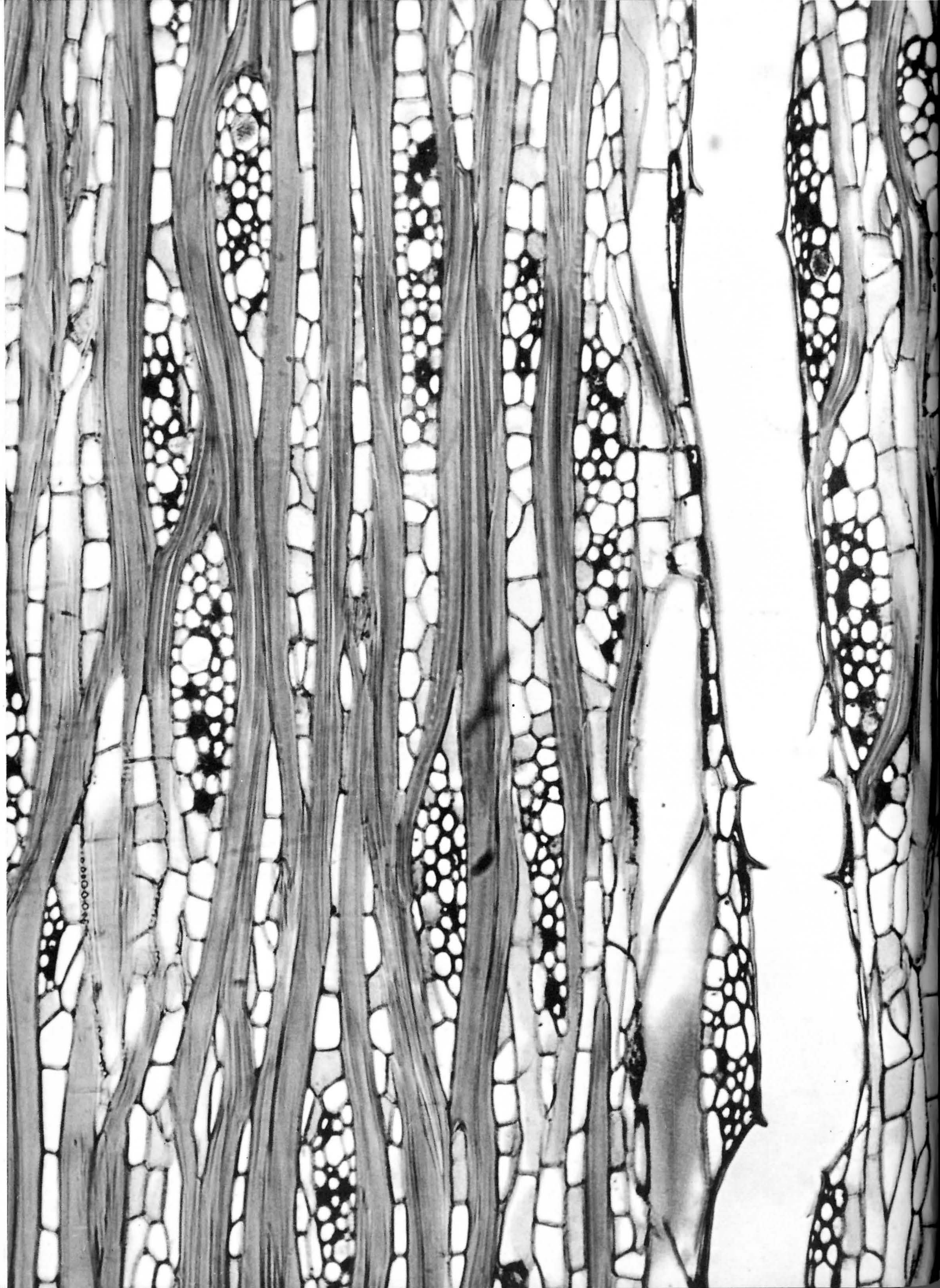
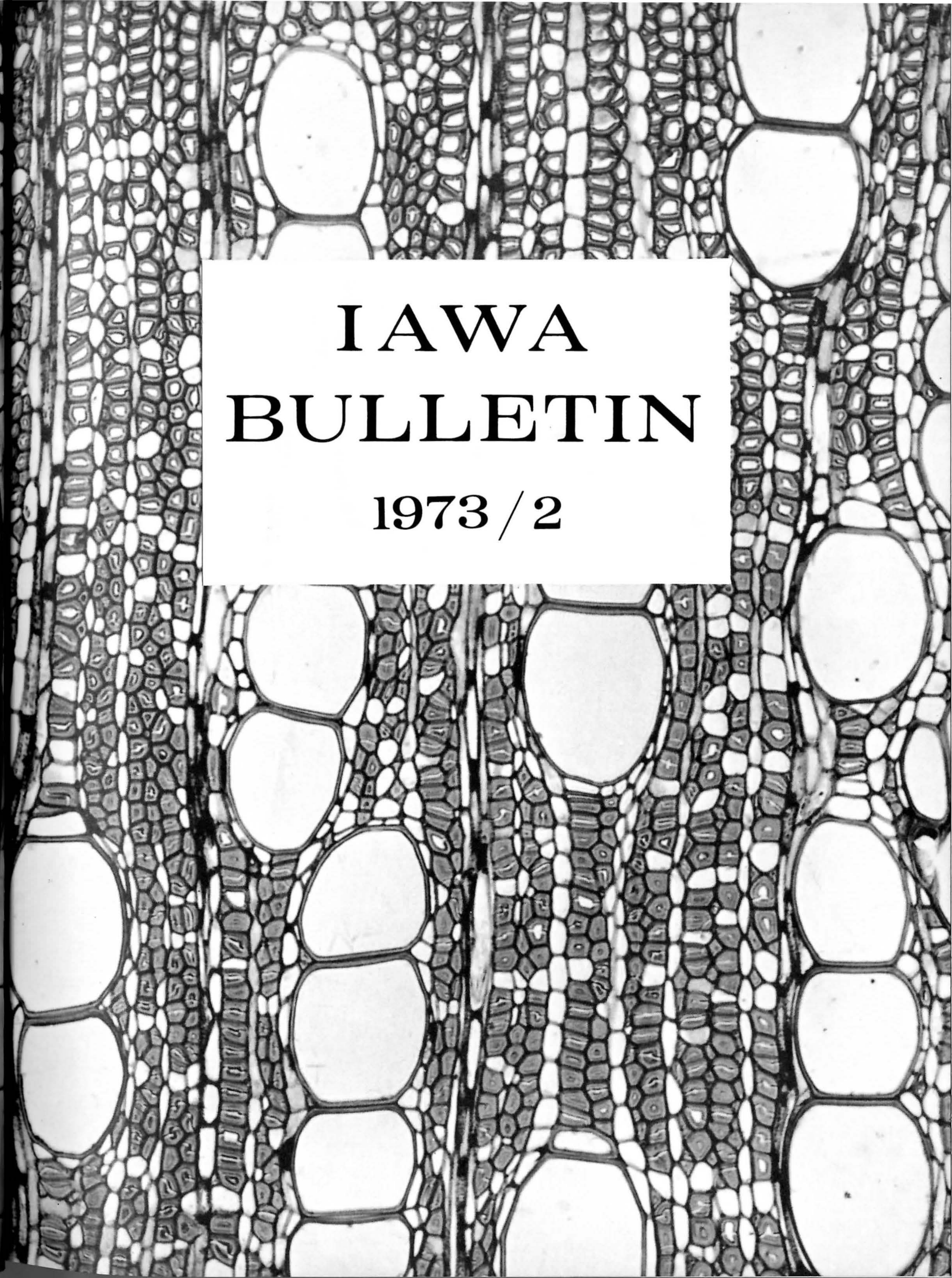




