periodic processes operate that glacio-eustatic sea level fluctuations during the late Palaeozoic supposed 'ice age' are the only possible amplifying mechanism that could preserve Milankovitch rhythms.[14] Besides all these problems, a uniform sedimentation rate is required over millions of years in order for the spectral analysis to be meaningful.[15]

It seems more reasonable that such evenly-bedded rhythmites, often hundreds of metres thick and covering extensive areas, had to be laid down rapidly. Otherwise, the randomness described by chaos theory would be the rule if the rhythmites were deposited by slow deposition over millions of years. The Flood is an adequate mechanism for rapid rhythmic sedimentation, due either to multiple turbidity currents or, in deep sediment-filled flows, to separation of similar particles during rapid deposition. The latter rhythmic sedimentation has been shown to be possible by Guy Berthault[16] in flume experiments and Steve Austin in observations of rapid sedimentation at Mount St Helens.[17]

It is even possible that carbonate-black shale rhythmites could have been deposited rapidly by the Genesis Flood, since some geologists believe that these rhythmites can be formed by turbidity currents.[18]

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M. J. Oard

New Dating Method Calculates Unreasonably Low Rates of Granite Erosion in Australia

Carbon-14 is not the only radioactive isotope formed by cosmic rays. Beryllium-10, half-life 1.5 million years, Aluminium-26, half-life 0.7 million years, and Chlorine-36, half-life 0.3 million years, are three other isotopes also produced. These isotopes are not only formed in the atmosphere, but also come into being when cosmic rays interact with solid objects. The latter three isotopes are referred to as *in situ* cosmogenic radioisotopes and are produced in extremely low quantities because cosmic rays predominantly react in the atmosphere before reaching the Earth's surface. With the advent of accelerator mass spectrometry (AMS), such low quantities of *in situ* cosmogenic radioisotopes, as little as 105 atoms per sample, can now be measured and used for radioisotope dating.[1]

Physicists do not totally understand the formation of *in situ* cosmogenic radioisotopes. Consequently, there are uncertainties in the use of those isotopes for age determination.[23] There are four principal mechanisms for the formation of *in situ* cosmogenic radioisotopes:-

(1) neutron spallation,
(2) muon capture,
(3) neutron activation, and
(4) alpha particle interaction.

It is generally assumed that the neutron spallation mechanism is the most significant. The production rate of cosmogenic radioisotopes on Earth is dependent upon latitude, altitude, and also the geometry and shielding history of the absorbing material. To provide useful data, the absorbing material should have maintained the same geometry and not been covered with shielding material. There is an exponential decrease in the production of cosmogenic radioisotopes with depth in the material. Half the incident cosmic rays are absorbed, forming half the radioisotopes, within a depth of about 45 cm on a horizontal, flat surface.

Since cosmogenic radioisotope production is only partially understood, scientists have employed an empirical technique to estimate the production rate. The concentration of radioisotopes is measured by AMS in a material of 'known' age. By dividing this concentration by the age, the production rate is calculated for a given locality, and then extrapolated for other latitudes and altitudes. A basic calibration was obtained from measurement of cosmogenic radioisotopes in quartz from glacially polished surfaces in the Sierra Nevada Mountains at 2-3.5 km altitude.[4] The surface was estimated to be 11,000 years old based on the C-14 age of organic remains associated with the surfaces. The striated pavements were assumed to have had zero cosmogenic radio-isotopes at the time of deglaciation. It was also assumed that little or no surface erosion occurred and that no till, dirt, volcanic debris, etc. has covered the surface since deglaciation (a good assumption). Because of this calibration, the *in situ* cosmogenic radioisotope dating method is not independent. Its accuracy depends upon the accuracy of other dating methods, in this case carbon-14 dating.

There are many dating applications for cosmogenic radioisotopes. A large literature on the subject has accumulated since the mid-1980s. One of these applications is the estimation of landform erosion rates.[5] Additional assumptions are required for calculating erosion rates :-

(1) erosion must be at a constant rate, or at least differences from a steady state must be estimated;
(2) there must be no infusion of radioisotopes from the atmosphere; and
(3) radioisotopes produced by alpha particles from uranium and thorium radioactive decay must be excluded.

The first assumption, and the necessary assumption concerning possible shielding by erosional debris, are the most significant.

This new dating technique has recently been employed to measure the erosion rate of granite inselbergs on the semi-arid Eyre Peninsula of south-central Australia (see Figure 1).[6] Inselbergs are generally rounded erosional remnants protruding above a featureless landscape, considered an erosion surface. Inselbergs and the surrounding erosion surface are puzzling landforms that uniformitarian scientists have difficulty explaining.[7]

