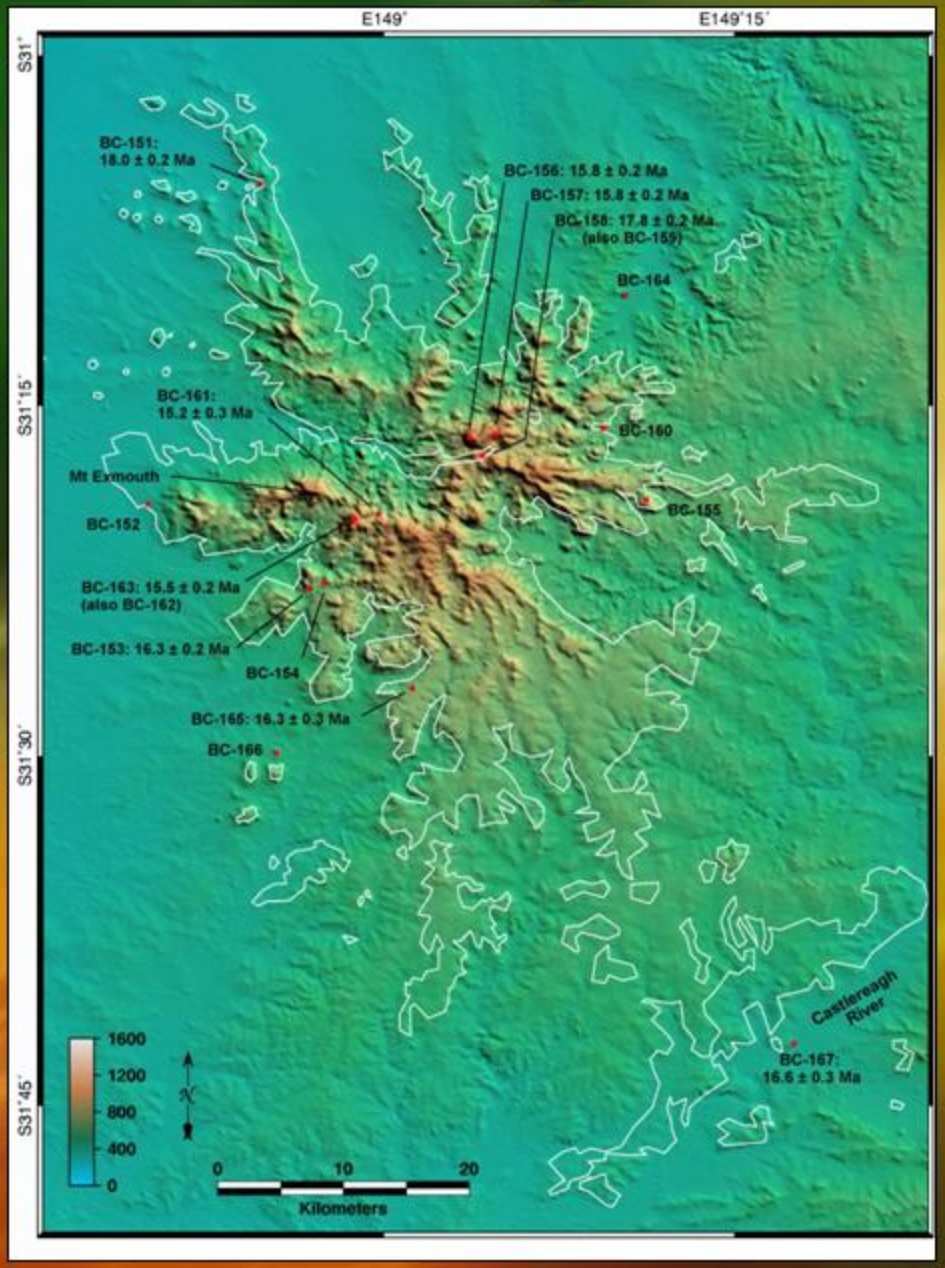
Nandewar erosional features



Governors Bluff

Sawn Rocks, a feature related to cooling joints in the now eroded rock

Warrumbungles volcano, digital space view