IAWA BULLETIN

1973/2

OUR COVER

The cover of the IAWA Bulletin for 1973 consists of photomicrographs at 110X of *Tetramerista glabra* Miq., family Tetrameristaceae. The sample is No. 3685 from the Malayan Forest Research Institute, Kepong, Selangor (BWC_w 13959).

The wood is of interest not only for the plentiful rhaphides in the ray cells but also because the family has very recently been extended to the Neo Tropics. Previously to Dr. Bassett Maguire's recent description in the Memoirs of the New York Botanical Garden of a new taxon in the family, this group was confined to Malaya and Borneo and consisted of only four species in a single genus.

. . . .

The International Association of Wood Anatomists was organized in 1931 to advance the knowledge of wood anatomy in all its aspects. It does this in part by attempting to promote and facilitate cooperation among the relatively small number of specialists in wood anatomy.

Prospective members are invited to write to the Office of the Executive Secretary for a copy of the Constitution, an application form, and information about IAWA. Membership dues, which includes a subscription to the IAWA Bulletin, are currently $5.00 (U. S.) per year.

EDITORIAL

It is gratifying to receive contributions for publication in the IAWA Bulletin in sufficient numbers to allow for planning as far as one issue ahead. In addition, some of the papers reaching us are very relevant to the long-standing concept of wood anatomy and should be of interest to a broad group of our readers. Keep them coming, please.

Evidently our editorial in the 1973/1 issue was provocative enough to start some members thinking about where IAWA has been and where it is going. One member took the time to write and his letter appears in the "Letters to the Editor" column in this issue. The Council needs this kind of information in planning and decision making. Why not send your opinions in for the next issue?

The next International Botanical Congress is scheduled for the summer of 1975 in Leningrad. We are in contact with the planning committee and will attempt to keep you advised of developments through this publication in future issues. Tentatively, IAWA will take responsibility for the organizing of at least two technical sessions; that is, two half-day programs. Members should be planning to offer papers for presentation at these meetings in the U. S. S. R. Papers presented at Leningrad could likely be published in the IAWA Bulletin.

W. A. Côté

C. H. de Zeeuw

Volume Percentage of Tissues in Wood of Conifers Grown in Yugoslavia

By

B. Petrić and V. Šćukanec[1]

Many properties of wood depend on its structure. Among others, a very important property is wood permeability. Permeability is the main property of wood affecting its behavior in preservation treatment, dimensional stabilization, chemical treatment, drying and probably gluing and finishing of wood.

INTRODUCTION

Wood as a part of the secondary conductive tissue possesses two conductive systems--longitudinal and radial. The longitudinal conductive system in coniferous wood is composed mainly of tracheids. The radial conductive system consists of wood rays, i.e., ray parenchyma, and in some genera, ray tracheids. As a constant characteristic of wood in some genera resin ducts and axial parenchyma are present.

Although the wood structure of coniferous species is very simple, the variation of permeability in different species and different directions is considerable. The reason for this, among others, is differences in the type and participation of elements in the wood structure.

Data on the volume participation of anatomical elements in the wood structure are scarce (1, 2, 4, 5, 6). In this connection the purpose

---

[1]Faculty of Forestry, University of Zagreb, Yugoslavia.

of the present investigation was to determine the volume participation of wood rays, axial parenchyma and resin ducts in wood of the most important home-grown and cultivated coniferous species in Yugoslavia.