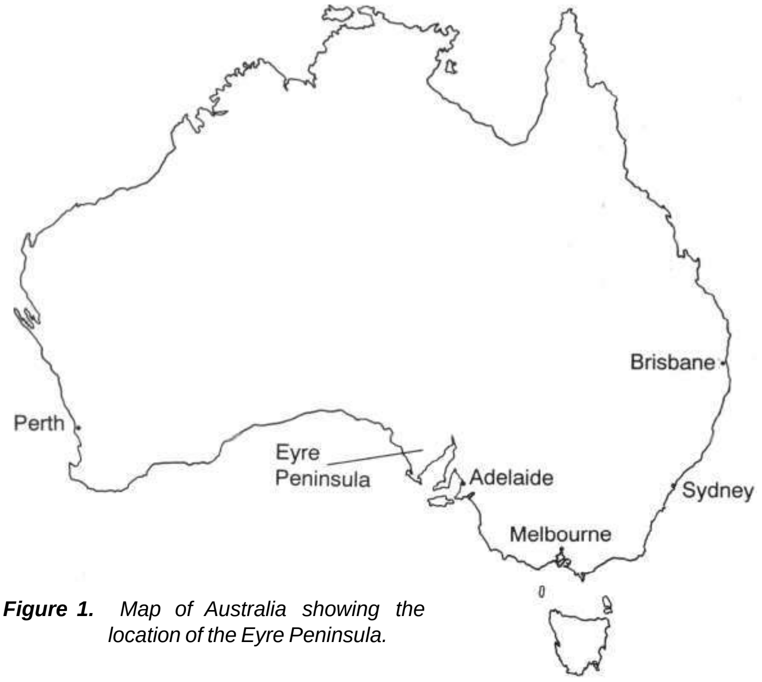

Figure 1. *Map of Australia showing the location of the Eyre Peninsula.*

The tops of inselbergs should meet most of the requirements for *in situ* cosmogenic radioisotope dating. The investigators determined the erosion rate of these inselbergs to be about 0.7 metres per million years (m/Ma), an exceptionally low rate and contrary to other estimates :-

> *'Rates of denudation as low as those we measured have no precedent in terrestrial environments or other temperature* [sic. temperate] *continents (Bierman, 1994) and have previously been measured only in the polar Antarctic desert. . .'*[8]

The investigators estimated an error of 23 to 32 per cent due to all the assumptions.

Meanwhile, the 'known' age of the Sierra Nevada striated and polished pavements was increased to about 14,000 years.[9] The new age estimate for these pavements suggests that the cosmogenic radioisotope production rate is lower and that the erosion rate of the Australian inselbergs is in the neighbourhood of only 0.5 m/Ma, less than previously estimated.

Erosional estimates made by other methods are significantly higher than those made by the cosmogenic radioisotope method.[10-12] The semi-arid climate of the Eyre Peninsula is very likely not the reason for the discrepancy. This is because semi-arid climates have relatively large denudation rates:

> *'Total denudation, brought about mainly by surface wash, reaches a maximum in the semi-arid and probably also the tropical savanna zones.'*[13]

With recognition that estimates of denudation rate are crude, Summerfield summarises denudation rate by climate and relief. For semi-arid climates of low relief, such as on the Eyre Peninsula, he specifies denudation rates in the range from 5 to 35 m/Ma.[14] This is 10 to 70 times the erosion rate calculated for the inselbergs from the *in situ* cosmogenic radioisotope technique.

Obviously, there is a significant inconsistency. Present-day erosion rates indicate the cosmogenic isotope age determinations to be much too old, like most other radioactive dating methods. The *in situ* cosmogenic radioisotope accumulation has most likely occurred since the Flood. There probably has been little erosion of these inselbergs since the retreat of the Flood waters, and the accumulation of the radioisotopes has most likely not been affected by variations in decay rates (if such variations are possible).

If the Sierra Nevada striated and polished pavements are about 5,000 years old within the creationist time-scale of a post-Flood ice age, then the worldwide production rate estimate could be multiplied by two or three times. Even at this higher production rate, we still have too much cosmogenic radioisotope accumulation in surficial rocks since the Flood, assuming that the other assumptions are close to correct.

However, there are two other assumptions that are required for the amount of *in situ* cosmogenic radioisotopes to represent past accumulation rates and the age of the landform. Both the cosmic ray intensity and the intensity of the Earth's magnetic field must have remained constant. The latter assumption is well known to be wrong among both evolutionary geologists and creationist researchers. However, the difference that changes in geomagnetism would make in the cosmogenic isotope production rate is only of second-order importance. Mainstream geologists estimate that changes in geomagnetic intensity over the past 137,000 years of geological time would not have affected cosmogenic radioisotope production by more than about 56 per cent for latitudes less than 50°, and less than 10 per cent for latitudes greater than 50°.[15] Although fluctuations and/or reversals are expected during the ice age in Russell Humphreys' geomagnetism model,[16] because of the short time-scale for these fluctuations the cosmogenic radioisotope accumulation would not be affected greatly. Therefore, the only other possibility for harmonising the amount of cosmogenic radioisotopes accumulated in the Australian inselbergs and the Sierra Nevada striated surfaces during a 5,000 year period is by postulating a significantly higher cosmic ray intensity over the early centuries following the Flood. In this case, more cosmogenic radioisotopes would be produced. This would also favour Robert Brown's hypothesis that the carbon-14 production rate was higher in early post-Flood time than it has been in recent centuries.[17]

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