
METHODS OF IDENTIFICATION OF PHILIPPINE WOODS.

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ONE of the greatest difficulties encountered by both producers and consumers of lumber in the Philippines is that of recognizing the immense number of timber species they have to handle. The difference in external appearance between two species is often very slight and besides this, every individual species may vary widely in those qualities which are most readily perceived—color, weight, and hardness. Moreover, enormous as is the number of tree species in the Philippines, their names are still more numerous. Barring a few widely distributed and very well-known species (such as Ipil, for instance), it is the exception rather than the rule to find the same name for a given tree in two adjacent provinces. Now it evidently avails the woodworker little to know that a given wood possesses certain mechanical properties or a certain degree of durability if, on the one hand, he is not sure of recognizing the wood when he finds it with its proper commercial and official name, or if, on the other hand, it occurs in his vicinity with a radically different name.

In this paper an attempt has been made to give the reader an idea of how to begin to recognize woods. A systematic key and descriptions of all known Philippine timbers would go far beyond the limits of such an article as this, besides including scores of species which are of little or no special interest to the average woodworker.¹

¹ The only key published so far is in "Philippine Woods," by F. W. Foxworthy, Philippine Journal of Science, Vol. II, Sec. C. No. 5. This work, which contains descriptions and photographs of the cross-sections of some sixty woods, is an excellent guide for the beginner. (In several cases it will be found that woods are described in this work as of considerably lighter color than in the present article; much of Doctor Foxworthy's material was from small, immature trees.)

Other works to which the reader is referred for further information about Philippine woods are: "Indo-Malayan Woods," same author, Philippine Journal of Science, Vol. IV, Sec. C, No. 4. (108 figures, of which about 90 are of Philippine woods; the plates accompanying the present article are from this work, lent by courtesy of the Bureau of Science); "The Forests of the Philippines," by Dr. H. N. Whitford, Bulletin No. 10, Bureau of Forestry; and "Uses of Philippine Woods," Bulletin No. 11, Bureau of Forestry.

METHODS OF IDENTIFICATION.

In the first place, it must be understood that the only positive way of identifying most woods is by the study of the structure as seen in a clean, smooth cross-section. The necessary equipment consists of a sharp pocketknife and a lens magnifying four to five diameters. The following elements, their relative abundance and their arrangement, are to be observed:

1. *Hard and soft tissue.*—The hard tissue constitutes, so to speak, the background of the picture in most woods. It is generally more abundant than any other element, and as a rule is darker and smoother-looking than the soft tissue. The latter, besides being lighter in color, has a spongy appearance. It very commonly forms either round or oval rings or else, irregular patches surrounding the pores. (See figs. 4, 6, 20.) Frequently these patches run together, forming more or less regular patterns of either continuous and parallel, or else broken, wavy, branching or diagonal, lines. In some woods the soft tissue takes the shape of regular patterns that are not related to the position of the pores. As a rule, very dense, hard woods contain little, and very soft woods, a great deal of soft tissue.

2. *Growth-rings.*²—These are concentric belts formed by the addition of material to the outside of the trunk during the growth of the tree. Sometimes they are quite regular and sharply distinguished, sometimes irregular or indistinct, while in many woods they are absent. (See figs. 8, 9, 11, 25.)

3. *Pithrays.*—These are bundles of wood fibers that run radially from pith to bark at right angles to the grain. In the cross-section they are visible to the naked eye in most woods. In longitudinal sections they are not generally conspicuous unless the section is exactly or very nearly radial. In such sections they form, in woods like Oak and Catmon, the "silver" or "flake" grain so familiar in quarter-sawn oak furniture. Their relative thickness, width, and frequency are important aids to identification. In probably a majority of all woods they are somewhat lighter in color than the hard tissue, in some darker, but only in very few exactly of the same color and shade as the remainder of the wood.