MATERIALS AND METHODS

Material used in this investigation came from the permanent histological wood preparations of a collection in the Wood Structure and Preservation Section, Forestry Faculty, University of Zagreb. Each preparation was made up of mature and sound botanically fully determined wood. The origin of material is given in Table 1.

The volume participation of wood rays, axial parenchyma and resin ducts was measured with the Leitz integration instrument (3) at a magnification of 60X. The surface participation of wood rays was measured on the tangential sections, while the surface participation of axial resin ducts and wood parenchyma was measured on cross sections. Individual measurements included an area of 2.4 sq. mm. Up to 20 such measurements were made for each wood sample. The volume participation was estimated on the basis of the surface participation, assuming that participation of the mentioned elements was constant in the direction of their spread. All the data were processed statistically in the usual manner.

RESULTS AND DISCUSSION

The results of the measurement of the volume participation of wood rays, axial parenchyma and resin ducts are presented in Table 1. It is not without interest to note that in the wood of Swiss Stone Pine (*Pinus cembra* L.) the volume participation of the wood rays was very high, which might

exercise a certain effect on the radial permeability of its wood, while in the wood of Macedonian Pine (*Pinus peuce* Griseb.) and Cluster Pine (*Pinus pinaster* Ait.) a very high volume participation of axial resin ducts was discovered.

In the radial permeability of some conifer woods, ray tracheids have a very important role in the structure of the wood rays (2). Estimation of this participation will be the subject of a subsequent study.

REFERENCES

1. Huber, B. and Prütz, G.: "Über den Anteil von Fasern, Gefässen am Aufbau verschiedener Hölzer" - Holz a. Roh- u. Werkstoff, Berlin, 1/10:377. 1938.
2. Liese, W. and Bauch, J.: "On Anatomical Cause of the Refractory Behaviour of Spruce and Douglas Fir" - Journ. of Inst. of Wood Sci., 19:3-14, 1967.
3. Liese, W. and Mayer-Uhlenried, K. H.: "Zur quantitativen Bestimmung der verschiedenen Zellarten im Holz" - Zeitschr. g. wiss. Mikroskop. u. mikroskop. Tech., 63:269-275, 1956/58.
4. Panshin, A. J., de Zeeuw, C. and Brown, H. P.: "Textbook of Wood Technology", Vol. 1, New York, 1964.
5. Trendelenburg, R. and Mayer-Wegelin, H.: "Das Holz als Rohstoff", München, 1955.
6. Wagenführ, R.: "Anatomie des Holzes", Leipzig, 1966.

TABLE 1

Species	Locality	Volume Proportion of: (%)								
		Tracheids	Axial Parenchyma		Axial Resin Ducts		Wood Rays			
							Total		With resin ducts	Without resin ducts
			$\overline{X} \pm \sigma_{\overline{x}}$	$\sigma \pm f_\sigma$	$\overline{X} \pm \sigma_{\overline{x}}$	$\sigma \pm f_\sigma$	$\overline{X} \pm \sigma_{\overline{x}}$	$\sigma \pm f_\sigma$		
Abies alba Mill.	Gorski Kotar	92.555	-	-	-	-	7.445 ± 0.165	0.522 ± 0.117	-	-
Taxus baccata L.	Pelister	94.012	-	-	-	-	5.988 ± 0.185	0.568 ± 0.127	-	-
Cupressus sempervirens L.	Rab	94.218	0.202 ± 0.038	0.119 ± 0.027	-	-	5.580 ± 0.184	0.582 ± 0.130	-	-
Juniperus excelsa Bieb.	Pelister	91.483	0.255 ± 0.025	0.080 ± 0.018	-	-	8.261 ± 0.151	0.477 ± 0.107	-	-
Picea abies Karst.	Pohorje	94.052	-	-	0.140 ± 0.035	0.110 ± 0.025	5.948 ± 0.300	0.948 ± 0.212	0.765	5.183
Pseudotsuga taxifolia Britt.	Pohorje	92.435	-	-	0.350 ± 0.048	0.137 ± 0.034	7.215 ± 0.163	0.515 ± 0.115	0.842	6.373
Larix decidua Mill.	Varaždin	93.442	-	-	0.418 ± 0.135	0.427 ± 0.096	6.130 ± 0.190	0.602 ± 0.135	0.660	5.470
Pinus sylvestris L.	Vrhovine	93.012	-	-	0.583 ± 0.087	0.349 ± 0.062	6.405 ± 0.170	0.538 ± 0.120	0.928	5.477
Pinus nigra Arnold	Vrhovine	94.132	-	-	0.380 ± 0.052	0.164 ± 0.037	5.488 ± 0.115	0.365 ± 0.081	0.758	4.730
Pinus halepensis Mill.	Mljet	92.964	-	-	0.525 ± 0.076	0.239 ± 0.054	6.511 ± 0.126	0.564 ± 0.089	0.699	5.812
Pinus cembra L.	Jul. Alpe	89.828	-	-	0.936 ± 0.113	0.358 ± 0.081	9.236 ± 0.318	1.006 ± 0.225	1.199	8.037
Pinus peuce Griseb.	Prokletije	92.294	-	-	1.369 ± 0.140	0.444 ± 0.099	6.337 ± 0.222	0.702 ± 0.157	1.105	5.232
Pinus strobus L.	Kostanjevica	93.324	-	-	0.926 ± 0.112	0.356 ± 0.079	5.290 ± 0.289	0.916 ± 0.204	0.760	4.530
Pinus heldreichii var. *leucodermis* Markgr.	Prokletije	93.342	-	-	0.537 ± 0.058	0.156 ± 0.035	6.221 ± 0.153	0.486 ± 0.108	0.602	5.619
Pinus pinaster Ait.	Rab	93.271	-	-	1.448 ± 0.246	0.777 ± 0.174	5.281 ± 0.132	0.418 ± 0.098	0.677	4.604

