wissenschaften 43, 540-541, 1956 (m.H.Marquardt u.H.Hassenkamp) / Ber.Dtsch Bot.Ges. LXX, 21-30, 1957 / Die Naturwissenschaften 44, 240-241, 1957 / Proc.Forst Europ.Region.Confer.on Electron Microscopy, 276-279, 1956 / Exp. Cell.Research 13, 165-167, 1957 (m.G.Hassenkamp)

3) Investigations in the field of wood anatomy
Arbeitsgemeinschaft Holz, Düsseldorf, 40 S. 1957 / Zeitschr.f.wiss.Mikroskopie 64, 269-275, 1957 (m.K.H.Meyer-Uhlenried) / Der Forst- u. Holzwirt 12 297-298, 1957 / Holzforschung, im Druck (mit U.Ammer)

<u>Mr. Syoji Sudo</u>, Senior Research Worker, Div. of Wood Technology, Government Fores Experiment Station, Meguro, Tokyo, Japan

Mr. Sudo's publications are:

The Wood Anatomical Characters of Styracaceae in Japan.Bull. of Tokyo Univ. Forests No. 45, 1953 (with Taizo Inokuma and Ken Shimaji) / Wood Anatomical Studies on the Genus Picea, Bull.of Tokyo Univ.Forests No. 49, 1955 / Electron Microscopical Studies on the Vestured Pits of Some Woods of Leguminosae in Japan, The Transactions of the 64th Meeting of Japanese Forestry Society. 1955 (with Noboru Xamabayashi and Keigo Kanazawa) / The Use of the Card Sorting Key for the Identification of Japanese Hardwoods. Journ. of the Japan Wood Researc Soc. Vol.3, No.3, 1957

<u>Dr. Martin H. Zimmermann</u>, Lecturer in Tree Physiology, Harvard University, Harvar Forest, Petersham, Mass, USA

Dr. Zimmermann has worked on

1) Paper chromatography of nectar secretions
Experienta 8: 424, 1952 / Schweiz.Bot.Ges. 63: 422-429, 1953 / Experientia 10: 145, 1954 / Experientia 10: 491, 1954 (mit A.Frey-Wyssling und A.Maurizio) Science 122: 766, 1955

2) Translocation of organic substances in trees
Plant Physiol. 32: 288-291, 1957 / Plant.Physiol. 32: 399-404, 1957 / The Physiology of Forest Trees, Cabot Foundation Symposium on Tree Physiology, K.V. Thimann ed Ronald Press, New York (in press) / Plant Physiology (in press)

<u>3. Scientific activity</u>

Decisions concerning an extension of our Glossary as outlined in the publication distributed (Tropical Woods Nr. 107, Oct. 1957, Page 2) will be taken during the Congress of Botany in Montreal, where we hope to meet as many members as possible.

Therefore notes of any errors or omissions and revelant critisism of the Glossary should be submitted to the Secretary Treasurer.

Zurich, 25th of February 1958

Secretary Treasurer: Assistant Secretary Treasurer:

A. Frey-Wyssling H. H. Bosshard

INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

NEWS BULLETIN 1958 / 2

Edited by the Secretary Treasurer Zürich, Switzerland

Office: Laboratorium für Holzforschung E.T.H. Universitätstrasse 2

EDITORIAL

Your Secretary Treasurer has the privilege of distributing a presentation copy of the classical memoir:

P. JACCARD
<u>Nouvelles recherches sur l'accroissement en épaisseur des arbres</u>. Essai d'une théorie physiologique de leur croissance concentrique et excentrique. 200 pages avec 32 planches hors texte, 23 tableaux et figures.
Librairie Payot, Lausanne et Genève, 1919.

It was possible to obtain this gift from the stock of the publications of the "Schnyder von Wartensee Foundation", Zurich, which promotes science by offering periodic competitions. In 1916, Prof. JACCARD won a prize with his successful investigations concerning the cambial growth of trees.

In this treatise he approached the problem of the excentric growth of stems and branches <u>experimentally</u>. He investigated the anatomy of artificial loops of shoots and twigs, and of bended, stressed or pressed growing stems. He further prevented lignification in the hinge of a shoot by a constant rocking movement mechanically applied.

