Appendix 5

Massive Erosion of Other Coastal Great Escarpments

Chapter 12 describes the coastal Great Escarpment around southeast South Africa. Other erosional escarpments are found inland from the coasts of eastern Australia, eastern South America, and western Peninsular India (see Figure 11.1 for the general shape of these escarpments). I will discuss only the large erosional Great Escarpments that lie along the coasts of Atlantic-type margins. These do not include the escarpments off western South America and western Australia, which are due to faulting, or the one off of eastern Peninsular India because it is not high or long enough to be considered a Great Escarpment. I will also examine the Blue Ridge Escarpment in the eastern United States.

The Coastal Great Escarpment of Eastern Australia

A Great Escarpment runs along most of the width of eastern Australia.[1] It is over 1,500 miles (2,400 km) long and varies in height from over 600 to around 3,000 feet (200 to 1,000 m). Figure 11.2 shows the escarpment west of Sydney, Australia. There are several gaps in the scarp, generally because it cannot be continuously traced with confidence in these areas. The escarpment separates a high plateau or tableland from a deeply incised coastal area, similar to southeast Africa. The plateau is an erosion surface

Figure A5.1. Dissected erosion surface on the high plateau west of the Great Escarpment, west of Sidney, Australia. Erosional remnant or inselberg in the middle of the picture.

[1] Ollier, C.D., 1982. The Great Escarpment of eastern Australia: tectonic and geomorphic significance. *Journal of the Geological Society of Australia* 29:13–23.

in which the rocks are sometimes planed at a sharp angle. A few erosional remnants or inselbergs were left behind (Figure A5.1). When viewed from the coastal plain, the escarpment looks like a mountain range. It has left erosional remnants to the east that have flat tops and are at a slightly lower elevation than the Tableland, [2,3] reinforcing the conclusion that eastern Australia experienced greater uplift than west of the Great Escarpment.

This Great Escarpment is similar to the Drakensberg of southeast Africa (see Chapter 12),[4] and the origin of the Australian coastal Great Escarpment is just as mysterious for uniformitarians as the coastal Great Escarpment of southern Africa. Just as in southern Africa, the escarpment is purely erosional:

> There can be no doubt that the Great Escarpment [in eastern Australia] is an erosional feature over its entire length. It coincides with geological boundaries in only a few places, and there it can be shown that it is differential erosion that forms the scarp, and not fault movement.[5]

The Australian Great Escarpment was caused by the uplifting of the eastern Australia plateau. The erosion surface forming the plateau truncates rocks of variable lithologies (rock types) and dips.[1] Some of the sedimentary rocks below the erosion surface are steeply dipping.[6]

Great Escarpment of Peninsular India

Most of Peninsular India is ringed with an escarpment, similar to southern Africa. It is the best developed in the Western Ghats. The word "ghat" simply means an ascent and can refer to a hill or an escarpment. The Western Ghats in particular are the most impressive with a total length of over 940 miles (1,500 km). The height of the escarpment varies, but its highest point is in the southern region and is at about 7,200 feet (2,200 m) msl.[7] Although its distance from the coast varies from 20 to 60 miles (30 to 100 km), it is seldom more than 40 miles (60 km) from the coast. The escarpment is the most distinct in the north where the western edge of the huge Deccan lava province helps preserve steep cliffs. Interestingly, many rivers start just east of the top of the Western Ghats and flow eastward across Peninsular India into the Bay of Bengal.

The escarpment was caused by the uplifting of Peninsular India followed by erosion. Geologists recognize it probably required a unique process: "The Great Escarpment of the Western Ghats is a massive and unique morphotectonic feature that probably requires a unique process" [8]

Another emarkable feature of the Western Ghats is the erosional process took no account of the hardness of the rocks, typical od coastal Great Escarpments in general:

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2 Pain, C.F., 1983. Geomorphology of the Barrington Tops area, New South Wales. *Journal of the Geological Society of Australia* 30:187–194.