$\overline{X}$ = arithmetic mean of sample
$\sigma_{\overline{x}}$ = standard error of arithmetic mean
σ = standard deviation of sample
f_σ = standard error of standard deviation

On the Morphology of Spiral Thickenings

By

R. A. Parham[1] and Hilkka Kaustinen[2]

Spiral or helical thickenings in secondary xylem are found as ridges of cell wall material usually comprising an S-helix about the cell axis over a portion or the entire lumen surface of certain cells (Panshin and de Zeeuw, 1970). They have been identified via the light microscope in the longitudinal tracheids of only a few gymnosperms: *Pseudotsuga, Taxus, Torreya, Cephalotaxus, Amentotaxus,* in some species of *Picea* and sporadically in *Larix laricina* as well as the hard pines. Spiral thickenings also occur in various angiosperms in vessel elements, fiber tracheids, vascular tracheids, and even some ray cells (Panshin and de Zeeuw, 1970; Phillips, 1966). Their limited distribution consequently makes them a useful feature for the identification of certain woods.

Early observations on the occurrence and deposition pattern of spiral thickenings were reviewed by Wardrop and Dadswell (1951). Subsequent studies have promoted essentially two different opinions as to the exact nature of the helix. Some investigators contend that the spirals are loosely attached to the S3 wall layer, possibly being formed as an additional elaboration and at a different orientation (Frey-

---

[1]Assistant Professor, The Institute of Paper Chemistry, Appleton, Wisconsin 54911, U. S. A.

[2]Research Fellow, The Institute of Paper Chemistry, Appleton, Wisconsin 54911, U. S. A.

Wyssling, 1959; Wardrop, 1964; Wardrop and Dadswell, 1951). They do, however, regard it as reasonable to consider the helix as secondary wall substance but differing in its extent of lateral development (Hodge and Wardrop, 1950). The other major opinion is that the spirals are definitely an integral part of the S3 (or S2 in compression wood) (Casperson, 1965; Wergin and Casperson, 1961). An intermediate view is offered by Côté (1967). In *Pseudotsuga* he found the thickenings identical in composition to the S3 layer with which they tended to blend. However, in *Tilia americana*, he found the spirals more ropelike, and they seemed to be apposited at a later time than the S3, but perhaps by the same mechanism. Thus, the exact nature of the thickenings remains a subject for debate.

Electron microscopic investigations of helical thickenings appear to have centered around those in *Pseudotsuga, Taxus,* or *Tilia,* with a few casual observations on *Pseudopanax* and *Hoheria* (Meylan and Butterfield, 1972). Consequently, the potential morphological variability of this structure in the wood of a number of kinds of trees is unrecorded. The present report describes this variability to some extent in 3 gymnosperms and 19 angiosperms. The results do not yield any new evidence as to the origin or function of helical thickenings, but they do illustrate a wide range of morphology and suggest that developmental studies will probably be necessary to correctly define the relationship of the spirals to the cell wall.

EXPERIMENTAL

Small cubes of dry wood were boiled in water for 2 hours and then sectioned radially at about 100 μm. Sections were then extracted for 1 hour with 2:1 benzene:ethanol, ethanol, and air-dried between glass slides. They were metallized for the SEM with successive coatings (about 20 nm) of carbon and 60:40 Au/Pd and examined with a JSM-U3 at 15-25 kv. All observations refer to spirals in the longitudinal tracheids of the softwoods and only to the vessel elements in the hardwoods.

RESULTS AND DISCUSSION

Softwoods. Helical thickenings in each of the three conifers examined illustrated a different morphology. *Pseudotsuga menziesii* (Mirb.) Franco, as also described elsewhere (Côté, 1967), showed spirals predominantly in earlywood, but frequently the thickenings were seen in even the last-formed latewood cells (Fig. 1). The spirals formed a closely spaced, flat helix with extensive branching and tended to blend with the S3 at various locations. All thickenings possessed a distinct microfibrillar structure within and all appeared closely associated with the lumen surface (Fig. 2).

Variably spaced, often discontinuous, and intermittent detachment from the S3 describes the ropelike spirals in *Torreya taxifolia* Arn. (Fig. 3). They were most prominent in earlywood and were easily dislodged from the wall. A similar spiral characterized *Taxus brevifolia* Nutt. (Fig. 4), but here the helix was either S or Z and was more firmly bound. They occurred throughout the annual increment and were widely, but regularly, spaced within each tracheid. In neither *Torreya* nor *Taxus* could the microfibrillar nature of the helix be seen, probably because of some masking incrustant (Fig. 5).

Hardwoods. It was convenient here to classify the helical thickenings into three major categories: unbranched or only rarely so, branched, or swirled. Within these categories further subdivisions were necessary, and in the text that follows are defined as:

Type 1 - spirals that are closely bound to, and periodically merge with, the lumen surface; they are usually not very prominent (as seen in the SEM).

Type 2A - very prominent spirals, somewhat or very loosely attached to the cell wall.

Type 2B - very prominent spirals but firmly attached to the wall.

Type 2C - a combination of 2A and 2B.

Unbranched Spirals

Type 1 - found largely or totally within latewood of *Ulmus thomasii* Sarg., *Celtis occidentalis* L., and *Robinia pseudoacacia* L. (see Fig. 6); only a rare tendency toward branching or swirling; spirals often more distinct at cell corners.

