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Paleogene basalts prove early uplift of Victoria's Eastern Uplands

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Discussion and Reply

Paleogene basalts prove early uplift of Victoria's Eastern Uplands

DISCUSSION

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VandenBerg (2010) has written a very well-supported account of the Eocene–Oligocene paleovalleys and basalts of the southern margins of the Eastern Uplands in Gippsland. He is probably quite correct in suggesting that this part of the Eastern Uplands contains residual topography that has suffered little tectonic disturbance since the cutting of a regional paleoplain prior to the Eocene. However, he fails to recognise that this stable province is very much restricted to the coastal fringes of the highlands, and post-Miocene tectonic disruption begins just north of his study area, as documented by Holdgate *et al.* (2008). It is only by broadening the focus to cover the whole of the Southeast Australian Highlands from Melbourne to Wollongong that we can fully understand the setting of VandenBerg's paleovalleys (Figure 1).

As shown in Figure 1, the Southeast Australian Highlands is made up of numerous remnants of a once more extensive paleoplain, the so-called 'High Plains.' The paleoplain is often capped by Eocene, Oligocene or Lower Miocene basalt, which preserves paleotopography that must to have been cut prior to extrusion. The fragments of paleoplain bear subdued relief (100–200 m, but with monadnocks up to 500 m above valley bottoms). They are separated either by deep, younger river gorges, or by abrupt linear steps that probably represent post-Miocene faults. VandenBerg (2010) mentioned some of these faults in the Omeo-Benambrabra area. The best-documented faults are in southern NSW, for example at Lake George, where the paleoplain is offset by 200–250 m, of which 130 m is preserved as post-Miocene half graben fill (Abell 1991; Singh *et al.* 1981). The biggest fault throws are probably west of the Kosciuszko Main Range. However, this remote NSW-Victorian border area has not been mapped in detail except for localised site investigations for the Snowy Mountain Hydroelectric Scheme in the late 1950s (see Sharp 2004a, b). The surfaces of some paleoplain fragments are relatively flat. However, others show

distinct regional tilt, well in excess of any purely erosional dip, particularly the NE-dipping Kosciuszko tilt-block and the NW-dipping plateaus adjacent to the Murray Basin.

In general, the paleoplain fragments step up to the highest elevations at Mt Kosciuszko and Mt Bogong, and then step down again towards the Murray Basin. The highest, most disrupted and most faulted paleoplain fragments occur in a broad belt from the Namadji Mountains in the southern ACT to Lake Mountain in Victoria. Within this area, sub-basalt remnants of Tertiary fluvial and lowland swamp sediments occur at current high elevations (Holdgate *et al.* 2008), for example at Hotham Heights (now at ~1700 m ASL) and Kiandra (now at ~1450 m ASL). This tectonised province is flanked to the northwest by the NW-tilted plateaus mentioned above. However, to the east and south of the disrupted belt is a less disturbed province that rises up to the lip of the coastal scarp in southeastern NSW. The largest untectonised paleoplains occur in the Monaro and middle Shoalhaven, where Taylor *et al.* (1990) and Brown (2006) respectively have described Eocene–Oligocene paleovalley complexes. The relatively undisturbed nature of these large paleoplain fragments may have led these authors to also support a uniform ancient age of uplift for the highlands, whereas a different style of more disrupted paleoplains occur further west in the Kiandra-Adaminaby area (Sharp 2004a).

The coastal scarp also continues westwards into Victoria in a much more eroded and fragmented form, where it follows the Gippsland edge of the Eastern Uplands. It is within this relatively untectonised area where VandenBerg's paleovalleys occur, probably occupying pre-Eocene valleys in the Gippsland coastal scarp, in contrast to areas further to the north which have been significantly disrupted. The distribution of modern earthquakes, which can be downloaded from the Geoscience Australia website (http://webmap.ga.gov.au/imf-natural_hazards/imf.jsp?site=natural_hazards_earthquake), also shows a distinct diminution of seismic activity in the less disrupted province.

