DIMENSIONAL CHANGE WITH TIME OF GREEN INCREMENT CORES TAKEN FOR GROWTH STRESS MEASUREMENT

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(Received August 1985)

ABSTRACT

Cores of green wood taken from *Eucalyptus pilularis* and *Pinus patula* trees with a standard 5-mm increment borer reduce in diameter with time. This reduction occurs in both the longitudinal and tangential axes. The rate of reduction is exponential and is at a maximum immediately after sampling, cores reaching a constant diameter in about 24 to 48 hours. In some cases the reduction approaches 0.05 mm and is considered to be a significant variable where such cores are used for the Polge/Thiercelin method of growth stress analysis. As this reduction was not reproducible in cores taken from rewetted dry wood, it is considered to be due to growth stresses rather than the cutting action of the borer.

Keywords: increment cores, growth stress, *Eucalyptus pilularis, Pinus patula.*

INTRODUCTION

There has been considerable interest in recent years in methods of growth stress measurement. One method recently described by Polge and Thiercelin (1979) involves the measurement of the tangential diameter of 5-mm cores taken with a standard increment borer from a living tree. These authors observed that the mean tangential diameter of the cores was negatively correlated with longitudinal growth stress.

During experiments that were conducted to evaluate the Polge/Thiercelin method with Australian grown species, it was observed that successive measurements of the same core gave variable readings. The experiments described here were undertaken to determine the nature of this variation.

MATERIALS AND METHODS

Cores were taken with a standard 5-mm increment borer from living trees and branches selected so as to include wood likely to cover a range of longitudinal growth stress. For this, cores were taken from vertical and leaning trees of *Eucalyptus pilularis* Sm. and large branches of *Pinus patula* Schlecht. et Cham.

To test the effect of sampling stress-free wood, cores were also taken from rewetted dried wood of *E. pilularis* and *P. radiata* D. Don. To ensure that this wood was thoroughly saturated and stress free, blocks were boiled in water for about seven days.

The means of one hundred measurements of both tangential and longitudinal core diameters were recorded using equipment similar to Polge and Thiercelin's (constructed by Hugo Ilic, C.S.I.R.O. Division of Chemical and Wood Technology, Highett Victoria). This equipment consists of a jig that holds the core sample, a microprocessor that controls core movement past the electronic micrometer, and a VDU that displays both individual diameters and mean diameters. Core

Wood and Fiber Science, 18(4), 1986, pp. 593–597

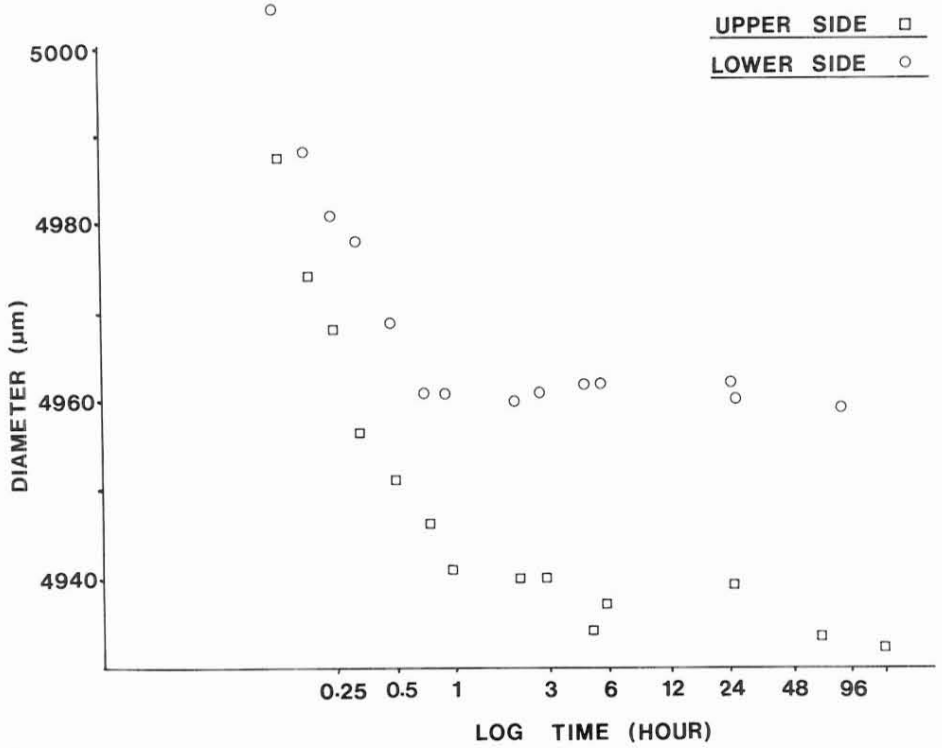

FIG. 1. Core tangential diameter versus time in a 40-year-old *Eucalyptus pilularis* (4 degree lean).

diameter was recorded every 0.125 cm. The cores were rotated to obtain measurements of the different axis. The accuracy of the measuring system was determined using a 5-mm glass rod. The repeatability was found to be ±0.001 mm. Using wood cores repeatability was ±0.004 mm when grain angle and measurement position were carefully aligned.