Type 2A - characterized all vessel elements observed in *Ilex opaca* Ait. (Fig. 7) and *Tilia americana* L. (Fig. 8) and in most vessels of *Ostrya virginiana* (Mill.) K. Koch; only in very last portion of latewood of *Catalpa speciosa* Warder and were flatter here than in *Tilia*.

Type 2B - in *Ulmus americana* L. and *Prunus serotina* Ehrh. (Fig. 9); widely spaced and with a slight tendency for branching or swirling in the latter species.

Branched Spirals

Type 1 - wide, branchlike spirals were seen in *Magnolia grandiflora* L., similar to those in *Pseudotsuga* (see Fig. 10); occurred in an irregular pattern and blended with the cell wall in *Nyssa sylvatica* Marsh., and were found only at the vessel tips (Fig. 11).

Type 2B - only in latewood of *Ulmus rubra* Mühl. (Fig. 12), and in some latewood vessels of *Morus rubra* L. where they tapered into the cell wall; soft maple, *Acer rubrum* L., had spirals in all vessels observed (Fig. 13) and exhibited a slight tendency for swirling.

Type 2C - as very prominent ridges in latewood vessels of *Gleditsia triacanthos* L. (Fig. 14) but only as indistinct ridges in earlywood (Fig. 15) where they supposedly do not occur (Panshin and de Zeeuw, 1970); appeared in only some latewood cells of *Aesculus octandra* Marsh., often tapering into the wall (Fig. 16).

Swirled Spirals

These spirals were distinct in latewood vessels of *Gymnocladus dioicus* (L.) K. Koch (Fig. 17), all vessels observed in hard maple, *Acer saccharum* Marsh. (Fig. 18) and in some vessels of *Carpinus caroliniana* Walt. near the cell tips.

LITERATURE CITED

1. Casperson, G. 1965. The anatomy of reaction wood (in German). Svensk Papperstidn. 68: 534-544.

2. Côté, W. A. 1967. Wood ultrastructure. An atlas of electron micrographs. University of Washington Press, Seattle, Washington.

3. Frey-Wyssling, A. 1959. Die Pflanzliche Zellwand. Springer-Verlag, Berlin.

4. Hodge, A. J. and A. B. Wardrop. 1950. An electron microscopic investigation of the cell wall organization in conifer tracheids and conifer cambium. Aust. J. Sci. Res. B3: 265-269.

5. Meylan, B. A. and B. G. Butterfield. 1972. Three-dimensional structure of wood. A scanning electron microscope study. Syracuse University Press, Syracuse, N. Y.

6. Panshin, A. J. and C. de Zeeuw. 1970. Textbook of Wood Technology. Vol. I, 3rd Ed., McGraw-Hill Book Co., New York.

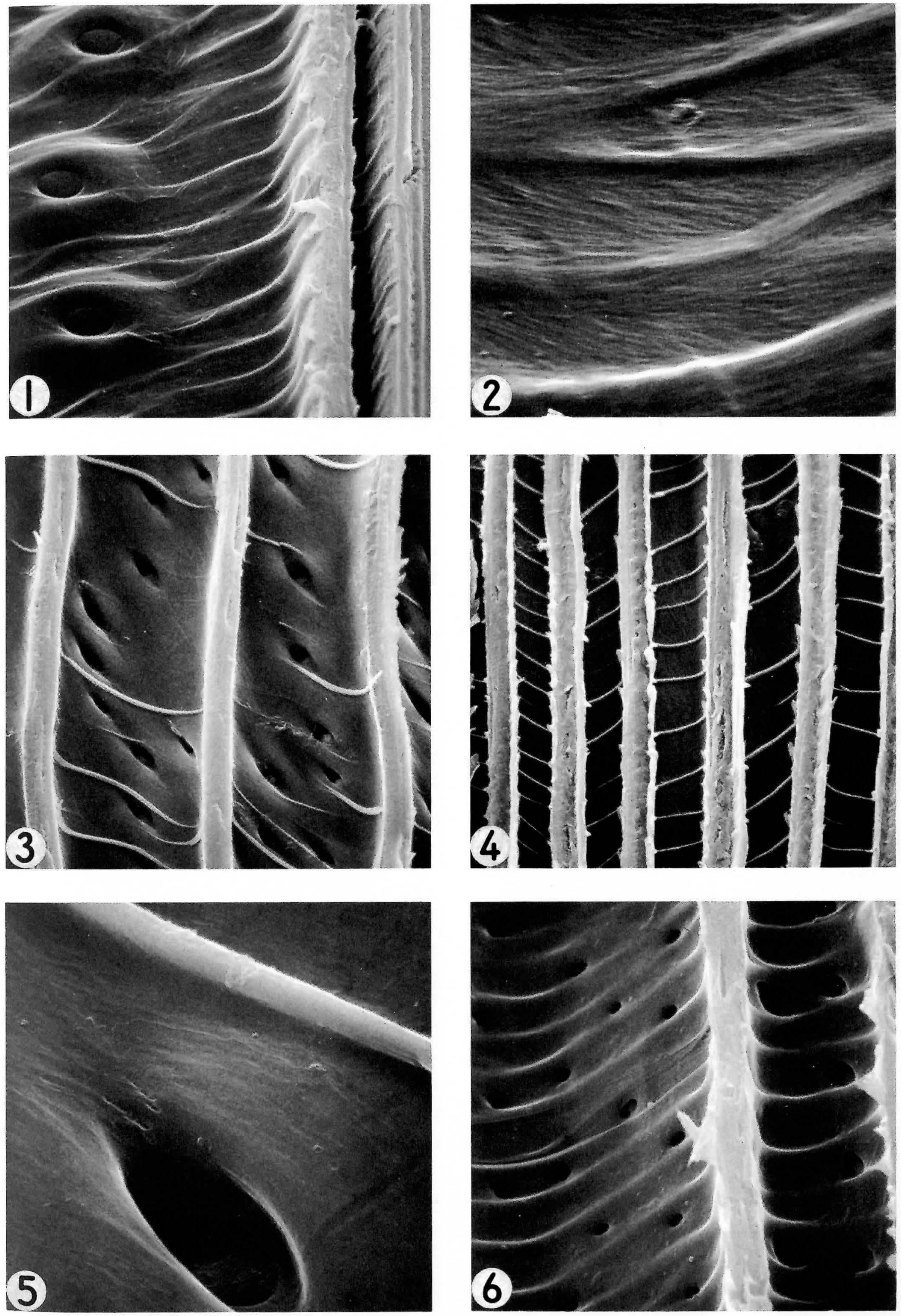
7. Phillips, E. W. J. 1966. Identification of softwoods by their microscopic structure. Dept. Sci. Indust. Res. For. Prod. Bull. No. 22, London.

