

FOUR ARCHETYPES OF THE LIVING AND FOSSIL TREES

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In recent times more and more number of relicts of plants from bygone geological periods are found in the depth of Earth or sometimes even on its surface. They are sometimes found but in small shreds; sometimes, however, larger pieces of more developed terrestrial plants, and even the trunks of huge fossilized woods or their pieces got before the pickaxes of miners. Several branches of science like, first of all, paleontology, phylogeny, taxonomy, phytogeography, climatology, geology, and sometimes even petrography want to know under which conditions these ancient plants may have lived before many hundreds of thousands or millions of years, and what kind of possible catastrophes sank the forests of the former mainlands into the depth of Earth sometimes several hundred metres deep. As these former terrestrial plants, in their individual life, had some particular organisation and structure preserving them in the depth of Earth during the millions of years in the same way as those living to-day, so the different branches of science can ascertain far-reaching scientific and practical relations from these fossilized relicts comparing them with those living to-day.

The relicts of former woody plants from the geo-historical past have remained in highly different states of continuance till our days. As a consequence of the different geological, climatological or chemical influences they have sometimes become fragile, mouldering; on other occasions, on the other hand, they became siliceous, carbonized or calcified, shortly they have got fossilized. They could be strongly deformed, often even in their original shape, during the different fossilizing and chemical processes as influenced by the pressure of the several layers; thus we can make sure of their original finer structure only with more exact examinations, first of all by the help of plant anatomy.

The whole present surface of our Earth, and the terrestrial areas of ancient ages, as well — at least since the Carboniferous period about 300 million years ago — has become populated only with four sorts of tree types. In this respect the oldest ones are the *Gymnospermae* as the

Cycas-types, much more wide-spread in the middle-ages of Earth, beside the *Coniferae*. In the middle-ages of Earth there appeared the two types of *Angiospermae*, the *Monocotyledones* and *Dicotyledones*. Each of these four types has such a particular internal structure, anatomy, differing so much from each other, that they can be separated easily even in fossil form. The internal structure of these existing four types of trees is demonstrated by the photographs Nos. 1, 2, 3 and 4. What are the anatomical peculiarities of these four archetypes of trees, separately, on the basis of which we can exactly ascertain to what tree type one or the other fossilized wood relict belonged in older times?

(1) *Cycas-type*. If in the cross-section after the central developed pith (1) one or two woody (6) and inner bark rings (7) follow, if in pith and bark (8) major mucilage canals pass (8) while in the woody part pith rays of one or more seriate (4), and in the pith rays conductive bundles (14), then a piece of trunk like that could only originate from some sort of *Cycas*-type trees (Plate 1).

(2) *Coniferae-type*. If in the sectional picture the cross-sections of the single elements (tracheids) are equal in size and arranged in radial direction close to one another in regular lines and annual sectors, if among these woody elements there are passing in radial direction pith rays of a width of one cell layer or two, and in the tree-body possibly resin-passages, as well, so from a structure like that a sure consequence can be drawn to a kind of *Coniferae* (Plate 2).

(3) *Palm-type*. If in the basic substance of the cross-section there are scattered larger cell groups, or more exactly, collateral closed vascular bundles, and if there aren't in the tree either annual rings or pith rays, then that fossil must have been some monocotyledonous woody plant generally a sort of palm type (Plate 3).

(4) *Dicotyledonous-type*. And if in the sectional picture beside the minor cavities there are much larger cavities, as well, — the cross-sections of vessels — arranged in the basic substance irregularly or regularly alone or in smaller or larger groups, and if in the tree there pass annual rings, as well as pith rays of radial direction with one layer or more, so we have to think unconditionally on the basis of that structure on some sort of *Dicotyledones* (Plate 4).

The sectional structures of these four archetypes of trees are demonstrated in Figs Nos. 1ab, 2ab, 3ab, 4ab.