It was found that the first 1.5 cm of a core was often distorted because of movement of the borer about the central axis of the core. A jig was constructed to steady the entry of the borer into the tree. This enabled measurement of core diameter to be made starting from a point 0.5 cm in from the cambium.

While measurements were performed, drying out was prevented by coating the core with glycerol.

RESULTS AND DISCUSSION

The results of the core measurements are shown in Figs. 1, 2, and 3. It will be observed that in all green cores both the longitudinal and tangential diameters decreased with time. The rate of decrease was exponential, most of the reduction taking place in the first hour after sampling. However, cores taken from the rewetted dry wood of *E. pilularis* and *P. radiata* did not change in diameter with time.

The reduction in diameter was much greater in *E. pilularis* than in the pines. The least reduction was found in the upper side branchwood of *P. patula.* These

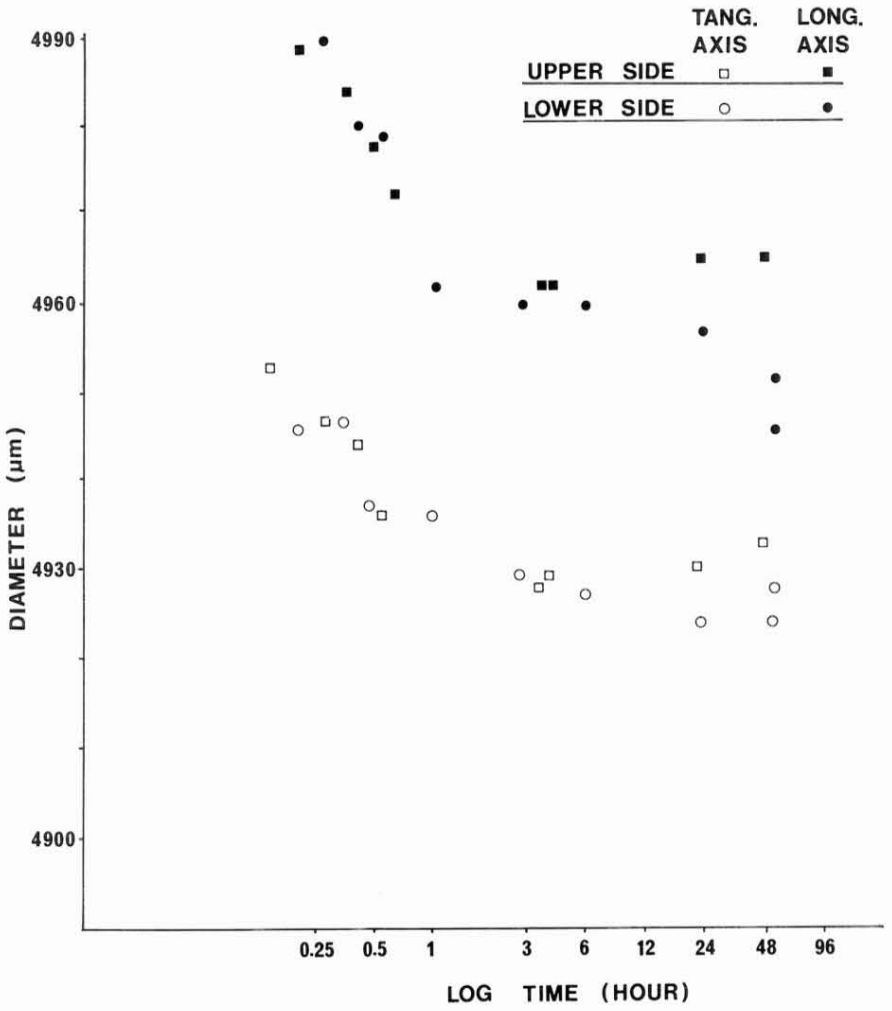

FIG. 2. Core diameter versus time in a 15-year-old *Eucalyptus pilularis* (4 degree lean).

differences between samples appear to reflect the known differences in growth stress, for example *E. pilularis* in common with many eucalypts (Boyd 1950; Chafe 1979) has a high longitudinal tension stress, whereas pines generally are considered low stress species (Jacobs 1965).