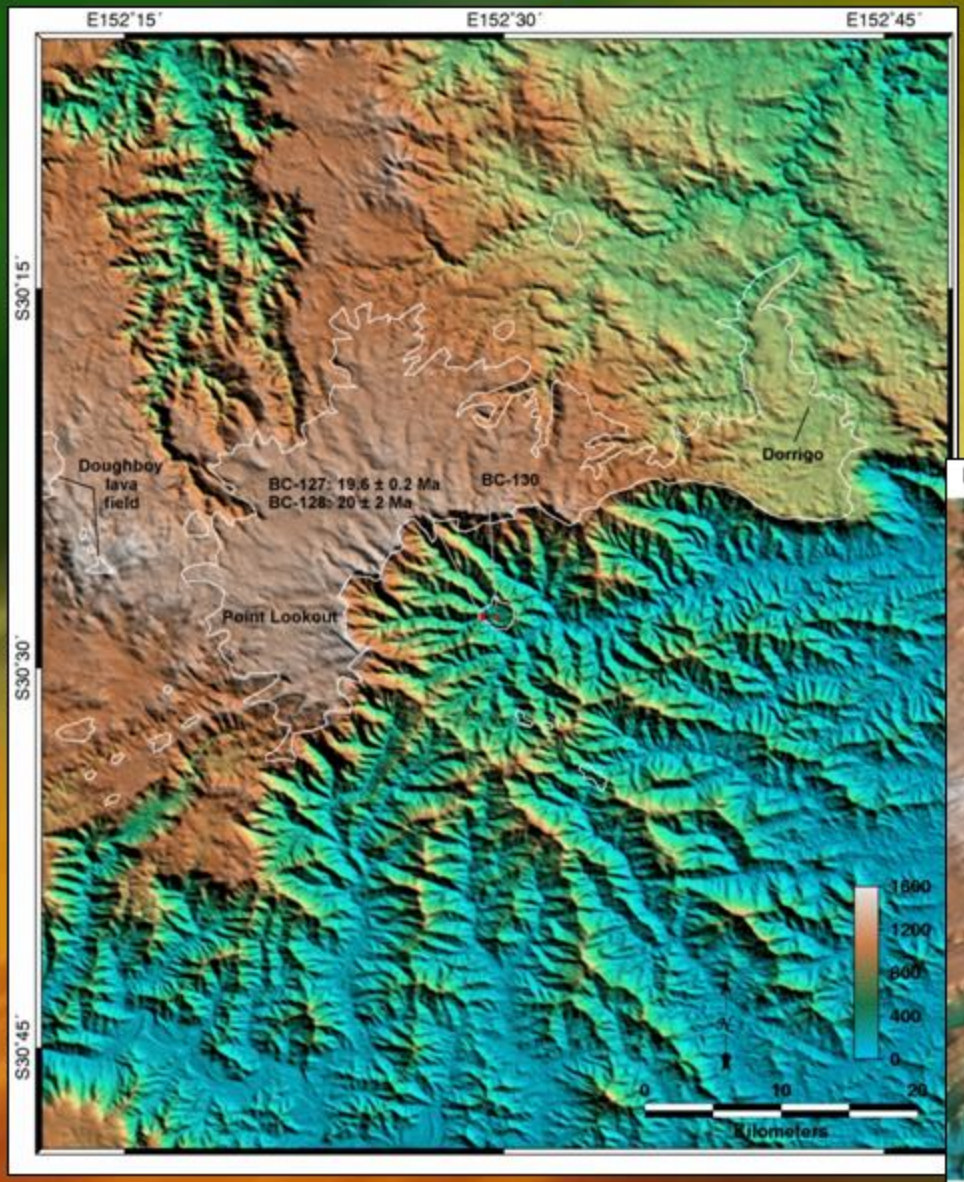
Note dissected nature of and radial drainage from central area of the volcano (18-15 million years in age). This volcano has well exposed domes and dykes of its central complex.