We generally begin a determination of an unknown sort of living trees or fossils by investigating the cross-sections, because if the sectional structure of a living or fossilized tree is known then the original result may already give valuable informations for the further investigations carried out more exactly and in details till the final determination of the sort of tree (Cf. the explaining texts of Photographs).

It is anyway natural that inside the single types of trees the variety is extremely great; nevertheless, on the basis of their entirely peculiar anatomical marks, the single sorts or families can be separated and well determined. The four type marks are unchanged in each of the species separately, highly facilitating the separation and determination of the single fossilized trees.

References

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P. Greguss: Xylotomy of the Cycads with a Description of their Leaves and Epidermis. Budapest, 1968.
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PLATE I

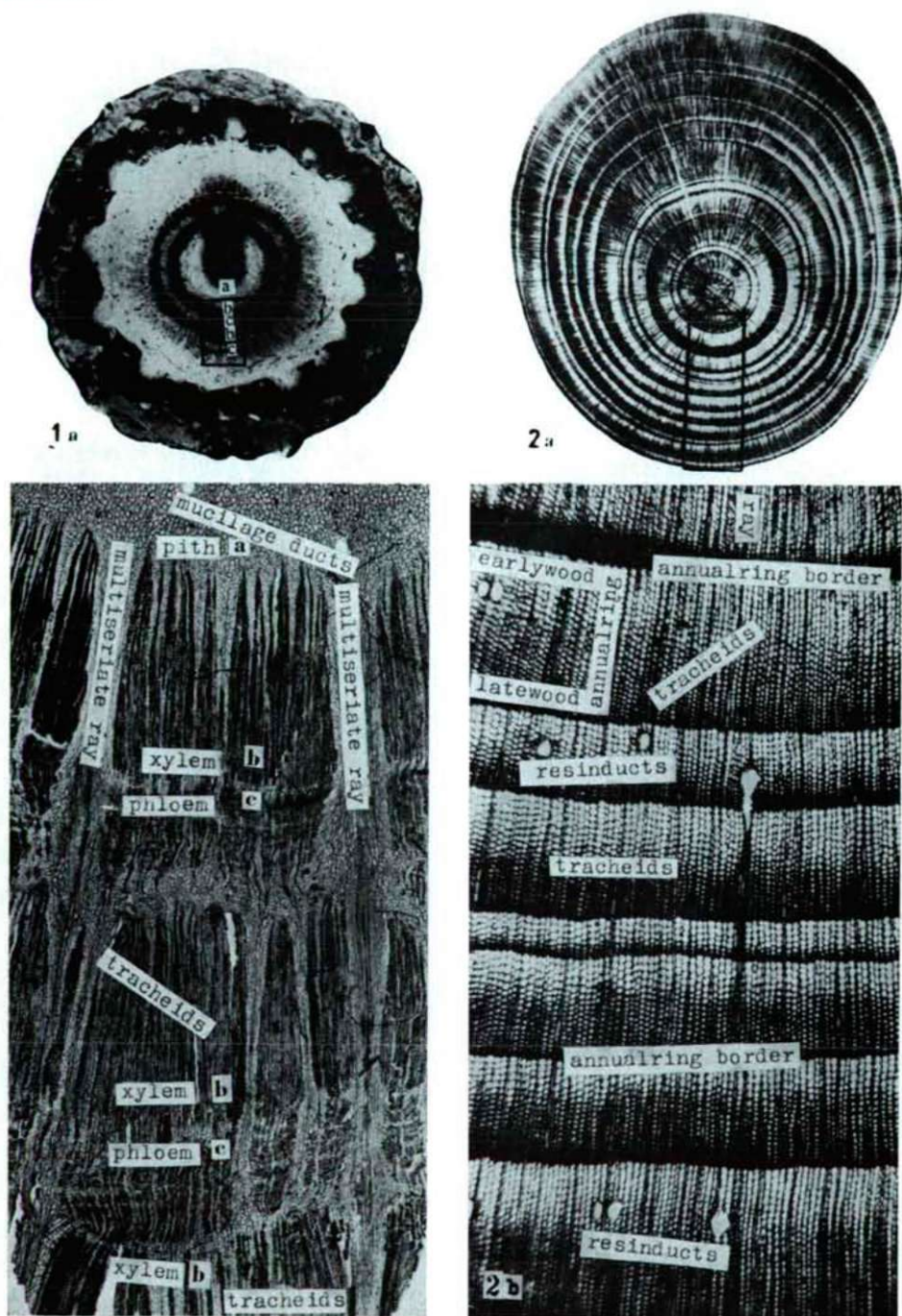
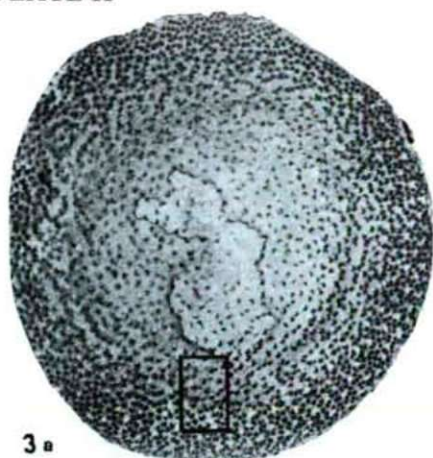
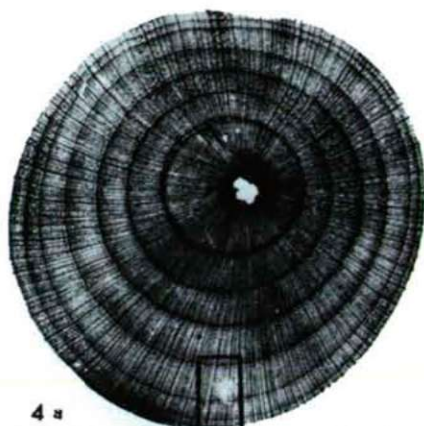