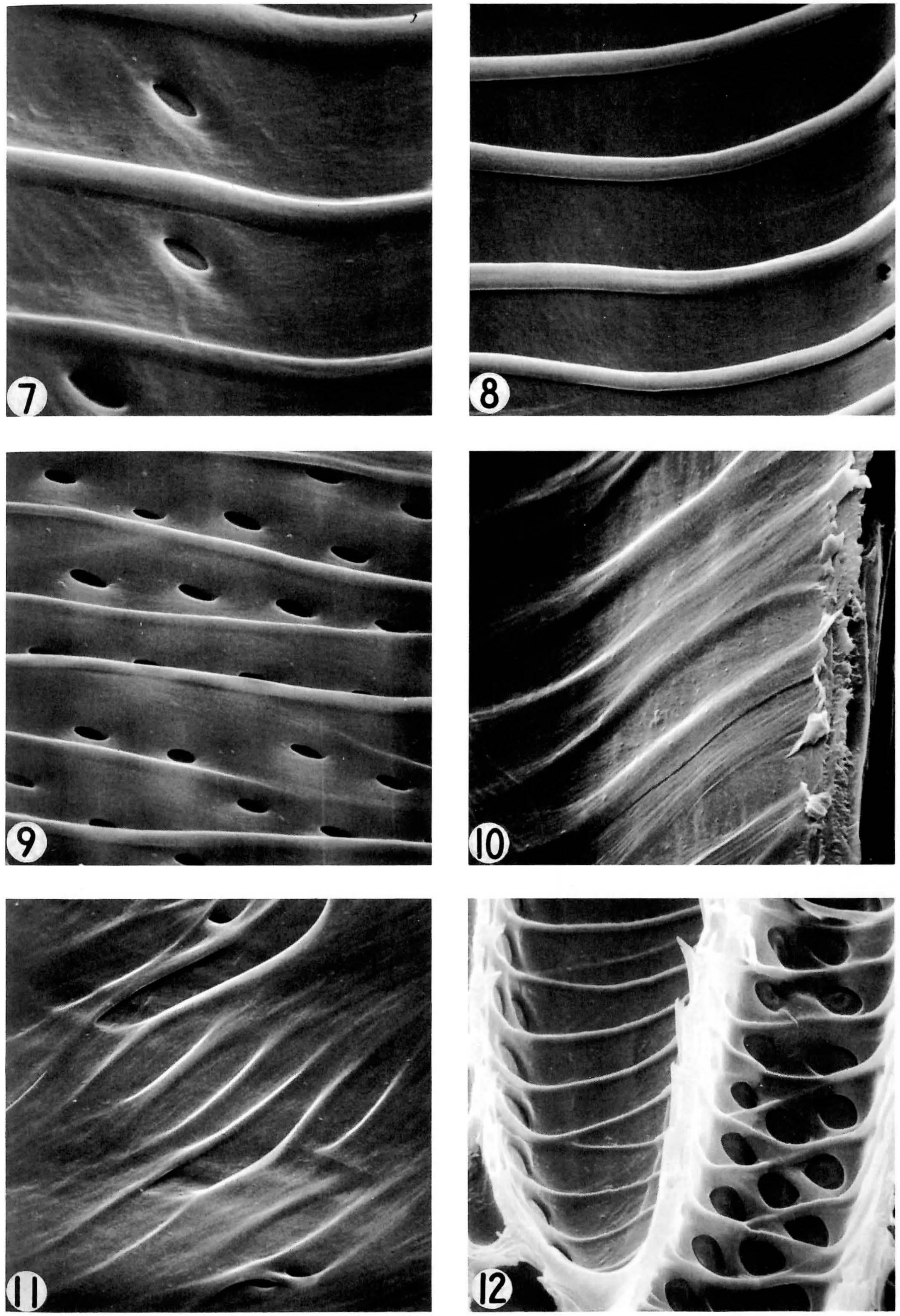
8. Wardrop, A. B. 1964. The structure and formation of the cell wall in xylem. p. 87-134. In M. H. Zimmermann (ed.): The formation of wood in forest trees. Academic Press, New York.