DEM Image: Cohen (2007)

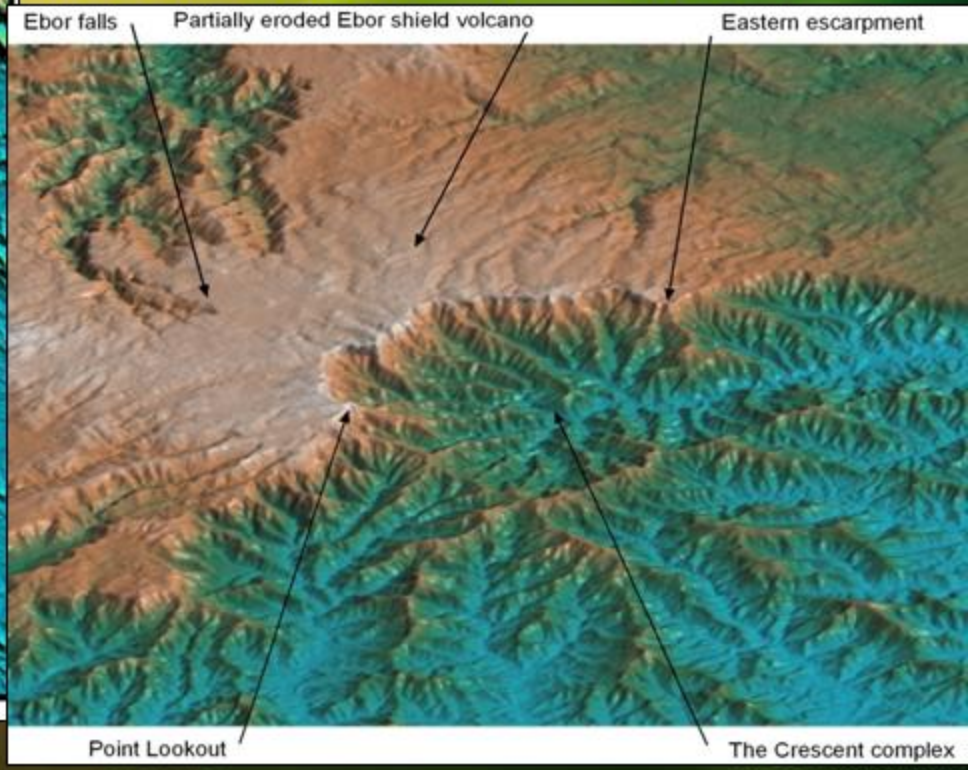
Warrumbungles, eroded central rocky plug and dyke prominences

Belougery Spire (left hand side) and Bread Knife (right) in a group of trachytic feeders for now removed flows.

Ebor-Dorrigo volcano, digital space view



Note dramatic change in habitat across the volcano (19-20 million years of age), due to escarpment erosion into the structure. A basaltic lava apron survives on the north-west side and isolated intrusives remain to the south-east



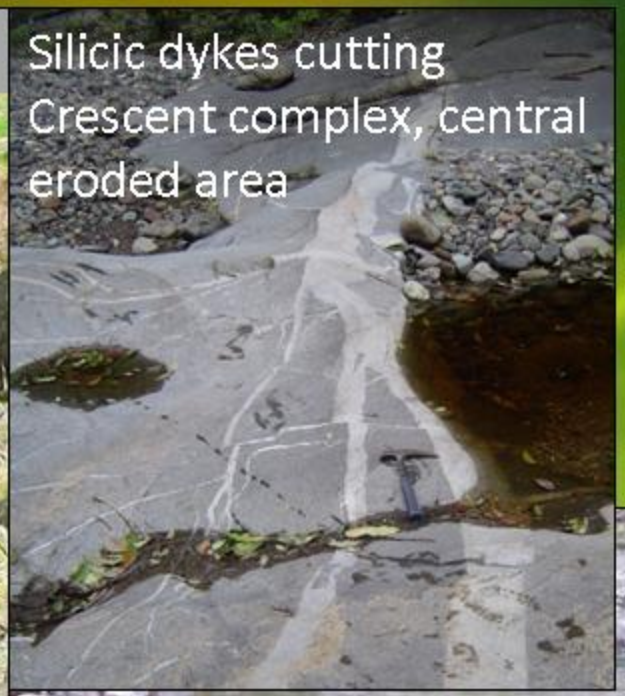
DEM Image: Cohen (2007)