Plate I. Fig. 1a Cross section of *Cycas revoluta* 1/2 nat. size, a) pith, b) xylem part, c) phloem part. 1b. Internal structure of conductive bundles, (x15). 2a. Cross section structure of a 12-years old twig of spruce (*Picea*). 2b. Anatomical cross structure of the spruce (x30). (Original)

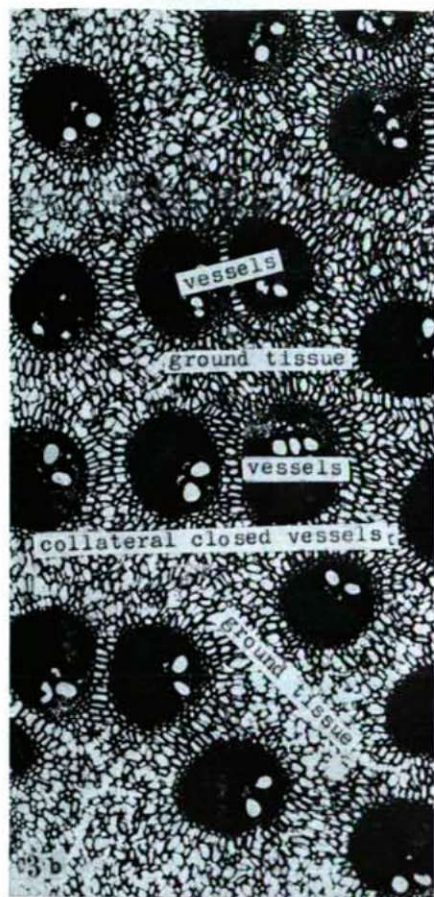
PLATE II



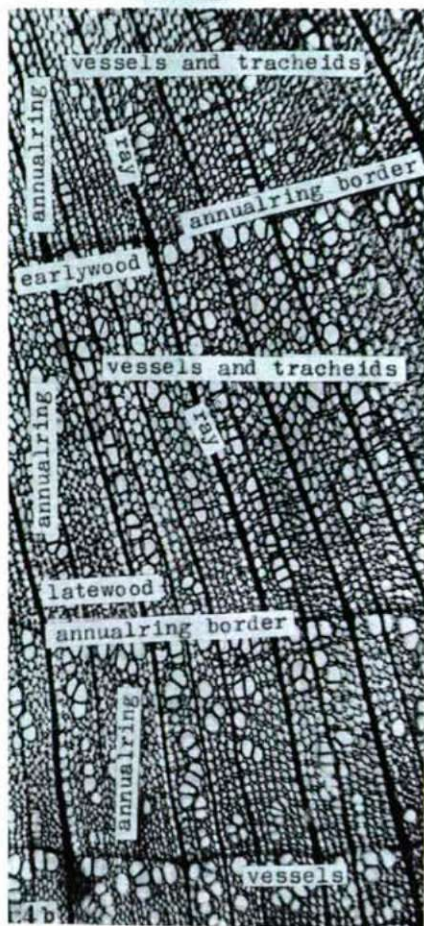
3 a



4 a



3 b



4 b

Plate II. Fig. 3a. Cross section structure of a palm stem (*Raphis*, x2). 3b. Anatomical structure of a palm stem (*Raphis*, x30). 4a. Cross section structure of a dicotyledonous tree (*Tilia* x5). 4b. Anatomical structure of a dicotyledonous tree (*Tilia*, x50). (Original)