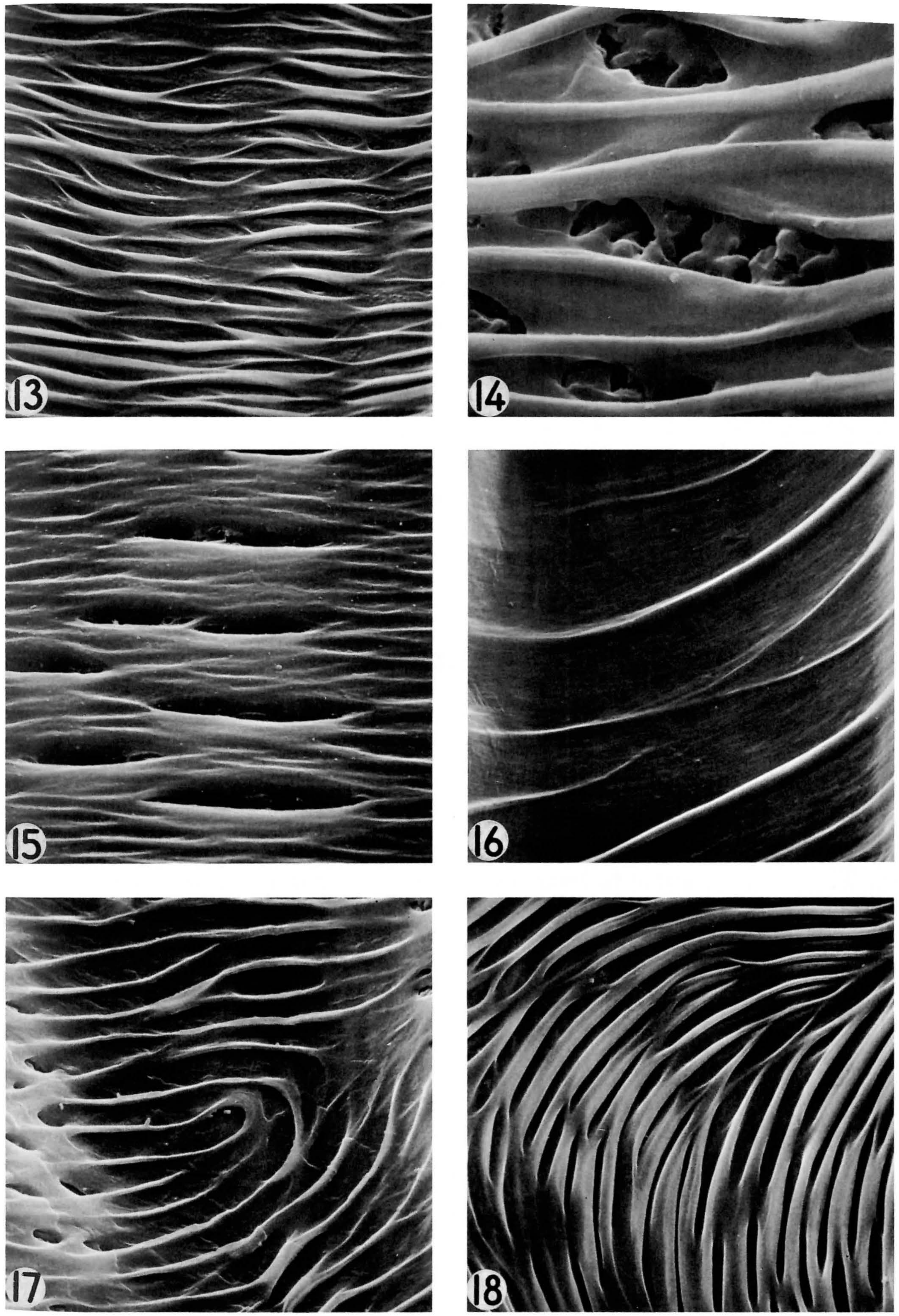
9. Wardrop, A. B. and H. E. Dadswell. 1951. Helical thickenings and micellar orientation in the secondary wall of conifer tracheids. Nature 168: 610-612.

10. Wergin, W. and G. Casperson. 1961. Über Entstehung und Aufbau von Reaktionsholzellen. 2. Mitt. Morphologie der Druckholzzellen von *Taxus baccata* L. Holzforsch. 15: 44-49.

FIGURES


1
2
3
4
5
6


7
8
9
10
11
12


13
14
15
16
17
18

ASSOCIATION AFFAIRS

Nominating Committee Formed

The Council has appointed a three-member committee to prepare a list of nominees for the 1973-1976 Council. The committee consists of Dr. William C. Dickison, Dr. Susan M. Jutte, and Dr. John F. Levy. A ballot for the election of the new Council will be circulated among the members by approximately May 1. Members are urged to vote as early as possible so that the new Council can begin functioning without further delay.

Membership Directory Changes

Address Changes

Dr. M. W. Bannan
68 Edenbridge Drive
Islington, Ontario
Canada M9A 3G2

Mr. J. D. Brazier
Princes Risborough Laboratory
Building Research Establishment
Princes Risborough, Aylesbury
Buckinghamshire HP 17 9 PX, England

Dr. Chris Davidson
Los Angeles County Museum of Natural History
900 Exposition Boulevard
Los Angeles, California 90007

Dr. J. M. Dinwoodie
Princes Risborough Laboratory
Building Research Establishment
Princes Risborough, Aylesbury
Buckinghamshire HP 17 9 PX, England

Eng. M. P. Ferreirinha
Presidente do Instituto dos Produtos Florestais
Rua Filipe Folque
10-J
Lisboa-1, Portugal

Dr. John W. Hall
Department of Botany
University of Minnesota
St. Paul, Minnesota 55101

Mr. Frank W. Hankins
P. O. Box 478
Alpine, Texas 79830
(Sept. - March)

Dr. James Henrickson
Department of Biology
California State University
5151 State University Drive
Los Angeles, California 90032

Address Changes (cont'd)