4. *Pores.*—The arrangement, shape, and relative size of the pores form the most conspicuous feature in the cross-section of most woods. In some species they are arranged in more or

² This term is preferable to "seasonal rings" or "annual rings." Too little is known about the manner of growth of tropical woods to warrant the use of these more definite terms.

less distinct concentric rows following the growth-rings; such woods are called "ring-porous," and all others "diffuse-porous." The only ring-porous woods described in the following notes are Banaba, Batitinan, Calantas, Narra, and Teak. (See figs. 7, 9, 25, 35.) Among diffuse-porous woods, some have the pores arranged in straight or oblique radial rows, others in more or less wavy, often branching tangential lines (forming sometimes irregular "herringbone" or other patterns) and a great many, finally, have the pores scattered without any regular arrangement. The largest pores are about like large pinholes, while the smallest are barely visible under a pocket lens.³ In many woods the pores are almost uniform in size, in others very variable, while in some cases they are quite distinctly of two different sizes. Sometimes they are all open, sometimes part of them are filled more or less completely with colored deposits which latter are generally plainly visible also in the pores exposed in longitudinal sections; in some woods they have numerous thin cross-partitions which, in the cross-section, give them the appearance of being filled with whitish deposits.

5. *Resin-canals*.—These are found only in the Pines and in the Lauan family. In the Pines they are widely scattered and found singly or in very small groups. In the Lauan family they form conspicuous concentric lines, which are the most striking distinguishing mark of this family. Unlike growth-rings, these lines occur at extremely irregular intervals from the heart outward and, moreover, they are incomplete; that is, they almost never form entire circles. (See fig. 17.)

6. *Ripple-marks*.—In addition to the above elements to be observed in the cross-section, there is one structural feature often found in longitudinal sections; namely, ripple-marks. These are extremely fine, transverse, parallel, generally slightly wavy lines, resembling the marks made by ripples on a smooth beach. They are most common in the tangential section, but in some woods are found in all longitudinal sections. Generally they are plainly to be seen (often better on split than on planed surfaces) with the naked eye; in fact, they are frequently more distinct to the naked eye than under the lens. They are found in very many woods, but in certain cases serve to distinguish two woods that might otherwise be confused.

It is hardly necessary to say that color, odor, taste, hardness, weight, fine or coarse and straight or twisted grain are all aids

³ Pores, or vessels, as they are also called, must not be confused with the internal cavity of individual cells, or of wood fibers. Pores are longitudinal cavities surrounded by cells.

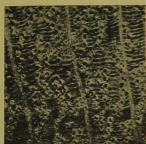


Fig. 1. Oak.



Fig. 2. Tamayuan.

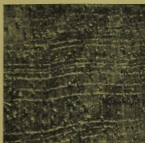


Fig. 3. Duguan.



Fig. 4. Acle.



Fig. 5. Batete.

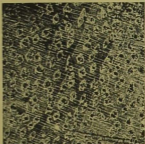


Fig. 6. Ipil.

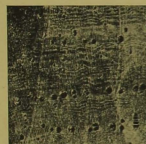


Fig. 7. Narra.

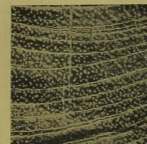


Fig. 8. Camuning.

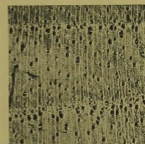


Fig. 9. Calantas.

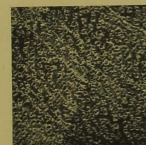


Fig. 10. Tucang-calao.

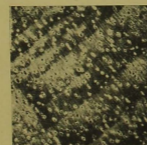


Fig. 11. Alupag.



Fig. 12. Lanutan.

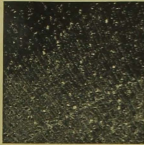


Fig. 13. Dungon.

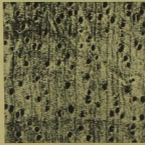


Fig. 14. Lumbayao.

