TIMESCALES IN GEOMORPHOLOGY

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In 1758, when Archbishop Ussher made his now famous proclamation that the Earth was created in 4004 BC, timescales in geomorphology were rather short! However, by the end of the 19th century, estimates of the age of the Earth had lengthened to hundreds of millions of years, and in 1907 Boltwood calculated U/Pb ages for some minerals in excess of 1 billion years. Thus, when W.M. Davis was elucidating his cycle of erosion, the antiquity of geological (and geomorphological) time was already being realized.

From the 1950's onwards, particularly in the Southern Hemisphere, and nowhere more so than in Australia, the extreme antiquity of landscapes was reinforced through the work of King, Twidale, Ollier and Mabbutt, for example. Indeed, from stratigraphic evidence and application of modern regolith dating techniques, the history of some Australian landscapes can now be confidently traced back at least 300 million years, to times when Australia was part of Gondwana.

Meanwhile, back in the Northern Hemisphere, the well known American geomorphologist, William Thornbury, wrote in 1954: "Little of the earth's topography is older than the Tertiary and most of it is no older than Pleistocene". Such a statement was not surprising considering that Thornbury was based in Indiana, surrounded by a sea of Pleistocene glacial deposits. Indeed he stressed the major role of Pleistocene climatic change in manner that would comfortably apply to studies of landscape evolution in New Zealand today.

In this talk, I will highlight the importance of numerical dating methods in constructing timescales for landscape evolution, using examples that may include:

1. Soil chronosequences on basalt flows in North Queensland and on glacial moraines in Westland (and mention of rock weathering rates determined from headstones in cemeteries and soil production rates from cosmogenic nuclides).
2. Drainage network and slope evolution on terraces in South Taranaki, in the context of classic early studies in the USA (e.g. Horton, Ruhe), and Wales (Savigear), respectively.
3. The history of aridity and "redness" of rocks, saprolite and sand dunes in Central Australia.
4. The age and dissection of volcanic landforms on Mars and Earth, including the use of tephra marker beds for dating New Zealand landscapes.

The talk will also demonstrate the application of quantitative models of landscape evolution to practical problems including land management and mineral exploration. Such models not only reconstruct the past, but also predict the future, as embodied in a

restated principle of uniformitarianism: “The present is the key to the past, but both are the keys to the future”.

In his book, “Life on the Mississippi”, published in 1883, Mark Twain used a combination of his own observations and historical records of meander cutoffs to calculate that 742 years into the future the lower Mississippi between Cairo and New Orleans would be shortened from 973 miles to just over 1 mile long! As Twain concluded “There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact”.

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