The highs and lows of the Ebor-Dorrigo volcanic landscape remnants (west to east)

Ebor Falls, cutting into lava apron

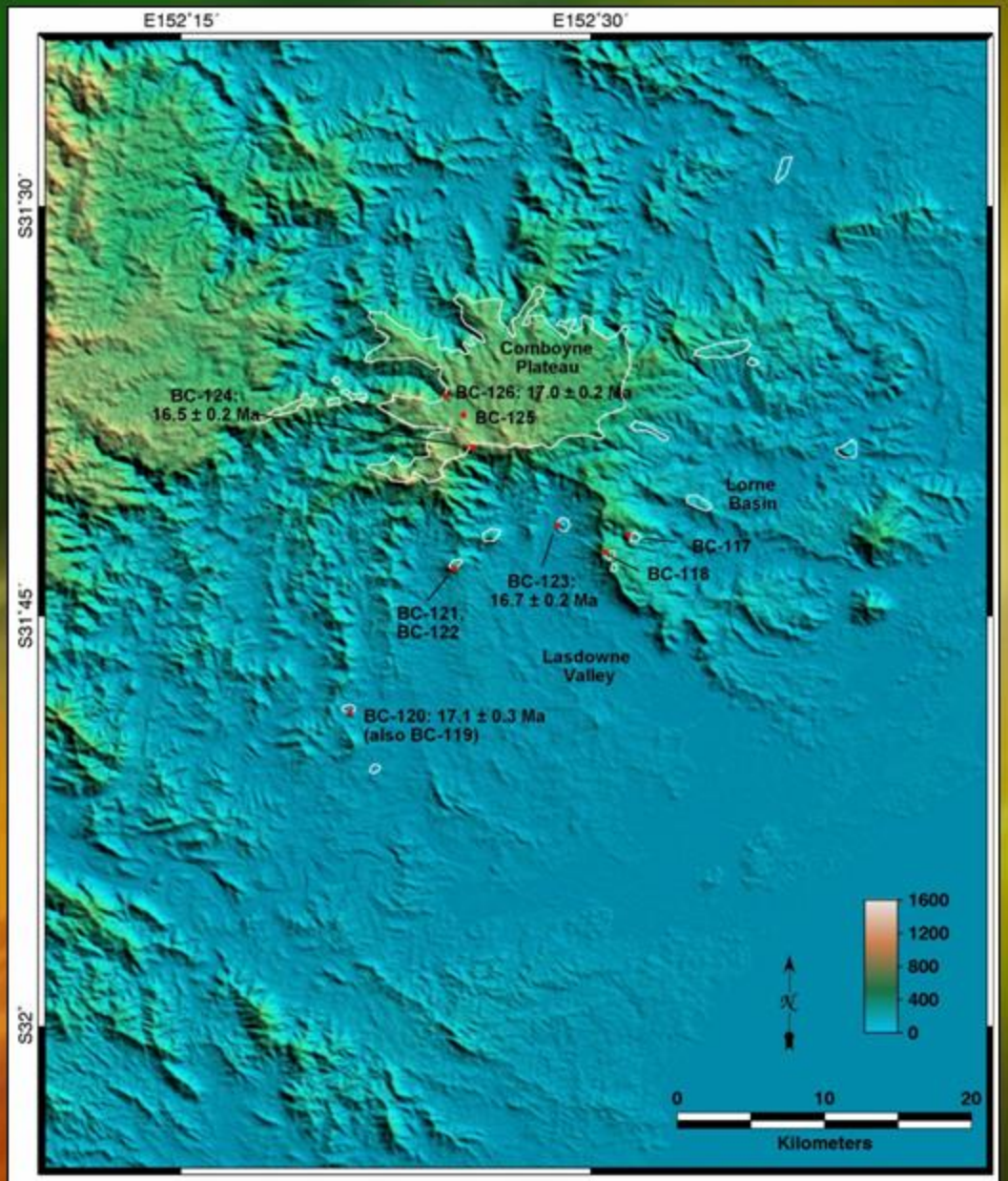
Photo: Amos T Fairchild

Silicic dykes cutting Crescent complex, central eroded area



Bellinger River, in its deep valley, east side