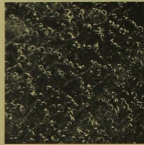


Fig. 15. Palo Maria or Bitag.

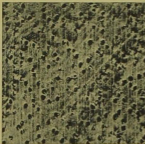


Fig. 16. Mangasinoro.

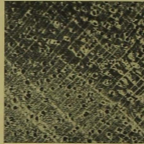


Fig. 17. White Lauan.

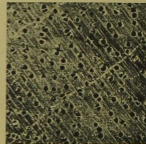


Fig. 18. Red Lauan.

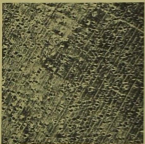


Fig. 19. Tanguile.

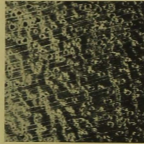


Fig. 20. Apitong.

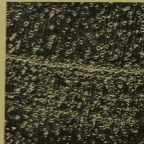


Fig. 21. Guijo.

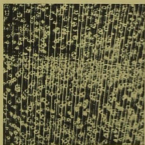


Fig. 22. Mangachapuy.



Fig. 23. Guisoc.

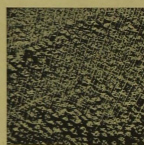


Fig. 24. Narig.



Fig. 25. Banaba.

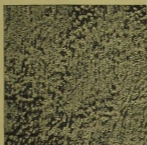


Fig. 26. Pagatpat.

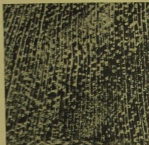


Fig. 27. Bacauan.

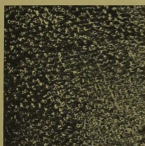


Fig. 28. Macaasim.

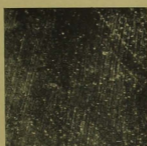


Fig. 29. Mancono.

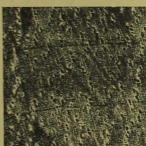


Fig. 30. Betis.



Fig. 31. Nato.



Fig. 32. Ebony.

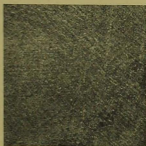


Fig. 33. Lanete.



Fig. 34. Molave.

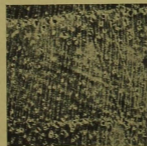


Fig. 35. Teak.

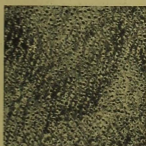


Fig. 36. Calamansanay.

to identification. In fact, many woods, once well known, can be recognized by one or more of these qualities without further recourse to the lens.

DESCRIPTIONS.

PINE FAMILY (*Pinaceae*).

BENGUET PINE (Mountain Province, Zambales) and TAPULAO (Zambales, Mindoro). Sapwood whitish; heartwood with alternate rings of light-colored wood with little resin and of darker, harder, and very resinous wood; no pores; scattered resin-canals; strong resinous odor.

AGOHO FAMILY (*Casuarinaceae*).

AGOHO (seacoasts and sandy river valleys) and MOUNTAIN AGOHO (mountains in many islands). Sapwood grayish, not sharply marked off from reddish brown to dark brown heartwood; very hard; very heavy; fine grain; pithrays fine to very thick, the large ones scarce in Agoho and numerous in Mountain Agoho; pores small, in irregular, branching radial lines; soft tissue forming fine, wavy, irregular, concentric lines, resembling those of Oak, but less conspicuous.

OAK FAMILY (*Fagaceae*).

OAK (many species in most hill and mountain regions). Sapwood yellowish; heartwood yellowish brown to dark brown; hard; heavy; rather fine grain; numerous very fine pithrays and a small number of very thick ones, the latter very conspicuous both in cross and radial section; pores and soft tissue very similar to Agoho. (Fig. 1.)

ANTIPOLO FAMILY (*Moraceae*).