It is true that the conclusions concerning the explanation of the formation of tension and compression wood drawn from those experiments are no longer up-to-date since the concept of "reaction wood" has later enabled a new physiological approach to be made. But the facts observed are still valid and ought to be taken into consideration in further discussions on reaction wood.

Prof. JACCARD's publication is seldom found in libraries because the "Schnyder von Wartensee Foundation" possesses only restricted exchange facilities. Therefore, I am glad to offer in its behalf a copy of this rare and valuable publication of my late teacher to the members of our Association.

SCIENTIFIC REVIEWS

The members are invited to co-operate with us in these "reviews" by submitting short communications regarding their personal research work.

<u>A Note on Juvenile and Adult Wood</u>

By B.J. Rendle, Address: Department of Scientific and Industrial Research, Forest Products Research Laboratory, Princess Risborough, Bucks, England

In the last issue of the News Bulletin, the Secretary Treasurer invited comments on the International Glossary of Terms used in Wood Anatomy, published in <u>Tropical Woods</u>, No. 107. The object of this note is to suggest that the terms "juvenile wood" and "adult wood" should be defined and included in the next edition.

It is common knowledge that the wood near the pith differs from that nearer the bark. The dimensions of the cells at any height in the tree tend to increase from the inside of the stem outwards, as exemplified by fibre or tracheid length and vessel diameter. It appears that as a general rule the cells attain their maximum size after a limited period of years which is characteristic of the species, and thereafter show minor fluctuations presumably due to the influence of external factors. Wood near the pith, in which the cells have not reached their full size, is sometimes known as "juvenile wood", and wood outside this central zone as "adult wood". In some (possibly most) species the different types of cell tend to reach their maximum size at about the same age, that is when the fusiform cambial initials have ceased to increase in length (1, 2, 8). But the pattern of development is not always so simple. In some species the cells continue to increase in size indefinitely, though the increase is usually more marked in the early years (8, 15). In woods with storied structure, however, the cambial initials normally attain their maximum length in the course of the first few years of growth; consequently the fibres and vessel segments show little or no further increase in length after this period, but they do show a continued increase in diameter (4, 10). In some non-storied woods also instances have been recorded where the pattern of development is not the same for all elements (10, 15, 19).

Apart from the overall dimensions of the cells, it has been shown that the wall thickness of the late wood tracheids in certain softwoods increases with age during the juvenile period (12) and Dadswell (6) has pointed out that changes in cell dimensions are accompanied by changes in cell-wall organization, notably the angle made by the micellar spiral of the middle layer of the secondary wall with the longitudinal axis of the cell. It has been shown that with the increase in average cell length during the juvenile period there is a decrease in micellar angle. It is of interest to note, too, that in Loblolly pine (Pinus taeda) the yield of cellulose from juvenile wood is consistently low as compared with adult wood (20).

The structural pattern of the growth ring also may show considerable changes in the first few rings, counting from the pith outwards. These changes are due not only to an increase in the size of the cells but also to changes in the character of the tissues and in their arrangement and relative proportions. The phenomenon is particularly noticeable in ring-porous woods which develop their typical ring-porous character gradually over a period of several years, and in certain hardwoods with a relatively complex structural pattern of pores, parenchyma, rays and fibres. In this connexion it may be of interest to quote the following extract from de Bary's "Comparative Anatomy" (7) based apparently on earlier investigations by Sanio. "And further, in the first and next-following annual rings of the stem and its branches, in many though not all Dicotyledonous woods, although the elements characteristic of the species are all present, yet their characteristic arrangement does not appear clearly till later, as it is merely indicated in the former region. The groups of vessels and the parenchymatous zones of Hedera Helix, Quercus pedunculata, Juglans, Casuarina, etc., are examples of this". Another good example is Ulmus procera (U. campestris), in which, as Clarke (5) has noted, the transition from early wood to late wood is gradual in the first formed rings (i.e. the youthful form); after a few years (about five) it becomes more abrupt, and the wood is then typically ring-porous. In this connexion also it is a matter of common observation that large rays, as in Quercus for example, do not attain their characteristic size for a number of years.

