Australian landforms: consistent with a young earth

Western Arnhem Land, 300 km east of Darwin, in northern Australia (see Figure 1), is a flat to undulating plateau that is deeply incised by gorges into the resistant Kombolgie Sandstone. This plateau is an erosion surface that has bevelled areas of steeply tilted sandstones (see figure 2).[1] Shallow valleys on the plateau are filled with patches of late Jurassic and Cretaceous sediment, the age determined by fossils. Thus, these sediments date the plateau at around 100 million years (Ma) old within the geological time scale. Yet the plateau is said to have eroded little, less than 100 m in 100 Ma, based on five mostly geomorphological criteria.[2] Nott and Roberts state:

> *'The preservation of such sedimentary sequences on the western edge of the Arnhem Land plateau, and along its eastern edge ..., implies that the plateau surface is at least Cretaceous in age and that its overall topography has changed little since the earliest Cretaceous.'*[3]

The above erosion rate for 100 Ma is likely exaggerated.

Elsewhere, Jonathan Nott has stated that the erosion of the Arnhem Land plateau, as well as the Tawallah and Yiyinti Ranges to the south, is less than 50 m in 100 Ma.[4] Actually, the erosion rate is probably nil, and Nott is trying to be as optimistic as possible, for he says:

> *'Both the Tawallah and Yiyinti Range regions, and the Arnhem Land region, have maintained their topographic outlines since at least the Late Jurassic and, except in the case of the latter region (where gorges are obviously cutting back into the Arnhem Land massif), these landscapes have changed very little, if at all.'*[5]

The lowlands to the west of the Arnhem Land escarpment are composed of a broad undulating plain 2-60 m above sea level called the Koolpinyah erosion surface (see Figure 2). This surface is cut in tightly folded, easily eroded Precambrian rocks. It is considered an exhumed surface, since the angular unconformity of the Koolpinyah surface continues westward under the sandstone of the Arnhem Land Plateau. It is deduced that the Koolpinyah surface was once covered by Cretaceous marine rocks 200-300 m thick based on the height of marine strata within valleys on the Arnhem Land plateau. Patches of this marine Cretaceous rocks still survive on the Koolpinyah surface. Thus, the denudation rate for the lowlands is estimated at about 2.5 mm/1000 yrs for the past 100 Ma, about an order of magnitude greater than the Arnhem Land plateau. This greater erosion rate for the lowlands seems anomalous, since high elevation terrain supposedly erodes faster than low elevation terrain.

The above slow erosion rates for the plateau and lowlands over 100 Ma can be compared to the much faster denudation rates for the most recent geological time. At time intervals between 1 yr and 0.5 Ma, Nott and Roberts calculate the denudation rate

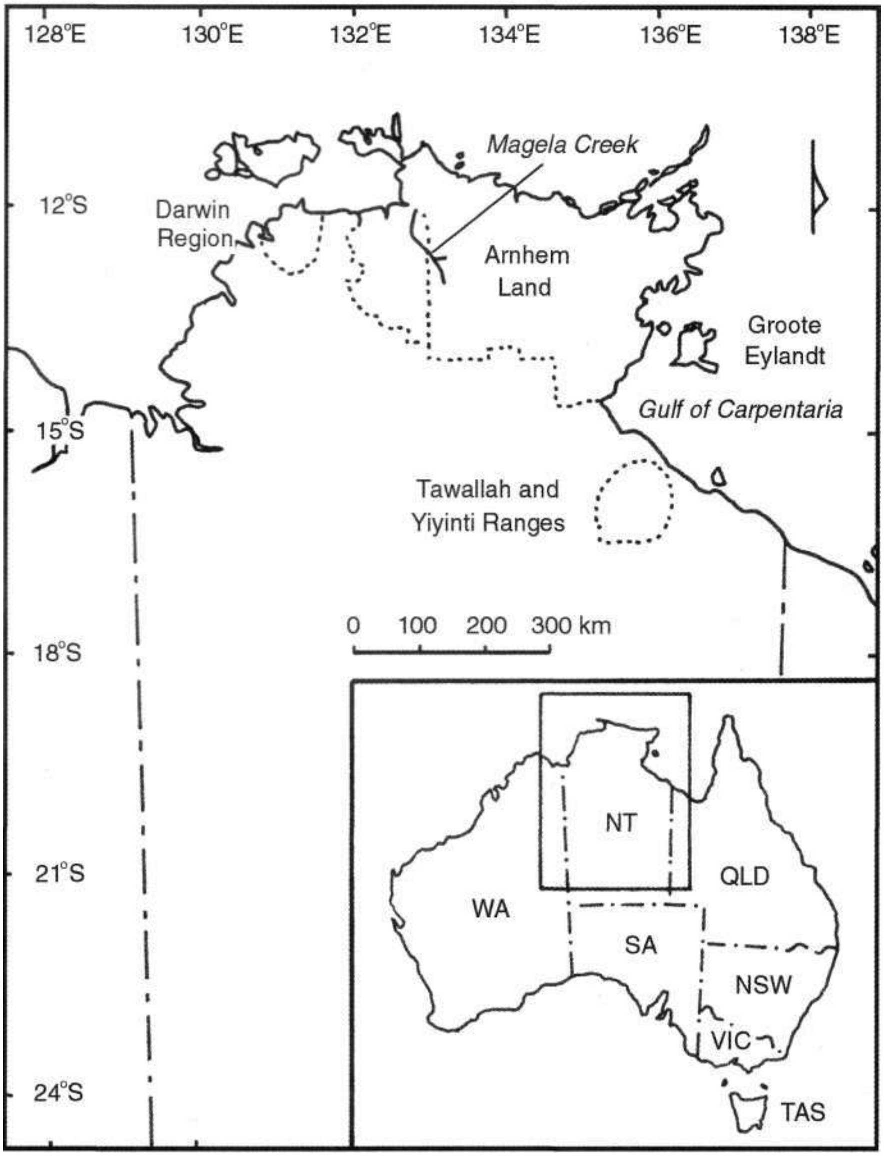

Figure 1. *Location map of study area in northern Australia. Standard state and territory abbreviations are shown in inset map (after Nott and Roberts[1]).*