ANUBING (probably in all islands). Sapwood whitish, rather soft; heartwood bright golden yellow when fresh, on exposure rapidly turning brown and in time greenish black; slight, disagreeable odor when fresh; hard; heavy; rather coarse grain; difficult to work and to finish; pithrays fine to moderately thick, not numerous; pores not large, somewhat variable, scattered; both pores and pithrays often containing a whitish substance; soft tissue in thin irregular rounded patches surrounding pores, not conspicuous.

ANTIPOLO (probably in all islands). In all respects very similar to Anubing, but considerably lighter and softer and with fewer white deposits.

TAMAYUAN FAMILY (*Olacaceae*).

TAMAYUAN (widely distributed). Sapwood grayish white, sharply marked off from pinkish to dark reddish brown heart-

wood; hard, but brittle; heavy to very heavy; very fine, straight grain; pithrays very fine, straight and regular; pores very small, evenly scattered; soft tissue inconspicuous, surrounding pores and forming very fine, irregular transverse lines between pithrays; all elements of nearly even color. (Fig. 2.)

ILANG-ILANG FAMILY (*Anonaceae*).

The woods of this family are rarely seen in commerce, except occasionally in mixed lots of lumber. They deserve mention here because they are very widely distributed and have a most characteristic and uniform structure. They may be roughly grouped together under the name of:

The **WHITE LANUTANS**. Sapwood very large, whitish or pale yellow; heartwood generally very small, perhaps none at all in some species, but where found, generally brownish; soft to moderately hard or hard; light to moderately heavy; fine, straight grain; pithrays fine to moderately thick, conspicuous, not very numerous; pores rather small, scattered; soft tissue forming very distinct, regular, conspicuous crossbars between pithrays, like rungs of a ladder.

DUGUAN FAMILY (*Myristicaceae*).

DUGUAN (all islands). Sapwood light-colored, but not sharply distinguished from heartwood; heartwood pale red to light reddish brown; soft; light; rather fine grain; pithrays fine, numerous, rather irregular; pores small, scattered, sometimes in radial rows of two to four; soft tissue forming fine, but distinct concentric lines at rather regular intervals. (Fig. 3.)

BATICULIN FAMILY (*Lauraceae*).

MARANG or **WHITE BATICULIN**⁴ (widely distributed but not abundant). Pale yellow, fading to dirty white; faint aromatic odor, when fresh; soft; light; fairly fine grain; pithrays fine, not very numerous; pores small, scattered, tending to form diagonal rows; soft tissue surrounding pores in narrow rings.

The **YELLOW BATICULINS**. These come from a number of widely distributed, but scattered species, all having woods of similar character; bright yellow, some with greenish, some with reddish or brownish tints or streaks; more or less lasting camphor-like odor; soft to moderately hard; light to moderately heavy; fine grain; pithrays finer and pores smaller than in Marang.

MALACADIOS. Glossy deep yellow; odor, when freshly cut, reminding of aromatic vinegar; grain finer than Baticulin.

⁴This is the wood described by Foxworthy under "Baticulin."

LIUSIN FAMILY (*Rosaceae*).

LIUSIN (almost all islands). Sapwood light-colored, not sharply distinguished from heartwood; heartwood pale red to light reddish brown; faint acid odor, when fresh; very hard; very heavy; fine grain; very difficult to work, dulling all tools with extreme rapidity; pithrays fine; pores rather large, oval, scarce, irregularly scattered; soft tissue forming irregular, wavy concentric lines, similar to those in Agoho and Oak.

NARRA FAMILY (*Leguminosae*).

ACLE (very widely distributed, but scarce). Sapwood whitish, sharply distinguished from heartwood; heartwood light to dark, dull brown; shavings give brown color to water; distinct peppery odor and slightly pungent taste; when quite fresh, lathers freely when rubbed with water or saliva; hard; heavy; not difficult to work, but dust provokes sneezing; pithrays very fine, not numerous; pores moderately large, irregularly scattered, sometimes in groups of from two to four or five; whitish deposits in some pores; soft tissue in conspicuous, irregularly rounded patches about pores. (Fig. 4.)