Changes in the structural pattern of the growth ring with age occur also in softwoods, particularly in those with a pronounced contrast between early wood and late wood. In a typical case it may be seen that in the first-formed rings the transition from early to late wood is less abrupt and the late wood zone is less dense and occupies a smaller proportion of the wood

than in the rings formed subsequently. This reflects the progressive changes in tracheid dimensions and wall thickness that take place during the juvenile period; it is not correct to attribute it directly to the fact that the rings near the pith are commonly wider than those nearer the bark (12).

Juvenile Wood in Conifers

It is pertinent at this point to refer to a somewhat different concept of juvenile wood that has been put forward by Paul (13). He has stated, correctly, that certain types of conifer, particularly when grown in plantations, commonly exhibit a characteristic growth pattern of rather wide rings at the centre gradually decreasing in width towards the outside. It is well known that in such trees the juvenile wood forming the central core is generally rather light in weight (low density) compared with the adult wood formed later. Paul seems to regard relatively wide rings and low density as essential characteristics of juvenile wood, and he refers to narrow-ringed, high density wood as "mature" even when it is formed close to the pith. But wood formed near the pith, whether it is wide-ringed or narrow-ringed, shows a gradual change in the size and form of the cells in successive periods of growth. From what has been said above it is clear that this change in structure is a distinctive feature of juvenile wood and practical definitions of juvenile and adult or mature wood must take into account the "ring-age" or distance from the pith, measured in terms of annual rings. Admittedly, suppression in the early life of a tree may lead to the production of juvenile wood that is not quite typical. Again, in special circumstances, as when a tree is suddenly released from suppression in later years, the resulting rapid burst of growth may produce wood with a tendency towards juvenile characteristics, namely shorter fibres and a correspondingly greater micellar angle (18), but these considerations do not affect the fundamental concept of juvenile wood in the usual sense of the term.

Duration of the Juvenile Period

It is fairly certain that the duration of the juvenile period (in the anatomical sense) varies from species to species. It has been suggested that it is roughly proportional to the normal life cycle of the tree (17.6) and there appears to be some evidence in support of this hypothesis. It may be that some individual trees attain the adult stage earlier than others of the same species. Whether the duration of the period is affected by environmental conditions does not appear to have been fully investigated. So far as other (morphological and physiological) manifestations of juvenility are concerned, there is evidence that unfavourable conditions of growth may prolong the juvenile period (3); in this connexion it is of interest to note that recent work in Canada has indicated that rapidly grown trees of white spruce attain their maximum cell dimensions sooner than slowly grown trees (9).

Another open question is whether the duration of the anatomical juvenile period is related to the age at which the tree begins to flower and bear seed.

Practical implications

Trained wood anatomists are well aware that wood specimens from young trees or from near the centre of older trees are not typical and must be used with due caution for studies in comparative anatomy. But it is not fully appreciated by foresters and timber technologists that in passing from the centre of a tree outwards there are changes in technical properties (due to the changing microscopic structure of the wood) which make it necessary to take ring-age into account. Failure to differentiate between juvenile and adult wood has led to false conclusions on such questions as the relations between conditions of growth and the quality of timber.

In so far as the core of juvenile wood is inferior in technical quality the duration of the juvenile period can be a matter of considerable importance in determining the value of the crop and may need to be taken into account in selecting species for commercial planting, particularly where such factors as fibre dimensions and the density and percentage of summerwood are important. Similarly, if it is found that individuals of the same species show appreciable differences in this respect the same consideration will apply in selecting elite trees for breeding.

Terminology

Although the principal changes that take place in the structure of wood in passing from the region of the pith outwards were recognised by the early wood anatomists, the terms juvenile and adult, or their equivalents, were apparently not applied to wood until comparatively recent times. In their studies of variation in the structure of wood Clarke (5) and later Rendle and Clarke (16) found it convenient to refer to the period during which the elements of successive annual rings at a given height in the tree become progressively larger as the "youthful period", and the wood formed in that period as "youthful wood". They proposed the term "adult" for the subsequent period in which the size of the elements remains relatively constant and for the wood formed in that period. Since then "youthful" has given place to "juvenile", by analogy with juvenile morphological forms.*)

The basic principle of distinguishing these two types of wood or stages of development appears to have been widely accepted though there is no general agreement as to the terms themselves. Some wood anatomists evidently prefer to speak of "immature" and "mature" wood rather than juvenile (or youthful) and adult, while others use the equivalent terms more or less interchangeably. It is suggested that the terms mature and immature are more appropriate to the stage of development of the tree itself than the wood. Maturity implies age and it would be straining the meaning of the word to describe, for example, the newly formed wood in the trunk of a 100-year old tree as mature. For the same reason it is inappropriate to use the term immature for wood that has been maturing for nearly a century at the heart of such an old tree. It is surely confusing to use a term in one sense as applied to the tree and in the opposite sense as applied to the wood.

