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THE LONGITUDINAL SHRINKAGE OF REDWOOD

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THE LONGITUDINAL SHRINKAGE OF REDWOOD¹

SCIENTIFIC RESEARCH FAILS TO BEAR OUT REPUTATION
OF SPECIES FOR EXCESSIVE SHRINKAGE ALONG THE GRAIN

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Redwood and one or two other native species of wood have the reputation of shrinkage excessively along the grain. Seemingly extravagant statements of butt joints in redwood structures opening up to an unusual degree have been made, yet measurements made at the Forest Products Laboratory on several hundred pieces of redwood from different trees, indicate that the great bulk of redwood does not shrink excessively along the grain. On the other hand, an examination of redwood siding on a large number of houses in Los Angeles revealed frequent instances of abnormally wide openings in butt joints. In some instances the openings had been filled in with putty, and in others sheet metal had been nailed over them. Only some of the butt joints had opened up, however; others were as tight as could be desired. Small slivers for microscopic examination were taken from 50 pairs of pieces of siding adjoining as many butt joints that had opened from 1/8 to 9/16 inch, to see if the wood were abnormal in any way.

A microscopic examination of 100 pieces of redwood siding forming open butt joints, already mentioned, showed that all but four of the 50 pairs had compression wood (Fig. 1) on either one or both sides of the joints. Of the four pairs that did not have compression wood on either side of the open joint, one member of a pair was wavy grained, one member of another pair was found to have compression wood some distance from the joint, and the other two pairs showed indications of having been put on in the first place with open joints, since the nails at the end showed no indication of pulling toward the end as those at practically all of the other open butt joints did. Compression wood, therefore, was almost the universal cause of open butt joints in the siding examined. It should be mentioned that the samples were taken almost entirely from joints in which the gap was especially large.

Recently a large number of measurements of the longitudinal shrinkage of redwood have been made at the Forest Products Laboratory on both virgin and

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second growth. The longitudinal shrinkage of some 600 strips of virgin and second-growth redwood was plotted against their specific gravity (Fig. 2). Some of the specimens had abnormally large shrinkage. A careful examination of the 59 specimens having a shrinkage of three-tenths of 1 percent and over showed that 41 consisted of compression wood, and of the remainder two were cross grained and the others had either very little or no summerwood. Exclusive of the points above 0.300 percent shrinkage, which for the most part represent abnormal wood, as just stated, there is a general downward trend in shrinkage with increasing specific gravity. Pieces of the soft, light springwood whittled out by themselves showed the most longitudinal shrinkage and pieces consisting entirely of the hard, dense summerwood showed the least shrinkage from the green to the oven-dry condition, in fact, some of the summerwood specimens elongated during the tests in the laboratory.

Measurements on second-growth redwood indicate that it has a larger percentage of specimens with relatively high longitudinal shrinkage than virgin growth. This is especially true of the more openly grown material. Of the specimens of wood from trees that grew in close proximity to one another, 64.5 percent shrank less than two-tenths of 1 percent, and of those that grew more openly 56.0 percent shrank less than this limit. This difference between virgin and second-growth wood was largely due to the presence, in the second-growth specimens measured, of a certain amount of the wide-ringed wood with non-dense summerwood having different structure, already referred to.

The question as to whether redwood contains appreciably more compression wood, wood light for the species, and spiral, wavy or curly grain, cannot be definitely answered at the present time, since it would require the examination of a large number of representative trees of each species to give a reasonable answer, and that has not been done so far. Of 56 old growth trees examined in connection with a specific gravity survey of redwood by the Forest Products Laboratory, 62 percent contained compression wood. This may be a larger percentage of trees than in most other species, but that fact does not necessarily mean that a larger percentage of pieces of redwood lumber contain compression wood than occurs in other commercial species. Compression wood is peculiar in that frequently it is formed only at irregularly occurring times in a tree's life. A large tree like redwood, from 500 to over 1000 years old, would, therefore, have a greater chance of developing compression wood during some time in its life than a tree of a smaller size and lower life limit.

Redwood may possibly contain a greater percentage of wood light in weight for the species than is found in several other trees, since the very narrow annual growth rings found in many of the old trees and the very wide rings in some of the second-growth trees contain a high percentage of springwood, which on account of its different cellular structure has a greater potential longitudinal shrinkage than the summerwood.

There is no reason to believe that redwood has more spiral grain than other conifers. On the other hand, less diagonal grain is produced artificially in sawing redwood than in cutting up some of the smaller, more crooked trees of

other species. Hence spiral and diagonal grain do not seem to be any more responsible for abnormal shortening of pieces of redwood than of other species.