BANUYO (Luzon, Masbate, Burias, Ticao, Samar, Negros). Sapwood whitish; heartwood pale golden brown to dark brown, sometimes distinctly reddish; softer and lighter than Acle; fine grain; growth-rings bounded by a line of dense, dark tissue; pithrays very fine; pores rather small; evenly scattered; soft tissue in rounded patches about pores.

BATETE (widely distributed, not abundant). Sapwood light red; heartwood reddish brown with irregular lighter and darker streaks; gives purplish brown tinge to water; hard; heavy; rather difficult to work; growth-rings not conspicuous, but distinct; pithrays fine; pores small; all cut surfaces exude a dark oil, which spreads into greasy brown splotches and streaks. (Fig. 5.)

IPIL (widely distributed, along coasts and in Cagayan Valley). Sapwood whitish; heartwood bright yellow when fresh and sound, turning on exposure to very dark reddish brown or almost black; peculiar, characteristic odor difficult to describe; hard to very hard; heavy to very heavy; fine grain; difficult to work; growth-rings bounded by a very fine, light-colored line; pithrays fine; pores small, scattered, many filled with sulphur-yellow deposits; soft tissue forming irregular patches about pores. (Fig. 6.)

NARRA (probably in all islands). Sapwood whitish, generally sharply distinguished from heartwood; heartwood pale

straw color through all shades of rose and red to dark blood red or dark reddish brown; gives water a red color, which, in shallow layers, turns to a changeable greenish blue; faint, sweet, cedary odor; moderately hard to hard; moderately heavy to heavy; rather coarse and often twisted grain; easy to work; growth-rings marked by an irregular line of pores at beginning, pores in remainder of each ring smaller and irregularly scattered; pithrays very fine, much less conspicuous than the numerous irregular, wavy and branching, concentric lines of soft tissue; ripple-marks often very distinct on tangential section. (Fig. 7.)

SUPA (Tayabas, Camarines, Albay, Mindoro). Sapwood pink; heartwood yellow, turning to rich golden brown on exposure; colors water reddish brown; faint pungent odor; hard; heavy; very fine grain; rather difficult to work; growth-rings bounded by fine, light line; pithrays fine, but distinct; pores very small; soft tissue inconspicuous; ends, and less frequently sides, stained by dark oil exuding from pores.

TINDALO (very widely distributed, but scattered). Sapwood whitish, sharply distinguished from heartwood; heartwood orange to dark red, darkening with exposure; odor reminding of taste and odor of raw beans or peanuts; hard; heavy; fairly fine, generally straight grain; not difficult to work; pithrays distinct, but not conspicuous; pores moderately large, scattered; soft tissue very conspicuous, partly forming long, fine concentric lines passing mostly between the pores, partly elongated patches about the pores; pores and soft tissue with a tendency to arrange themselves in a rough "herringbone" pattern.

CAMUNING FAMILY (*Rutaceae*).

CAMUNING (widely distributed, but small and scattered). Sapwood clear yellow; heartwood brownish; very hard; very heavy; very fine grain; pithrays very fine; pores very small; soft tissue forming numerous, very fine, concentric lines which often branch. (Fig. 8.)

CALANTAS FAMILY (*Meliaceae*).

CALANTAS (very widely distributed, but scattered). Sapwood pinkish; heartwood pale to dark red; distinct cedary odor; soft; light; rather coarse grain; ring-porous, but not always conspicuously so; pithrays rather fine, but fairly distinct; pores small to moderately large, the largest at the beginning of each ring; frequently dark, reddish, glistening, varnish-like deposits in pores; soft tissue forming continuous concentric lines of very uneven width, often inclosing the pores. (Fig. 9.)