3 Seidl, M.A., J.K. Weissel, and L.F. Pratson, 1996. The kinematics and pattern of escarpment retreat across the rifted continental margin of SE Australia. *Basin Research* 12:301–316.

4 Ollier, Ref. 1, p. 22.

5 Ollier, Ref. 1, p. 27.

6 Pain, Ref. 2, p. 187.

7 Ollier, C.D. and K.P. Powar, 1985. The Western Ghats and the morphotectonics of Peninsular India. *Zeitschrift für Geomorphologie* N. F. 54:57–69.

8 Ollier and Powar, Ref. 7, p. 68.

> In the region of interest … escarpment ridge crest elevations vary from 500 to 1900 m [1,640 to 6,230 feet], but overall the remarkable continuity and length (~1500 km [940 mi]) of the Western Ghats in spite of structural variations remains the key issue, suggesting a single, post-Cretaceous process underlying both fairly uniform recession and shoulder uplift (emphasis and brackets added).[9]

And no faults helped in the erosional process:

> It is important to note that these stratigraphical and structural studies unequivocally demonstrate an absence of any large-scale faulting within the study area. The lack of faulting in vicinity of the escarpment and Konkan Plain, together with an absence of any large-scale, seismically-determined structural offset of the base of the volcanic sequence across the line of the Western Ghats (Kaila et al. 1981) confirms that the present escarpment should be considered as a purely erosional feature.[10]

The parallel erosion of hard and soft rocks does not accord with slow processes of erosion over millions of years. The hard and soft rocks should have eroded at different rates. Instead it fits with the Retreating Stage of the Flood as a single process that acted late in Earth history.

The east-west Palghat Gap makes a remarkable break in the Great Escarpment and remains a geomorphological enigma.,[11,12] This gap is called a wind gap (see Volume III on wind gaps) because it does not have a river or stream flowing through it, only wind flows

Figure A5.2. Blue Ridge Escarpment, a 2,000-foot (600 m) high cliff, at Cesear's Head State Park, North Carolina.

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[9] Gunnell, Y. and L. Fleitout, 2000. Morphotectonic evolution of the Western Ghats, India. In, Summerfield, M.A. (editor), *Geomorphology and Global Tectonics*, John Wiley & Sons, New York, NY, p. 321.

[10] Widdowson, M., 1997. Tertiary palaeosurfaces of the SW Deccan, Western India: implications for passive margin uplift. In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*, Geological Society of London Special Publication No. 120, p. 224.

[11] Ollier and Powar, Ref. 7, p. 66.

[12] Ollier, C.D., 1985. Morphotectonics of continental margins with great escarpments. In, Morisawa, M. and J.T. Hack (editors), *Tectonic Geomorphology*, Allen & Unwin, Boston, MA, p. 9.

Figure A5.3. View northwest of the Blue Ridge Escarpment from the rolling Piedmont erosion surface, North Carolina.

through. This does not conform to the uniformitarian principle. There are other huge wind gaps along the crest of the Western Ghats.[13] Wind gaps are a predictable feature of the Channelized Flow Phase of the Flood.

Because of all the aboe, the Western Ghats is a major puzzle for mainstream geomorphology. As Peninsular India uplifted, an escarpment formed and eroded inland with no regard to rock hardness and leaving behind wind gaps. This conflicts with the model that requires slow process of erosion over millions of years. Widdowson expressed his frustration:

> Today, the most striking geomorphological feature of western India is the Western Ghats escarpment running the entire length of [western] peninsular India. The origins and nature of this huge feature has been the subject of morphological study and debate for over a century…[10]

The Great Escarpment of Eastern Brazil

In eastern Brazil there is a very well defined escarpment that separates a high area in eastern Brazil, called the Brazilian Plateau, from a coastal plain,[14] similar to other coastal Great Escarpments. It has been given various local names. The largest section is called the Serra do Mar and extends 500 miles (800km) parallel to the coast with a maximum height of 7,300 feet (2,245 m).[15] It resembles especially the Western Ghats in India.