Dr. Clayton T. Keith
Eastern Forest Products Laboratory
Department of the Environment
Montreal Road
Ottawa, Ontario K1A 0W5
Canada

Miss Joyce W. Lanyon
The Forestry Commission of N. S. W.
Wood Technology Division
P. O. Box 100
Beecroft, N. S. W. 2119
Australia

Dr. Anders E. Lund
Texas Forest Service
College Station, Texas 77843

Mr. Alain Mariaux
Centre Technique Forestier Tropical
45 bis, Avenue de la Belle Gabrielle
94130 Nogent Sur Marne, France

Dr. Vladimír Nečesaný
State Forest Products Research
Institute
Lamačska 5
CS-891 29 Bratislava, Czechoslovakia

Monsieur Didier Normand
Centre Technique Forestier Tropical
45 bis, Avenue de la Belle Gabrielle
94130 Nogent Sur Marne, France

Mr. Wallace J. Smith
Forest Products Research Branch
Queensland Department of Forestry
GPO Box 944
Brisbane, Q. 4001, Australia

Dr. Michael A. Taras
Forestry Sciences Laboratory
Grade & Quality of Southern Timber
Carlton Street
Athens, Georgia 30602

Resignation

Mr. J. F. Leroy
Laboratoire de Phanerogamie
Museum National d'Histoire Naturelle
16, rue Buffon
75 Paris (5ème), France

Member Deceased

We have learned through Honorary Member B. J. Rendle that Dr. Thomas E. Wallis of 21 Sunbury Avenue, Mill Hill, London, England, a long-time member of IAWA, died peacefully on March 7, 1973, at the age of 96.

New Membership Directory

It is our intention to publish a new Membership Directory to be distributed with the 1973/3 issue of the IAWA Bulletin. Since most address changes come to our attention with submission of dues payments, we have delayed preparation of the new Directory to a time when it is hoped most dues will have been paid. Please send in any address changes or anticipated changes in your listing by June 30.

Change of Membership Status

In keeping with the recent constitutional amendment for a "Retired" category of membership, three members have requested their change of status. They are: Professor K. A. Chowdhury, Professor Alexis J. Panshin, and Mr. Ralph O. Marts. These members retain all of the privileges previously held with the exception of the right to vote.

Multilingual Glossary

In a recent inventory we found that we still have a very large supply of the Multilingual Glossary of Terms Used in Wood Anatomy. A few members have purchased these publications in bulk for use in class or for distribution as gifts or for other purposes. The Association can afford to distribute this publication in bulk quantities at $2.00 per copy although it has been sold at $3.00 per copy to bookstores and on individual orders. Members interested in obtaining copies of this very useful reference for student use or for some other purpose are invited to place their order directly with the Office of the Executive Secretary. This will help to augment our limited Association income.

WOOD ANATOMY ACTIVITIES AROUND THE WORLD

Request for Wood Specimens

Following a taxonomic revision of the family CRYPTERONIACEAE at the Rijksherbarium, Leiden, a comparative anatomical study of the genera, now thought to belong to this family, is envisaged. Vouchered wood specimens of the genera *Axinandra* (from Ceylon and Borneo), *Crypteronia* (from S. E. Asia), *Dactylocladus* (from Borneo), *Alzatia* (from Peru) and *Rhynchocalyx* (from South Africa) will be needed for such a study. It should be noted that *Dactylocladus* and *Axinandra* were formerly in the MELASTOMATACEAE.

I would much appreciate receiving any wood specimens, if possible with all data concerning the corresponding herbarium specimens, belonging to these genera.

P. Baas
Rijksherbarium
Schelpenkade 6
Leiden, The Netherlands

Tetrameristaceae in the Neotropics

The creation of the genus *Pentamerista* Maguire from material collected by the New York Botanical Garden in the Guiana Highlands of South America has added a second genus to the Tetrameristaceae and reduces the genus *Tetramerista* to a single species. This new genus augments the listing of plant groups which link the ancient land masses of South America and Southeast Asia (See note concerning the cover for the 1973 Bulletin). The publication describing the two known species in the family should be of

interest to anatomists because of the prominent role played by wood structure and vegetative morphology in defining the relationships existing between *Pentamerista neotropica* Maguire and *Tetramerista glabra* Miquel.

The pertinent reference is: Maguire, B., C. de Zeeuw, Y. Huang and C. C. Clare, Jr., Tetrameristaceae, Memoirs of the New York Botanic Garden 23: 165-192 (1972).

1973/3 Issue

In the next issue of the Bulletin we will carry a book review of the new book by Professor Pal Greguss, "Xylotomy of the Living Conifers". Dr. de Zeeuw's analysis is now in preparation.

LETTERS TO THE EDITOR

Dear Editors:

"I was interested to read the editorial of the 'New Years' issue of the IAWA Bulletin. Most members will, I think, wholeheartedly agree with the extended scope of the Association, though I do not feel that this involves any major change in policy. Scanning the last year's issues of the Bulletin there is already a great diversity of 'subdisciplines' represented in the papers published. One has, I think, to be careful about including too much on wood technology, since it might easily result in too wide a scope of the association, so that the advantages of having a group of people with similar interests might be lost. This statement is not valid, of course, for those technological studies which primarily focus on wood structure and derive their technologically important conclusions from anatomical studies.

I would like to challenge your statement that fewer studies of systematic wood anatomy are being done today. Certainly, this discipline is very unpopular in forest products research establishments in most countries nowadays, but fortunately there is a tendency of institutes for systematic botany to take over these studies, so impressively shown to be rewarding by many senior wood anatomists in forest products institutes."

(3/8/73) Signed: Pieter Baas