PIAGAO AND TABIGI (mangrove swamps). Sapwood whitish; heartwood pale red to dark red or reddish brown; moderately hard to hard; moderately heavy to heavy; very fine grain; easy to work; growth-rings marked by fine, light-colored line of soft tissue; pithrays fine, numerous, regular; pores small; soft tissue inconspicuous; ripple-marks often present, but not generally very distinct.

TUCANG-CALAO (widely distributed, but scarce). Sapwood grayish; heartwood red; strong camphor-like odor; hard; heavy; fine grain; pithrays fine; pores moderately large, irregularly scattered, singly or in small groups; soft tissue surrounding pores and also forming numerous irregular, often wavy, tangential lines of variable length. (Fig. 10.)

MANGO FAMILY (*Anacardiaceae*).

AMUGUIS (probably all islands). Sapwood pale red; heartwood coppery red; slight sour odor; moderately hard to hard; moderately heavy to heavy; fine, glossy grain; pithrays very fine; pores small to moderately large, numerous, evenly scattered, with occasional glistening deposits; soft tissue scarce, in thin rings about pores; ripple-marks sometimes present, but not conspicuous.

DAO (probably all islands). Sapwood very large, light brownish or reddish gray; heartwood darker, with irregular blackish streaks; moderately hard; moderately heavy; rather coarse, straight grain; pithrays fine, light-colored, distinct; pores moderately large or large, scattered singly or in groups of two or three, with glistening deposits; soft tissue in very thin rings about pores.

PAHUTAN (probably all islands). Sapwood very large, pinkish or brownish gray; heartwood irregular in shape, coffee brown, often with alternating belts of lighter and darker color; moderately hard to hard; moderately heavy; fine, smooth grain; pithrays fine, indistinct, whitish; pores small, scattered; soft tissue in small patches about pores and forming fine, straight, not very conspicuous, concentric lines.

ALUPAG FAMILY (*Sapindaceae*).

ALUPAG (very widely distributed, but rather scarce). Sapwood very pale red; heartwood red to very dark brown; very heavy; very hard; fine, straight grain; very difficult to work; growth-rings distinct, though not conspicuous, outer part darker than inner; pithrays very fine; pores small, scattered, with pithy cross-partitions giving appearance of whitish deposits; soft tissue in small patches about pores. (Fig. 11.)

MALUGAY (almost all provinces, most abundant in Mindoro). Sapwood very pale red; heartwood pale red to red; moderately hard to hard; moderately heavy to heavy; very tough; fine, straight grain; pithrays rather fine, numerous; pores moderately large, scattered, with partitions as in Alupag; soft tissue in thin rings about pores and forming thin, continuous, often wavy concentric lines bounding growth-rings.

MALUBAGO FAMILY (*Malvaceae*).

LANUTAN (central Luzon). Sapwood whitish; heartwood violet or purplish, with distinct alternating bands of lighter and darker color marking the growth-rings; faint, pleasant odor, when fresh; moderately hard to hard; heavy; tough; fine, straight grain; pithrays fine, distinct; pores small, numerous, scattered; soft tissue in thin rings about pores; ripple-marks always present and generally very distinct. (Fig. 12; note that this photograph was taken on the corner of a square block, showing ripple-marks on both radial and tangential sections.)

DUNĠON FAMILY (*Sterculiaceae*).

DUNĠON (widely distributed, in dry hill forests, but not abundant.) Sapwood grayish or pinkish, not sharply marked off from heartwood; heartwood reddish brown to dark chocolate; hard to very hard; heavy to very heavy; very tough; rather fine and sometimes crossed grain; difficult to work; pithrays moderately large; pores small to moderately large, scattered; chalky white deposits filling sometimes a few, sometimes very many pores; old knots and heart-cracks often containing white stony deposits; soft tissue in thin rings around pores and forming fine, indistinct cross-lines between pithrays. (Fig. 13.)

DUNĠON-LATE (coast and coastal swamps). Not distinguishable from DunĠon by structure; said to have wider sapwood and on the average, perhaps, somewhat lighter in weight and color.