Comboyne volcano, digital space view



Note dissected remnants forming a nearly isolated volcano on the edge of the escarpment (16-17 million years of age).

Note extensive coastal plain to the south of the volcano.

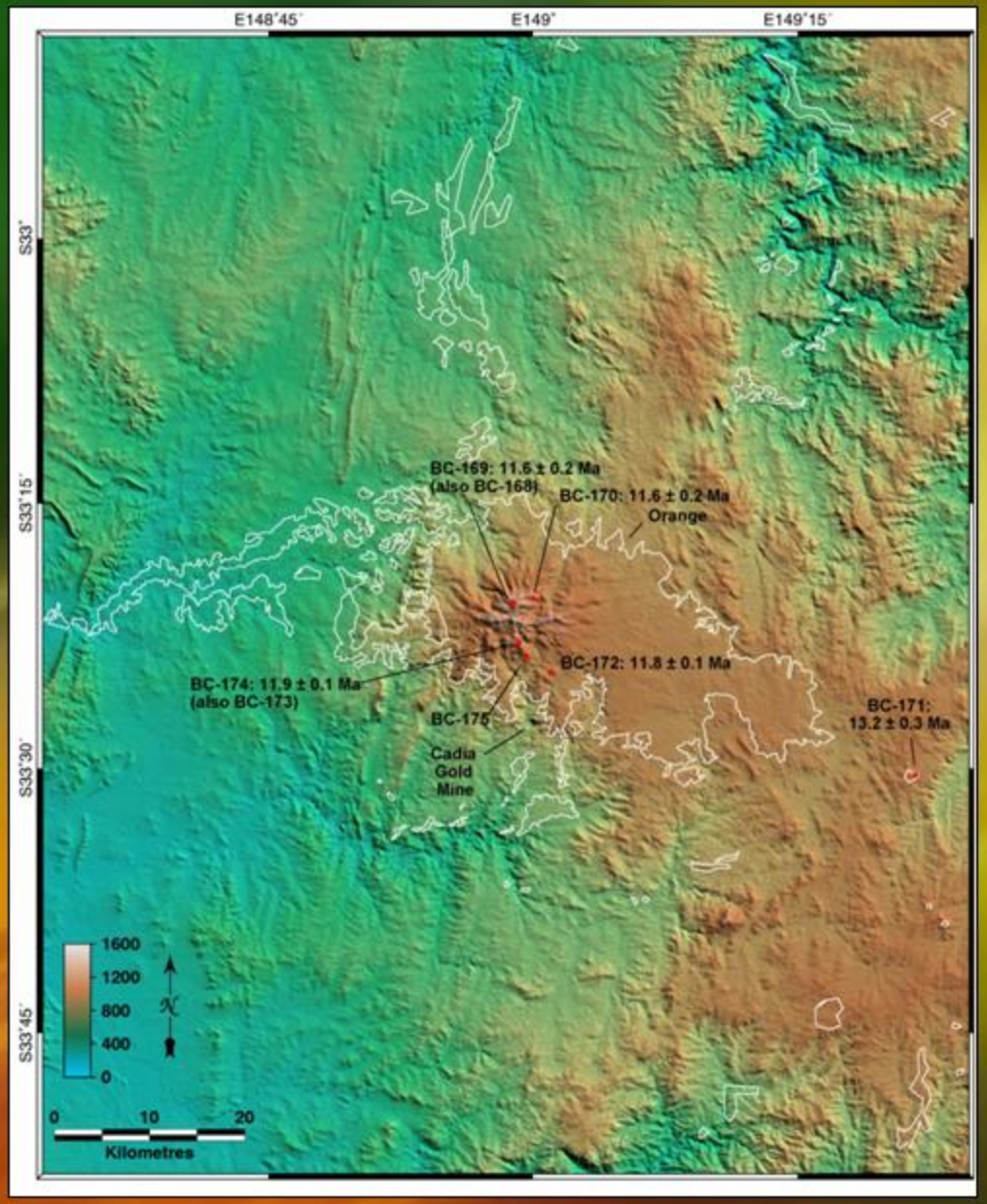
DEM Image: Cohen (2007)

