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All correspondence to be addressed
to Director

NEW ZEALAND

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
THE INSTITUTE OF NUCLEAR SCIENCES

PRIVATE BAG, LOWER HUTT

26 January 1967

Dr. G. Reber,
Tasmanian Regional Laboratory, C.S.I.R.O.,
"Stowell", Stowell Avenue,
Hobart, Tasmania,
AUSTRALIA.

Dear Dr Reber,

Thank you for your inquiry of the 10th of this month which
I shall attempt to answer. There are, in fact, a number of expressions relating
C-14 activity to age: one (the older) based on the assumption that the contempo-
rary C-14 level remained (and presumably will remain) constant.

A second equation allows for the world-wide depression of
contemporary C-14 levels by the combustion of fossil fuels, while a third one
can sometimes be used to give highly accurate dates since 1955, occasionally
to the nearest month. The latter is due to the increase in atmospheric C-14
concentrations as a result of nuclear explosions. At present the C-14 level
is more or less settling at 60-65 % above the pre-1954 value. In the absence
of further (thermo)nuclear testing the C-14 concentration will fall off
asymptotically in a few hundred years due to carbon exchange with the oceans.

Under the circumstances you will understand that your
question can only be given a highly qualified answer.

If we fall back on the assumption of a constant C-14
concentration of the value usually taken for pre-industrial wood (or air),
after correcting for isotopic fractionation, then the time interval corresponding
to a certain C-14 activity is given by

$$t = T_M \ln \frac{A_O}{A_S},$$

where A_O is the standard (=assumed present) activity, A_S is the activity of
the sample, T_M is the mean life of C-14 (8033 years) and t is the time period,
which may be past (+) or future (-), depending on A_S.

With these provisos an activity of 16.8 % above the 1890
wood standard corresponds to 542 years into the future from the time of measure-
ments.

Needless to say the assumption made excluded all values
greater than the standard for actual future dates. Nevertheless when the
contemporary C-14 concentration reaches the point of 16.8 % above standard
(as it will again sometime after bomb tests have been stopped or later, by an
increase in the cosmic ray flux) it will be 542 years before the excess 16.8 %
will have worn off.

Apart from the disturbances mentioned the C-14 activity
has actually varied by (at least) a few percent during the past 5000 years, i.e.
as far back as we can check. Whether the cause(s) are galactic, solar or
terrestrial is still unanswerable.

Sincerely yours,

(H.S. Jansen)