Redwood may perhaps have a little more wavy grain than many other conifers, since wavy-grained boards are found rather frequently in redwood lumber.

The long length in which redwood lumber is usually cut and frequently used does cause greater absolute shortening of the members during drying than would occur in shorter lengths of the same or other species, other things being equal.

Since the bulk of redwood does not shrink a great deal along the grain, where did redwood get its reputation for excessive longitudinal shrinkage?

The opening of butt joints, no matter what the species or type of wood, shows that excessive shrinkage occurred after the wood was put in place, since butt joints are usually made tight when constructed. The fact that the wood at the ends of siding next to the open butt joints previously referred to frequently had sheared along the grain at the nails, causing noticeable displacement, is further evidence that shrinkage took place after the siding had been nailed on and that the open joints in general were not due to faulty carpentry. Widely open butt joints, therefore, mean in general that the wood dried in place, which in turn means that it was not dry enough when fastened in position. Even if it is dried, some openings in butt joints may result from using lumber with a high potential shrinkage. Such lumber would expand in damp weather, crushing its ends or displacing abutting pieces, and when it subsequently shrank in dry weather it would leave open joints. Much redwood lumber has been marketed and used in an insufficiently dry condition; this is known definitely. If the timber had been properly dried before use much direct end shrinkage could have been avoided and many of the pieces with abnormal shrinkage would have been thrown out on account of crookedness and would not have been used for the better class of work, and thereby trouble in use caused by end shrinkage would have been further minimized.

Siding of other species, if inadequately dried before use, would also show occasional open butt joints caused by compression wood and other abnormal types. Most other species of wood, however, could not be marketed in a wet condition without quickly deteriorating from stain and decay. Redwood, on account of its high decay resistance and natural dark color, which does not show stain readily, can be shipped and stored in a wet condition for longer periods of time.

If all virgin redwood had been properly dried before it was put into use and if the crooked pieces had been thrown out, most of the stock that has given redwood its reputation for excessive longitudinal shrinkage would have been eliminated and the size of the open joints caused by the abnormal pieces that were not eliminated would have been greatly reduced.



Figure 1.--Cross section of an 18-inch second-growth redwood log showing compression wood on the lower side. The wide rings with wide summerwood constitute the compression wood.

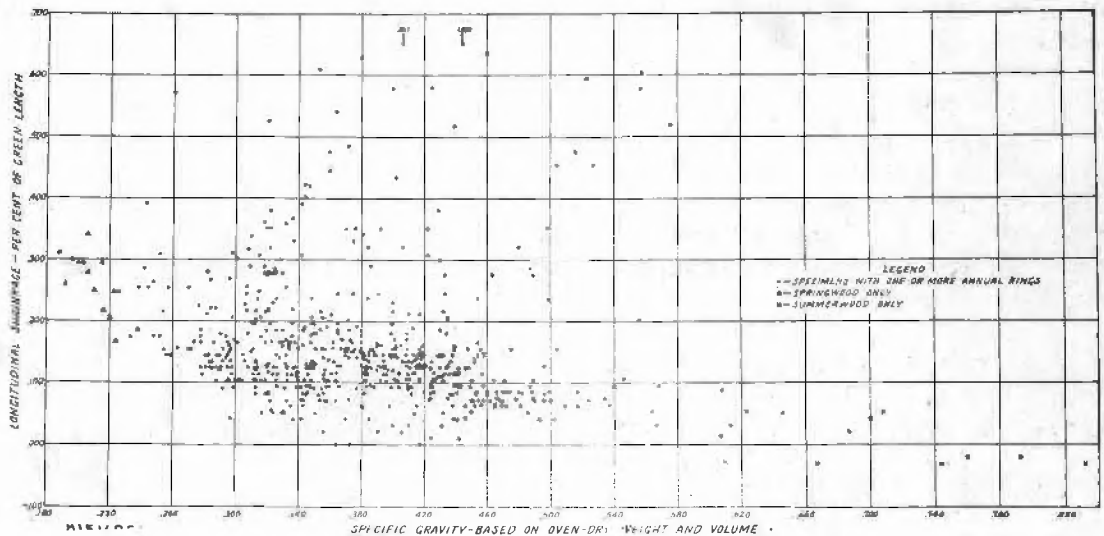


Figure 2.--Longitudinal shrinkage of redwood in relation to its specific gravity.

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