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[13] Widdowson, M., 1997. Tertiary palaeosurfaces of the SW Deccan, Western India: implications for passive margin uplift. In, Widdowson, M. (editor), *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*, Geological Society of London Special Publication No. 120, p. 244.

[14] Ollier, Ref. 12, p. 11.

[15] Ollier C. and C. Pain, 2000. *The Origin of Mountains*, Routledge, London, U.K., pp. 210–211.

The Blue Ridge Escarpment

The Blue Ridge Escarpment of the southern Appalachian Mountains is about 310 miles (500 km) long and averages 1,000 to 1,640 feet (300 to 500 m) high.,[16,17] The escarpment is the most abrupt in western North Carolina, where it rises vertically about 2,000 feet (600 m) (Figure A5.2 and A5.3). Spotila and others stated:

> In northern North Carolina and southern Virginia the Blue Ridge highlands exhibit low relief, such that the escarpment is a striking boundary between two subdued surfaces, which we refer to as the Upland and Piedmont surfaces.[18]

The Blue Ridge Escarpment is not as high or as well defined as the Great Escarpments along eastern Brazil, eastern Australia, western India, and around southern Africa,[12,19], but it is still considered a Great Escarpment,[20,21] similar in many respects to other coastal Great Escarpments.[17] It is primarily an abrupt topographic rise across high-grade metamorphic and granitic rocks from the Piedmont Province to the east to the Blue Ridge Mountains to the west. It is not a result of faulting and is believed to have slowly eroded westward.[17] The escarpment at Ceasar's Head eroded toward the northwest in granite.

The northwest erosion of this escarpment is reinforced by the remnants (outliers) of the Blue Ridge Province on the western Piedmont province. The amount of erosion toward the northwest is uncertain[20] but significant. Thornbury stated: "These [Blue Ridge] outliers suggest that the front of the scarp may have been considerably farther east in Tertiary time [of the uniformitarian timescale]."[22] The location of the escarpment cannot be correlated to whether the rocks are soft or hard; the lack of preferential erosion[17] on hard and soft rocks is a conundrum to geologists. So, the Blue Ridge Escarpment is believed to have formed by erosion, like other Great Escarpments, but the cause is unknown.[17]

The Blue Ridge Escarpment most likely represents a northwestward retreating erosional escarpment, or a 500 km long retreating "waterfall" late in the Flood. The erosion of the Appalachians most likely was from currents flowing generally from the northwest, perpendicular to the Appalachians.

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16 Oard, M.J., 2011. Origin of Appalachian geomorphology Part I: erosion by retreating Floodwaterand the formation of the continental margin. *Creation Research Society Quarterly* 48(1):33–48.

17 Spotila, J.A., G.C. Bank, R.W. Reiners, C.W. Naeser, N.D. Naeser, and B.S. Henika. 2004. Origin of the Blue Ridge escarpment along the passive margin of Eastern North America. *Basin Research* 16:41–63.

18 Spotila *et al.*, Ref. 17, p. 42.

19 Oard, M.J., 2008. *Flood by Design: Retreating Water Shapes the Earth's Surface*, Master Books, Green Forest, AR, pp. 53–54.

20 Battiau-Queney, Y. 1989. Constraints from deep crustal structure on long-term landform development of the British Isles and Eastern United States. *Geomorphology* 2:53–70.

21 Pazzaglia, F.J. and T.W. Gardner. 2000. Late Cenozoic landscape evolution of the US Atlantic passive margin: insights into a North American Great Escarpment. In Summerfield, M. A. (editor), *Geomorphology and Global Tectonics*, John Wiley & Sons, New York, NY, pp. 283–302.

22 Thornbury, W.D., 1965. *Regional Geomorphology of the United States*, John Wiley & Sons, New York, NY, p. 105.