With the exception of *P. patula* lower side branchwood, the longitudinal axis of the cores was wider than the tangential axis in cores taken from both green and rewetted dry wood (Figs. 1–3). These observations are in accord with those of Polge and Thiercelin (1979). In *P. patula* lower side branchwood the tangential axis was the widest (Fig. 3).

While the diameter of all cores decreased with time, there was a marked difference between cores in respect to the rate of decrease. The greatest rate of decrease was found in the 40-year-old *E. pilularis* (Fig. 1) and the least in the *P. patula* (Fig. 3). Of the two age-classes of *E. pilularis,* 40-year-old and 15-year-old, the former showed the greatest rate of diameter reduction. Likewise the difference in

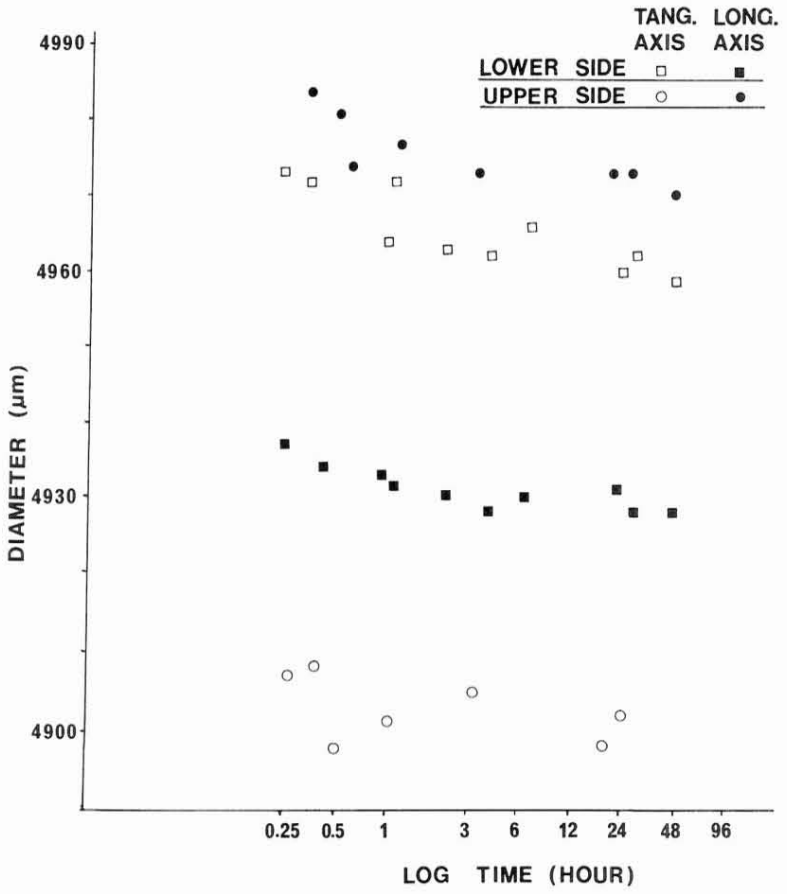

FIG. 3. Core diameter versus time in *Pinus patula* branch wood.

diameter between the cores of *E. pilularis* taken from the upper and lower sides of leaning stems were greater in the 40-year-old than in the 15-year-old. However, further sampling is required to verify the effect of age on core diameter.

As the reduction in diameter with time did not occur in cores of rewetted dry wood, it is concluded that the diameter reduction is due to growth stresses present in the tree at the time of sampling. This suggests that the magnitude of reduction with time ought to be a function of the stress in the tree; however, no such clear relationship could be found between time-related diameter reduction and markedly contrasting stress situations in the tree, that is, in the upper and lower sides of leaning trees (Figs. 1–3).

It could be suggested that the reduction in core diameter with time is an artifact produced by the pressure of the measuring device on the core. This is discounted by the observation that no reduction with time was found in rewetted, dry cores.

It would be expected that recovery from growth stress should result in expansion of the core in the tangential axis. This did not occur, and as observed by Polge and Thiercelin, tangential core diameters were smaller than longitudinal core diameters in hardwoods.

The Polge/Thiercelin method of growth stress determination requires measurements of a high degree of accuracy. The reduction of core diameters with time appears to be a significant variable that should be taken into account when using their method. This can be simply done by leaving cores for 48 hours before measuring.

The reduction of the dimensions of green timber samples with time does not appear to have been previously recorded. It poses a perplexing question in respect to the stability of green wood.

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