PLATE III

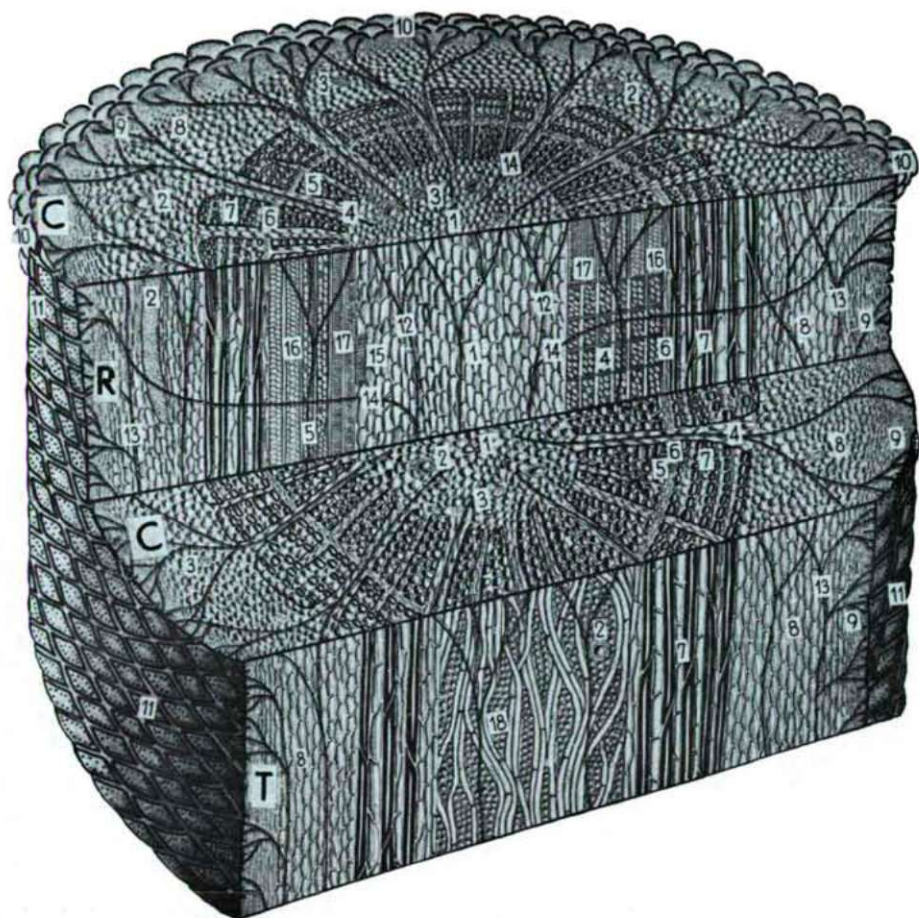


Plate III. *Schematic drawing of a Cycas stem in three planes of section.* C = cross section, R = radial section, T = tangential section. 1. Pith, 2. Mucilage canals, 3. Calcium oxalate druses, 4. Primary ray, 5. Xylem part, 6. Cambium, 7. Phloem part, 8. Cortex, 9. Periderm, 10. Vestiges of leaf bases, 11. Leaf scars, 12. Pith bundles, 13. Bundles in the cortex are passing out to the leaf bases, 14. Common bundles are passing out through the primary rays into the leaves, 15. Transfusion cells, 16. Tracheids with araucaroid pitting, 17. Tracheids with scalariform thickening, 18. Multiseriate rays. (Original, Greguss and Havas).