It could be argued that "adult" has its disadvantages also, but at least it is not already employed in forestry or timber technology in a different sense.

Perry and Wang (14) in a recent paper criticise both "juvenile wood" and "mature wood" on the ground that they will lead to confused thinking in the future. They suggest "core-wood" or "pith-wood" in place of "juvenile wood", and "outer wood" or "exterior wood" in place of "mature wood". One objection to "pith-wood" is that it might be taken to imply that the wood is pith-like in character. The other terms proposed by Perry and Wang denote position or distribution within the tree and might be considered appropriate enough in referring to trees of a certain size, but not for all cases. They do not embody the essential idea of gradual, adolescent changes in structure during the juvenile period, culminating, as a general rule, in the fully adult or mature stage of development.

As a step towards standardisation the following terms and definitions are proposed for consideration and comment.

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*) According to Jackson's Glossary of Botanical Terms, the term juvenile as applied to plants was introduced by Goebel, or rather by I.B. Balfour, the author of the English edition of The Organography of Plants (11) who translated Jugendform as juvenile form.

Juvenile wood. Secondary xylem produced during the early life of the part of the tree under consideration and characterized anatomically by a progressive increase in the dimensions and corresponding changes in the form, structure and disposition of the cells in successive growth layers. The period during which juvenile wood is formed is called the juvenile period; it varies according to the species and may be affected by environmental conditions.

Adult wood. Secondary xylem produced after the juvenile period in the part of the tree under consideration. In adult wood as a general rule the cells have reached their maximum dimensions and the structural pattern is fully developed and is more or less constant except in so far as it is influenced by environmental conditions.

It is believed that these definitions supply a reasonably practical means of distinguishing between the two types of wood, though there will generally be a transitional zone of varying extent. Admittedly, where the "adolescent" changes appear to continue indefinitely it is difficult to make the distinction between juvenile and adult wood; in such cases it may be expedient to regard the initial period of rapid change as the juvenile period. It is hoped that this attempt to standardise the terms will serve a useful purpose.

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Wood Microtechnology

By A. Frey-Wyssling

Wood Technology has long been business of engineering. Big logs and beams ha been tested and records of weights, shrinkage and strength concerning the di ferent wood species have been tabulated in elaborate handbooks. The mechanic of stressed, crushed, bended and broken macroscopic wood samples have been studied, as well as the behaviour of appropriate specimens when shaved, turn drilled, bored, nailed or sawn. Since wood is a complicated complex of grown cells, it has always been understood that the registered effects of such tes are the resulting integration of the properties of the different cellular co ponents. Yet, the engineer looks but seldom at the individual cells in his raw material through a microscope. He has not been trained in the particular field of microscopy and thus such an investigation is left to the biologist.

In paper-making, this situation has been fully realized and a symposium on Paper Technology where the microscopists do not cover an important sector of the deliberations (1) is no longer conceivable. In Wood Technology this stat of affairs has not yet been reached, although there are vast fields where th wood anatomist could contribute considerably to the understanding of technological problems: The specific value of different wood species for various purposes bases on their anatomical structure. Early wood and late wood of a growth ring have quite different technological properties (13). Many wood "defects" such as "reaction wood" (tension and compression wood) or resin ca vities (pitch pockets) are due to microscopic features (5). The question of the formation of valuable or facultative heart wood is another biological problem (2). Numerous procedures of refinement or of improving special qualities of the raw material wood can be controlled microscopically (6,7,10,11). Long before a bent rod breaks, microscopic slip planes arise in the cell walls indicating that the intercellular substance has a greater strength tha the cohesion of the microfibrils in the wood fibre (8,12). When wood is crushed, the form stability of the individual cells plays a decisive role (9). In all these cited cases and in many others, wood technology should be supported by a biological laboratory of microscopic and submicroscopic research.