Contrasting topography Comboyne volcano

Comboyne Plateau formed on basalt flows

Big Nellie, a large isolated rhyolite plug on the outskirts of the volcano

Canobolas volcano, digital space view



Note the relatively intact and small size of this southern most NSW central volcano (11-12 million years of age).

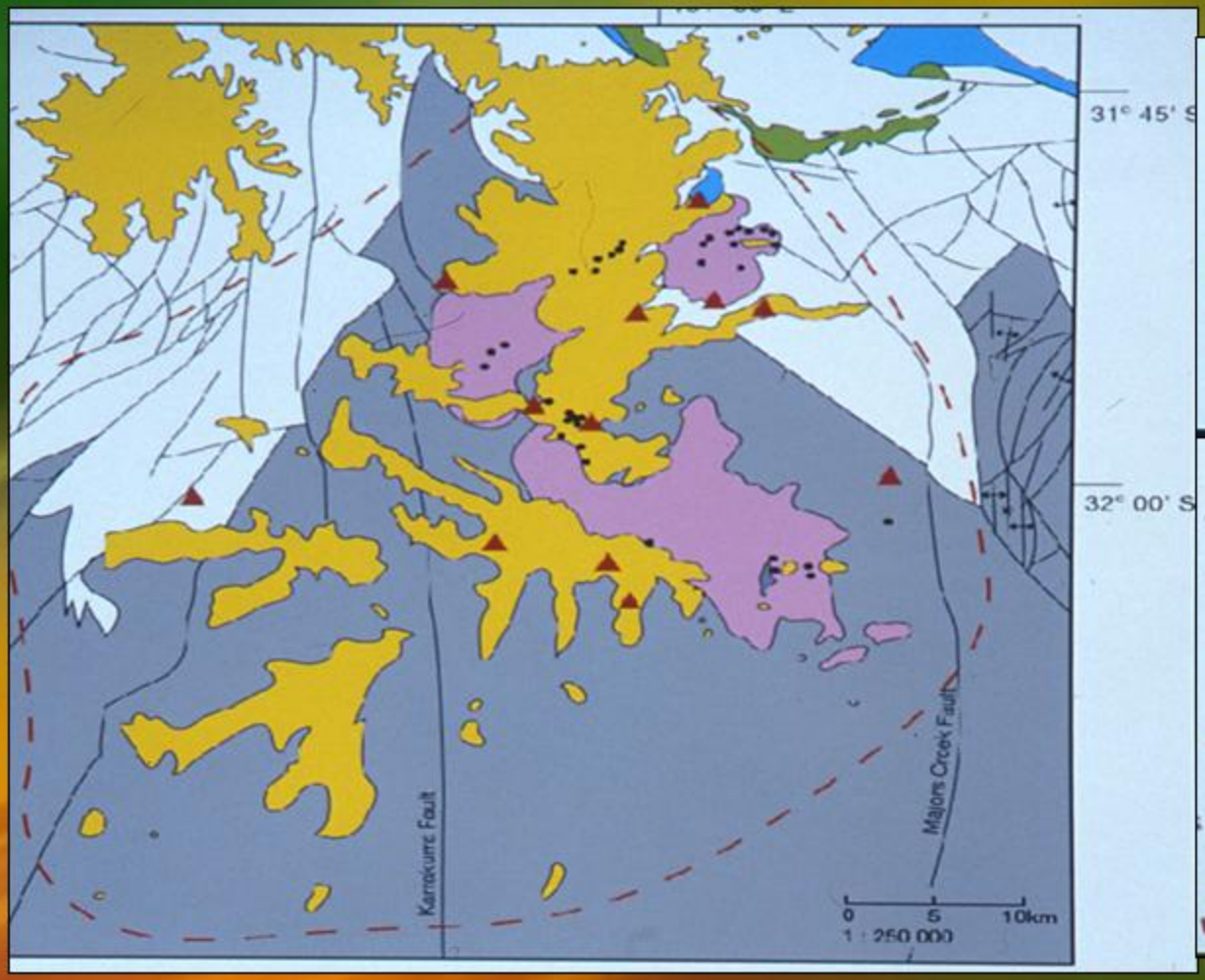
The basalt lava flows extend out where they filled former valleys without much inverted topographic relief.