PLATE IV

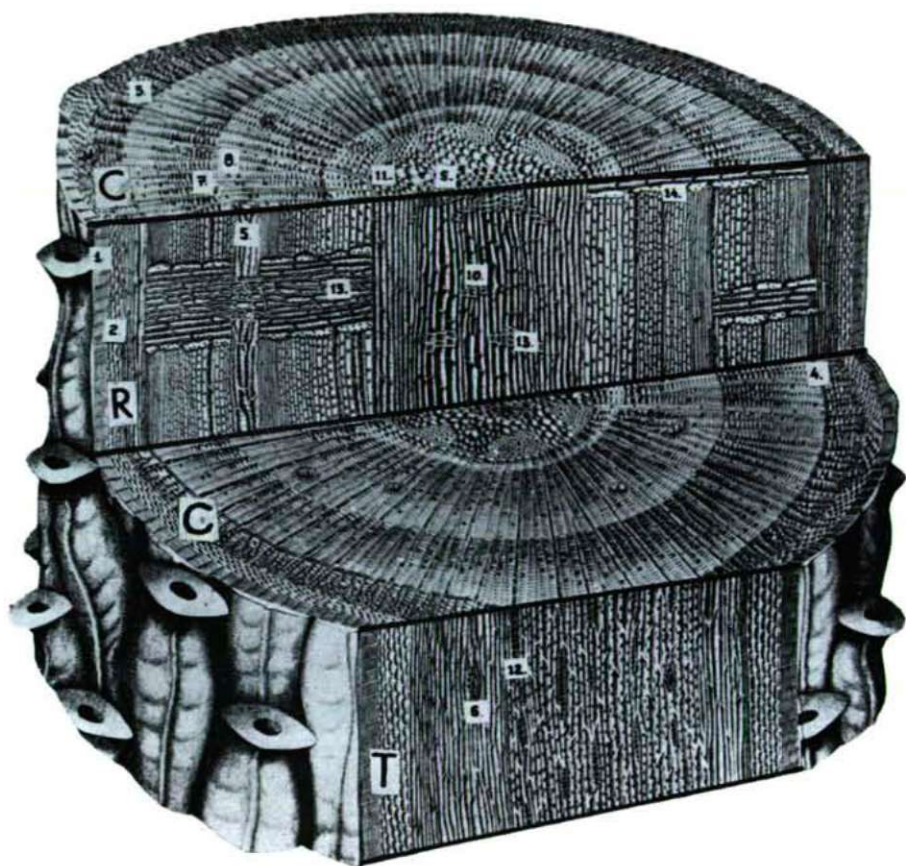


Plate IV. Schematic drawing showing the wood of a 3-years old spruce (*Picea*) twig in three planes of section. C = cross section, R = radial section, T = tangential section. 1. Epidermis. 2. Periderm. 3. Phloem. 4. Cambium. 5. Vertical resin duct. 6. Horizontal resin duct. 7. Earlywood. 8. Latewood. 9. Pith. 10. Pithsclerenchyma. 11. Primary wood. 12. Medullary ray (seen in tangential view). 13. Thick-walled ray cells. 14. Marginal cells, transverse tracheids. 15. Thick-walled epithelial cells. (Original, Greguss and Gosztanyi).