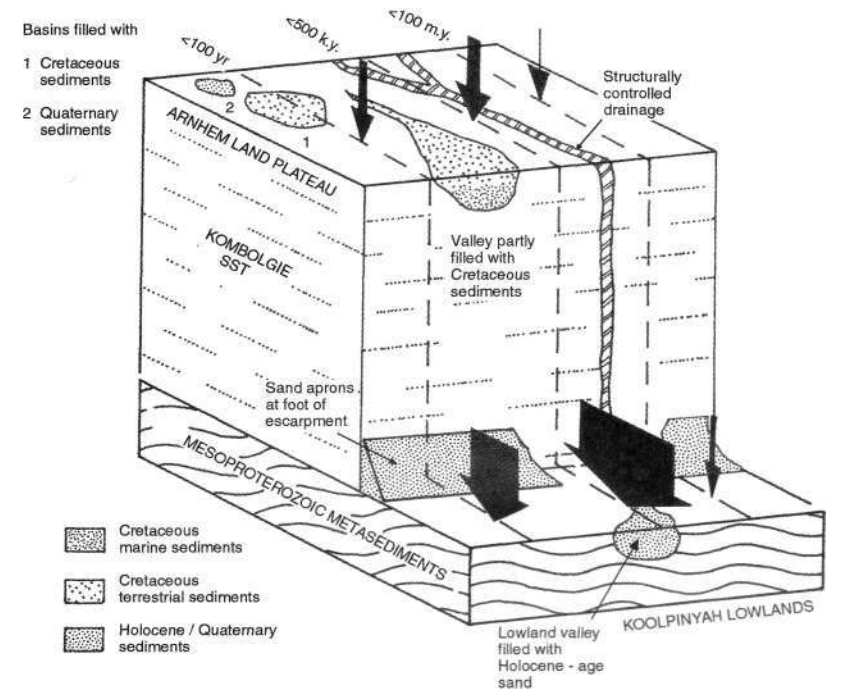

Figure 2. *Schematic diagram of Arnhem Land plateau and Koolpinyah lowlands, showing denudation over different time scales. Width of arrow on each of the time-lines represents rate of denudation. Note angular unconformity at base of escarpment coinciding with lowland Koolpinyah surface, and fades transition from Cretaceous marine to terrestrial sediments within upland valley (after Nott and Roberts[2]).*

of the plateau at least three to five times as fast and for the lowland at least eight to 20 times as fast as the average for 100 Ma (as indicated above, the denudation rate for the plateau is more likely 10 or much more during the late quaternary than the past 100 Ma). The denudation rate for the past few decades is based mainly on sand transport measurements and delta progradation into a lake. Dates for periods from 3,000-500,000 years are based especially on ^{14}C, ^{10}Be, ^{26}A1, and thermoluminescence (TL). All these methods surprisingly produced an erosion rate of about 3-4 mm per 1,000 years for the plateau.[6] The erosion rate for the past several decades likely is the true erosion rate, but I am highly suspicious of why the methods for the period 3,000 years to 0.5 Ma agree with current estimates, since the radiometric methods are based on many assumptions. The *in situ* cosmogenic radioisotopes, ^{10}Be and ^{26}A1, produced much too low erosion rates on the Eyre Peninsula in south-central Australia.[78] Twidale recently questioned whether these radioisotopes really can be used to date such 'old' landforms.[9]

This brings up the question of why the denudation rate should speed up 5 to 20 times or more during recent geological time. If the current erosion rates had continued for the past 100 Ma, approximately 500 m (probably much more) and 4000 m of sedimentary rock would have been eroded from the plateau and lowland surface, respectively. In other words, 7.5 % and 20 % of the total denudation of the plateau and lowlands, respectively, for the past 100 Ma would have occurred during the Quaternary.[10] Nott and Roberts eliminate tectonic instability, Quaternary glaciation, and the influence of man as the cause for the greatly increased denudation rate. They suggest the cause may be increased rainfall and oscillations in sea level during the Quaternary, the latter especially effecting the lowland surface. I doubt that increased rainfall from the currently high tropical monsoon climate of around 1,500 mm/yr can be documented for the Quaternary in this region. Moreover, Quaternary sea level is near its highest level at present. Lower sea level during supposed Quaternary glaciations is expected to increase stream incision into the lowlands, enhancing erosion. Regardless, oscillating sea level does not explain the current high erosion rate. Erosion rates should be even higher during the Quaternary than at present. A more reasonable, straightforward interpretation of the much different current erosion rate and the rate deduced for the past 100 Ma is that the age dating methods based on fossils and bolstered by radiometric methods are flawed. In other words, the Arnhem Land plateau and the Koolpinyah surface are not that old.

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