Such a center ("Stelle für mikroskopische Holzbeurteilung") has been developed for years at the Department of General Botany in the Swiss Federal Institute of Technology (E.T.H.) Zurich. In addition to the classical methods of wood anatomy, new microscopic procedures concerning high-frequency heating (14) and checking the shrinkage anisotropy on their sections in the microscope (3) have been developed. Further research is extended to the microscopy of fibre- and chip-boards, their textures, the distribution and the penetration of the bonding agents, the orientation of the wood chips etc. (4). In 1958 this activity led to the establishment of a special Laboratory, of Wood Microtechnology by the Council of the E.T.H. and to the appointment of Dr. H.H.Bosshard, Professor of Wood Technology as its head.

The new designation Microtechnology implies that, in the first place, technological problems will be tackled which need a refined microscopic equipment. Whilst there exist many first-class experimental stations for classical wood technology, laboratories with the special object to study wood properties on the microscopic level are rare. So it is hoped that this new laboratory will give some impulse to a hitherto underdeveloped branch of wood technology.

For our Association this development opens a new avenue. Originally the main purpose of our activity was to create a solid basis for the taxonomy and the phylogeny of wood plants and to furnish reliable keys for the determination of wood samples. This academic goal is now widened and enlarged by the need of the important science of wood technology for a more detailed knowledge of wood properties and of wood quality which can only be acquired by intensifying the research of wood anatomy.

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Naturwissenschaften 43, 54, (1956)

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Holz als Roh- u. Werkstoff 1, 329 (1938)

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Bericht No. 119 der Eidgenössischen Materialprüfungsanstalt, Zürich, 1938

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Holz als Roh- u. Werkstoff 14, 407 (1956)

MONTREAL BOTANICAL CONGRESS

Aug. 19-29, 1959

It has become a tradition to organize and issue invitations to a special symposium of our Association in connection with the International Botanical Congress. In Canada in 1959, we shall try to meet for discussions on

Anatomy and Physiology of Wood

We have proposed to deal with the following items in two half-day sessions:

1. Physical Properties of Wood Depending on Anatomical Features
2. Sapwood/Heartwood Relations

Members who are in a position to contribute to one of these problems are kindly invited to contact us in that matter as soon as possible.

It is furthermore possible to have joint sessions with cytology in the symposium on cell morphology and with physiology and general anatomy if there is a symposium on phloem physiology or anatomy.

Towards the end of the Congress it is planned to hold an internal business meeting for the members of our Association.

OFFICE OF THE SECRETARY TREASURER

1. Membership

a) Subscription: The outstanding subscriptions for 1958 amount to Sfr. 589.--. Each delay in payment renders our administrational work much more difficult. The members are therefore invited kindly to pay at their earliest convenience but not later than stipulated and to pay exactly Sfr. 7.--. Members who have so far paid less should take note of it. All members who have difficulties in transferring money from their country to Switzerland should write us. We shall appreciate better paying habits.

b) Mutations: A new address is announced from

Mr. Robert W. Hess
Director of Research
10200 S.W. Hawthorne Lane
Portland 25, Oregon, USA

We are very pleased to announce the nomination of five new members:

Dr. Paavo J. Ollinmaa, Pengerkatu 30 A 4, Helsinki

Dr. Ollinmaa's scientific work has concentrated on the following items:

Some of the southern broad-leaved trees in Finland, naturally grown and cultivated. Silva Fennica 77, 1952

The carbohydrates in birchwood (together with Gustafsson and Saarnio) 2 pages, Acta Chemica Scandinavica 6, 1952

The accuracy of some volume formulae and volume tables in the cubing of entire trunks. Metsätaloudellinen Aikakauslehti 1-2, 1953

Forestry and the forest industry of Canada and their importance for the economy of the country and the world. Metsätaloudellinen Aikakauslehti 8-9, 1954

On the structure and properties of coniferous compression wood. Paperi ja Puu 11, 1955

On the anatomic structure and properties of tension wood in birch. Acta Forestalia Fennica 64.3, 1955, 263 pages

On the structure and properties of tension wood. Paperi ja Puu 12, 1956

A reliable method for the determination of the weight by volume of wood. Paperi ja Puu 5, 1956

What is tension wood? Metsätietoa 1, 1957

Measurement of a single tree. Metsäkäsikirja II, 1957

Determining the weight by volume of wood when applying the method of submersion in water. Paperi ja Puu 11, 1957

Michael V. Labern, East Malling Research Station, Maidstone, Kent, Engl.