PLATE V

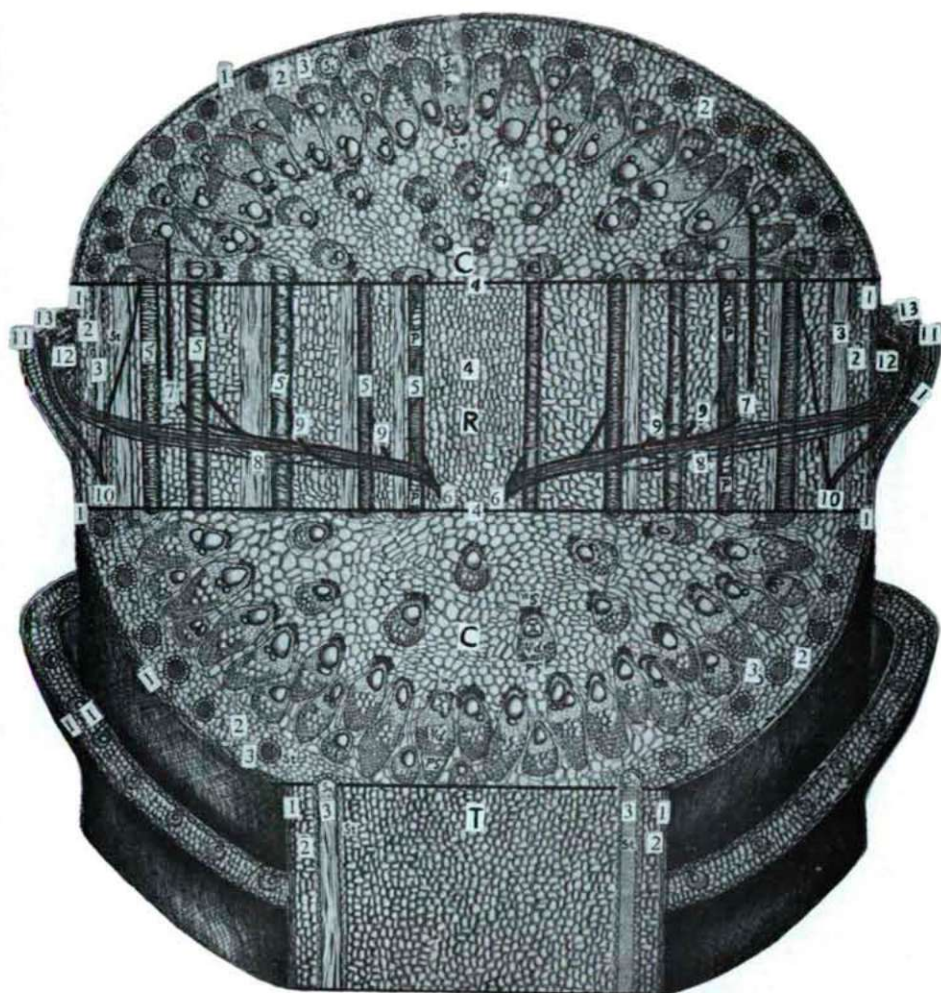


Plate V. Schematic drawing showing the wood of a palm stem (*Raphis*) in three planes of section. C = Cross section, R = radial section, T = tangential sections. Cross section, 1. Epidermis on the stem and in the leaves. 2. Parenchyma cells of the cortex. 3. Sclerenchymatous fibres (Sc) with stegmata (St). In the ground tissue the vascular bundles are sporadic. The part of the vessels: X = Xylem, Ph = phloem, Sd = dorsal sclerenchyma, Sv = ventral sclerenchyma. Radial section. On the side of the stems there are two leaf bases. Upper and lower epidermis (1—1). In the middle there is the mesophyll. The sclerenchyma fibres are with stegmata. The veins are going in the leaves. In the vascular bundle there are vessels with scalariform and spiral thickenings. (5). At P = perforation. The black and hachured line shows the running of the vessels. (6). From the mark spall