Thus, VandenBerg (2010) has very successfully demonstrated the well-preserved paleovalley system in a limited untectonised area of the Southeast Australian Highlands, where initial uplift may have been

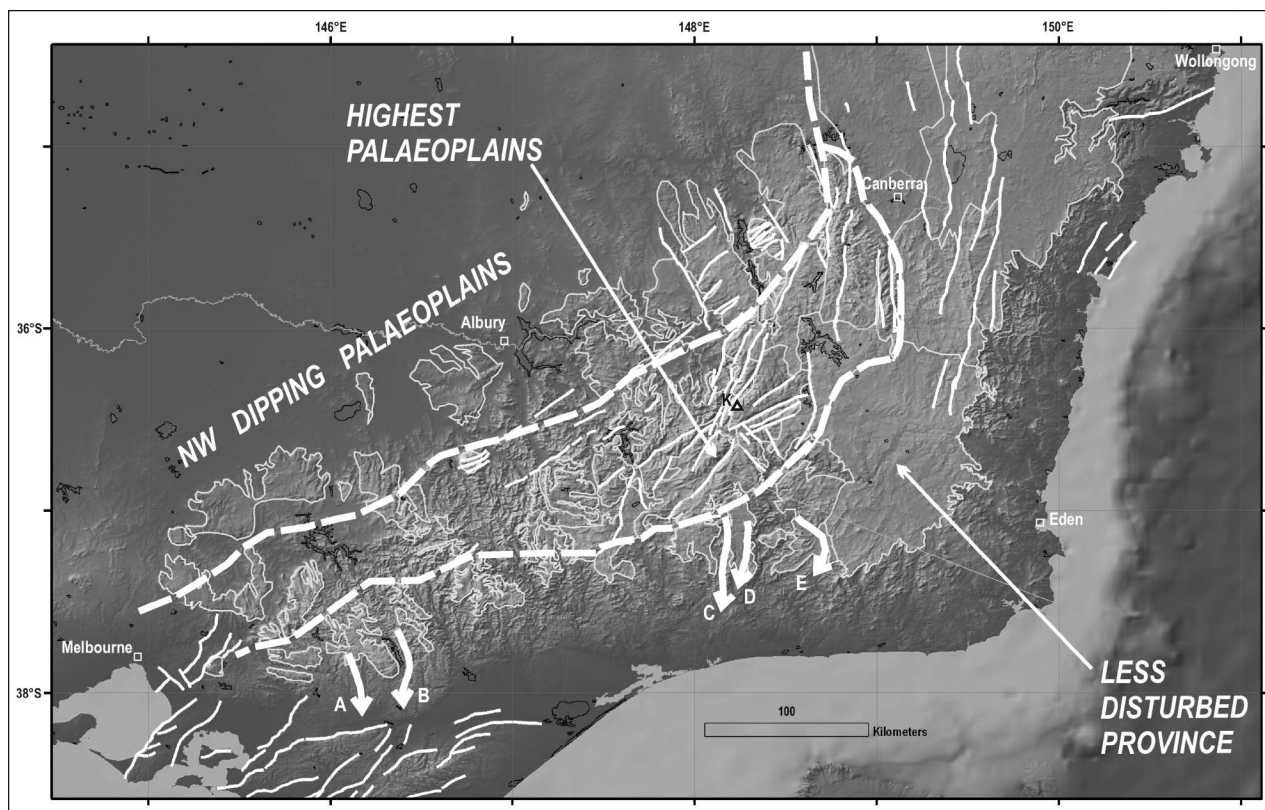


Figure 1 Digital Terrain Model image of the Southeast Australian Highlands showing fragments of the pre-Eocene paleoplain outlined in thin white lines and interpreted post-Miocene faults as thicker white lines. Three overall tectonic provinces are separated by thick dashed lines. The location and interpreted flow directions of selected Eocene–Oligocene of paleovalleys in Gippsland, modified from those of VandenBerg (2010), are shown as white arrows. Abbreviations: A, Toorojil; B, Aberthomson; C, Timbuchan; D, Butrindal; E, Bondick; K, Mt Kosciuszko.

mid-Cretaceous and the topography was mature by the Eocene. However, the broader picture shows significant post-Miocene tectonic activity in many other areas of the highlands, demonstrating the dangers of not taking a regional view. Early uplift, indicated in VandenBerg's title, is therefore only the prelude to the neotectonic history of parts of the highlands.

One other very minor variation is suggested to VandenBerg's interpretation of the Bondick paleovalley in East Gippsland. In the Bonang area, there is a string of isolated mapped outcrops of Cenozoic basalt that drop in altitude from near Bonang (750–840 m ASL) to west of Malinns (~440 m ASL). These outcrops may represent fragments of a southwest-flowing paleovalley (Figure 1), rather than one flowing northwest towards Basalt Hill (VandenBerg 2010, figure 12b).

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