Mr. Labern engages exclusively in anatomical work and has studied the following problems:

Anatomy of roots (wood and phloem) of a series of new clonal apple rootstocks bred at Summerland, British Columbia.

Root anatomy (wood and phloem) of a series of clonal cherry rootstocks

Root anatomy (wood and phloem) of some established clonal plum rootstocks

Stem anatomy (wood and phloem) of some potential new plum rootstocks

Stem anatomy (wood and phloem) of some potential new plum rootstocks

Root anatomy (wood and phloem) of a series of apple rootstocks bred in England for resistance to Woolly Aphid

Wood anatomy of plums and apples affected by various virus diseases

<u>Dr. Irving H. Isenberg</u>, The Institute of Paper Chemistry, <u>Appleton</u>, Wisconsi USA

Dr. Isenberg has sent us a selected list containing the following publications:

Microchemistry of tyloses. J. Forestry 31: 961, 1933

Age and the chemical composition of white fir wood. J.Amer.Chem.Soc. 58: 2231, 1936

Anatomy of redwood bark. Madrono 7: 85, 1943

Properties of pulpwood. Mimeographed, 153+78 pp. Institute of Paper Chemistry, 1943

A color reaction of wood with methanol-hydrochloric acid. J. Forestry 43 888, 1954

Extraneous components of American pulpwoods. Paper Ind. 28: 816, 1946

Location of extraneous materials in redwood. Madrono 9: 25, 1947

The maceration of woody tissue with acetic acid and sodium chlorite, Science 105: 214, 1947

The characteristics of unbleached kraft pulps from western hemlock, Douglas-fir, western red-cedar, loblolly pine, and black spruce. Part. II. The morphological characteristics of the pulp fibers. Tappi 33: 95, 1950

Pulpwoods of the United States and Canada. 2nd ed. 1951, 187 pp. Institut of Paper Chemistry.

Fibre measurements of tropical woods. Tappi 35: 145, 1952

The swelling of spruce pulp fibres. Tappi 39: 226, 1956

Papermaking fibres. Economic Botany 10: 176, 1956

The fine structure of the cambial wall of bigtooth aspen. Tappi 39: 882, 1956

Extraneous components of American pulpwoods. Paper Ind. 38: 945, 1042, 1957

<u>Krit Samapuddhi</u>, Chief of Forest Products Division, Royal Forest Department, <u>Bangkok</u>, Thailand

Mr. Samapuddhi is especially interested in the wood anatomy of home-grown timbers of Thailand:

The alkalinity of the ashes of some timbers, 1943: Thai Science Journal Vol. VIII, No. 3 (in Thai) 3 pages, 1 table

The utilization of wood, 1952, Thai Science Journ. Vol. VI, No. 7 (in Thai), 6 pages

The structure of the cell-wall, 1950. Thai Science Journ. Vol. V, No. 10 - 11 (in Thai) 15 pages, 6 illustrations

The anatomy of teng and rang, 1954. Vanasarn Forestry Journal Vol. XII, No. 1 (in Thai), 7 pages, 1 table, 2 illustrations

Yarng Oil, 1954. Published as Thai Forest Bulletin No. R. 14, 12 pages, 15 illustrations, 1 table (in English)

The forests of Thailand and forestry programs, 1955 revised 1957. Thai Forest Bulletin No. R. 20 (in English), 35 pages, 8 illustrations, 9 tables

A note on preliminary studies in some methods of identifying the timbers of Pentacme siamensis, Shorea obtusa and Shorea robusta, 1957. Thai Forest Bulletin No. R. 24 (in English) 10 pages, 1 table, 9 illustrations

Some secondary species recently introduced into the Thai timber market, 1958. Thai Forest Bulletin No. R. 27 (in English), 12 pages, 11 illustrations, 1 table.

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(A list of publications will be submitted to the readers in the next issue.)

Zurich, 1st of September 1958

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