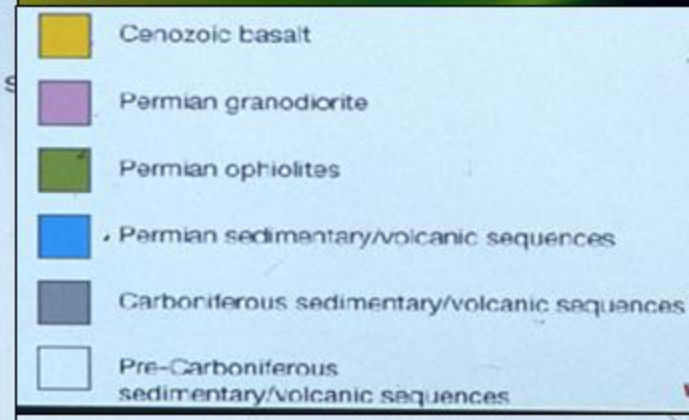
The silicic flows and intrusions are confined to the higher parts of Mount Canobolas.

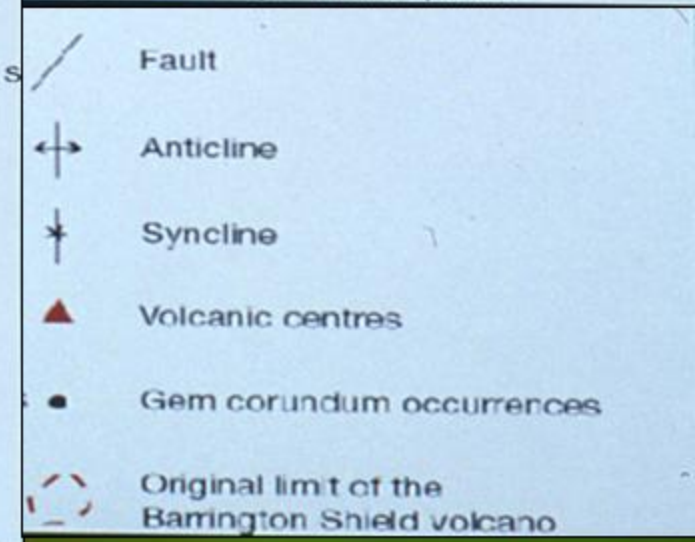
DEM Image: Cohen (2007)

Canobolas volcano, seen from its outermost flanks near Orange

Barrington Tops volcano, geological distribution (age 60-4 million years)







Map after Sutherland & Graham (2003)