the big bundles on the one side the vertical bundle (7—7) into the satellite bundle (8), after into the bridge, and go out in the leaves (11) and in the cortex. (7). In the the outercortex come little bundless (10) from under (towards) as upwards and pass out as leafbase bundles in the leaves. Tangential section. 1. Epidermis, 2. Cortex parenchyma, 3. Sclerenchyma fibres (Sc) with stegmata. (Original, Greguss and Meskó—Bóka)

PLATE VI

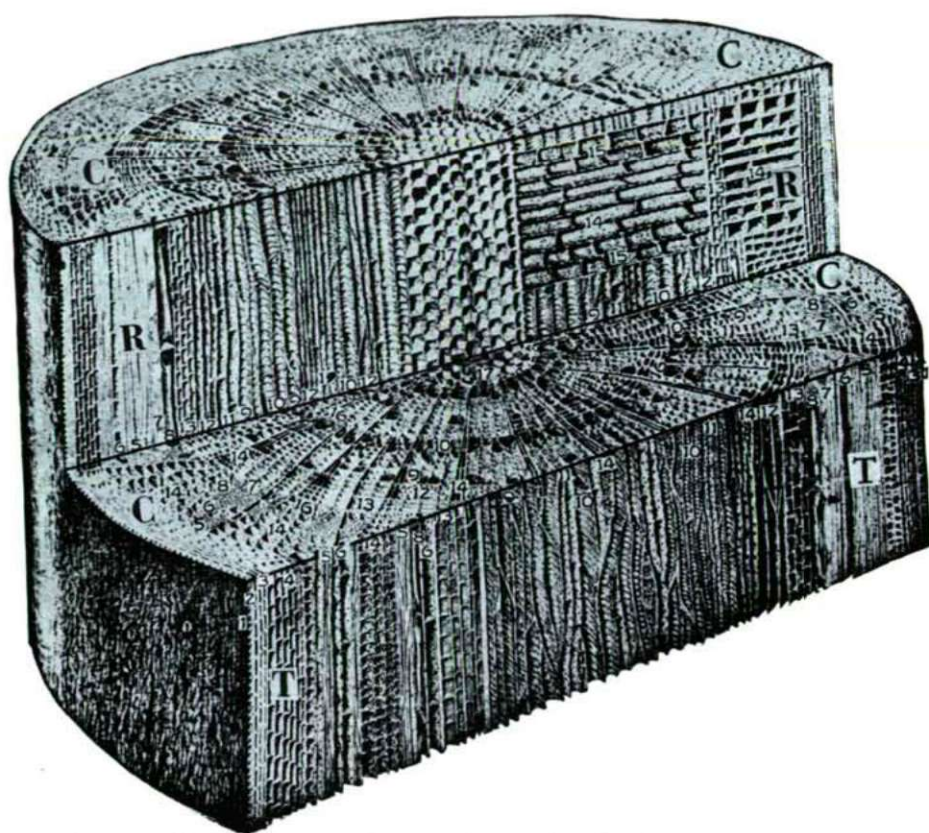


Plate VI. *The internal structure of a two years old twig of lime-tree (Tilia).* C—C = Cross section, R—R = radial section, T—T = tangential section. 1. Cuticula. 2. Epidermis. 3. Bark. 4. Bast. 5. Bast fibres. 6. Bast parenchyma cells. 7. Companion cells. 8. Sieve tubes. 9. Tracheids. 10. Vessels. 11. Wood-parenchyma cells. 12. Fibre tracheids. 13. Cambium. 14. Rays. 15. Ray-edge cells. 16. Annular border. 17. Pith (Original. Greguss and Tóth).