Barrington plateau topography

Plateau dissection, right

Plateau top, lower

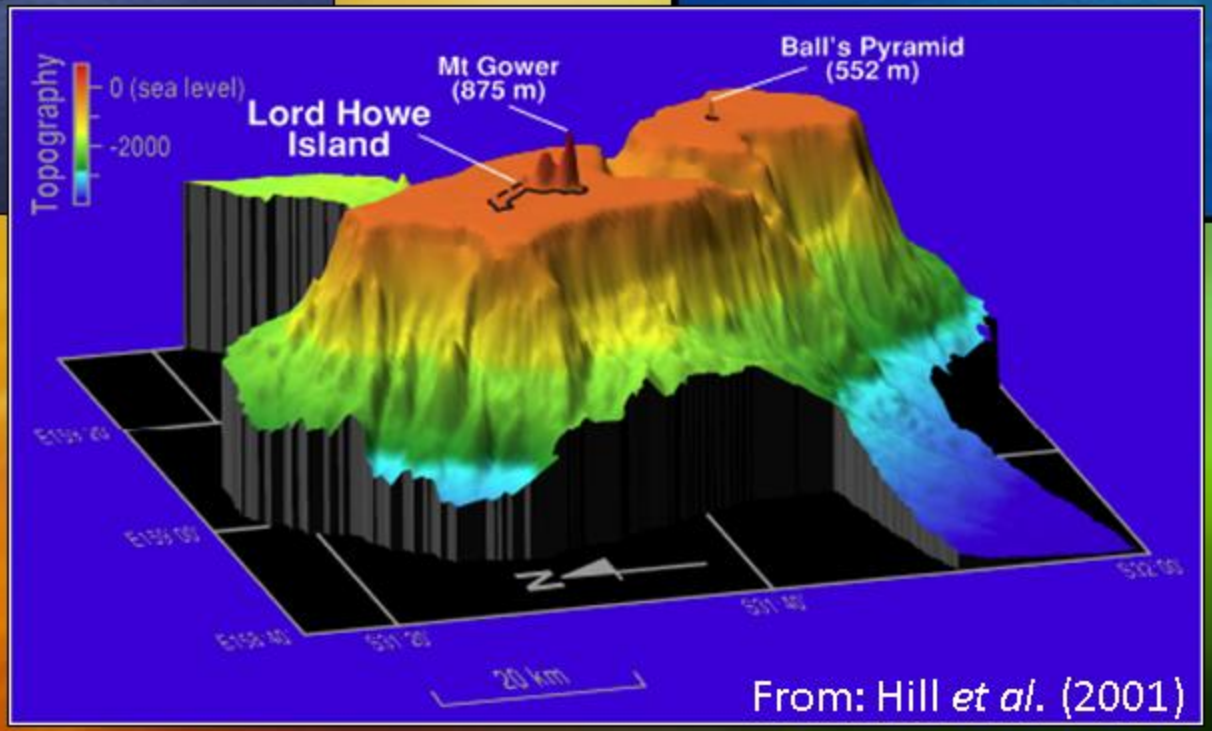
Lord Howe Island marine park on submerged top of eroded shield volcano (7 million years old)

Lord Howe Is.

Source:
travelplace.co.uk

Ball's Pyramid

Source:
howeadivers.com



From: Hill *et al.* (2001)

Geodiversity influences on habitats

- The underlying geomorphology of the eroded Cenozoic volcanic areas can directly influence vegetation and biological habitats,

  e.g. Rainforests often develop on nutrient-rich basaltic areas, while eucalypt sclerophyll stands tend to colonise more deficient soils developed on rhyolites
- The topography developed on the eroded volcanic areas can influence agricultural and other land use

  E.g. Rugged eroded scarps are too steep to farm, whereas flatter basalt plateaus are ideal for rich and easy cultivation
- The contrasts in land forms in the large central shields between resistant silicic and the more susceptible basaltic weathering helps determine national park selection along with biodiversity factors,

  e.g. Spectacular juxtaposed contrasting rock types provide aesthetic settings for recreation, photography and geotourism

Conclusions

- Volcanic remnants form significant parts of the National Park and reserves in New South Wales
- The large central volcanoes decrease in age and size from the northern border to central New South Wales
- This increase in erosional inroads to the north gives rise to a wide range of diverse landforms
- Basalt lava fields show greater age ranges and lack the inner rugged cores of the central volcanoes
- This geodiversity just within the volcanic landforms provides an exceptional opportunity to study detailed interactions between geological habitats, the plant and animal communities within them and human utilisation

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Acknowledgements

- Francesca Kelly, St Peters, Sydney for helping compile the presentation
- National Parks and Reservations website, for information and images