LUMBAYAO (Zamboanga, Cottabato, Basilan). Sapwood very pale red, merging gradually into heartwood; heartwood pale red to dark red; soft to moderately hard; light to moderately heavy; rather coarse, straight grain; easy to work; pithrays moderately large, rather far apart, conspicuous in radial section and plainly visible as narrow dark lines 1 to 2 millimeters long in tangential section; pores large, rather evenly scattered; soft tissue in smooth, thin rings about pores; ripple-marks often present, but generally not conspicuous. (Fig. 14.)

LUMBAYAO-BATU. A wood known sometimes by this name and sometimes as DunĠon is found in the same region as Lumbayao;

has the color, weight and (nearly) hardness of *Dun̄gon* with the structure of *Lumbayao*; possibly only a very hard variety of the latter.

PALO MARIA FAMILY (*Guttiferae*).

PALO MARIA, or BITAOG (all coasts except swamps). Sapwood reddish white to pale red; heartwood red; hard; heavy; tough and difficult to split; fine, curly grain; pithrays very fine, indistinct; pores small to moderately large, scattered or in irregular wavy rows or in small groups, some partly filled with whitish deposits; soft tissue forming numerous, fine, broken, very wavy concentric lines about one-half millimeter apart; these lines make a beautiful, fine zigzag pattern on the tangential section. (Fig. 15.)

BITANHOL, or PALO MARIA DEL MONTE (almost all provinces). In general appearance and structure like Palo Maria, but somewhat lighter in weight and color and much straighter grained.

LAUAN FAMILY (*Dipterocarpaceae*).

In this family, which produces about 75 per cent of all the timber in the Philippines, there is a wide variation in hardness, weight, color, and even in structure, but certain broad characteristics apply to practically all the "dipterocarps." The interrupted and irregularly spaced rings of resin-canals have been mentioned in the introduction. They are more or less conspicuous in all the woods of the family except *Narig*. It must be kept in mind, though, that their absence from a given specimen does not show that the wood is not a dipterocarp, for, on account of their irregular arrangement, small specimens are easily cut out in such a way as not to contain any portion of a ring. In color the majority are of various shades of yellow, red, or reddish brown. A few, especially the *Apitongs*, have a resinous odor; in weight and hardness they go through nearly the whole scale. Growth-rings are very scarce, and, when found, very indistinct. The pithrays are fairly uniform throughout the family, but the pores vary from very small to large. Some, besides the resin in the resin canals, contain it also in the pores; other deposits in the pores very rarely occur. The soft tissue is generally very irregularly arranged, rarely forming any kind of a pattern. Ripple-marks occur seldom and are very rarely distinct.

The dipterocarps are the dominant family in all the high, dense forests of the Islands. All the woods described here are abundant and widely distributed unless their distribution is otherwise described.

The timbers of this family may be grouped under five names: Lauan, Palosapis, Apitong (including Guijo), Mangachapuy (or Dalingdingan), and Yacal.

THE LAUAN GROUP.

(Arranged roughly by color, ranging from nearly white through red to dark reddish brown.)

MANGASINORO (southern Luzon, Mindanao). Sapwood and heartwood scarcely distinguishable; pale straw color, darkening but little on exposure to light; soft to moderately hard; light; resin-canals very scarce; pithrays fine; pores moderately large, round, scattered, but tending to form a diagonal net-like pattern; soft tissue visible only in very fine rings about pores. (Fig. 16.)

KALUNTI (Zamboanga, Basilan). Very like Mangasinoro, but with less yellow tint; pores larger, less rounded and often arranged in radial strings of three to five or six; resin-canals often present.

MALAAONANG (northern Luzon to Tayabas). Very like Mangasinoro, but darker (very light brown) and with soft tissue forming fine short irregular lines, often connecting tangentially two or more pores; also with occasional rings of resin-canals.

WHITE LAUAN. Sapwood and heartwood grayish white, latter in large trees with very pale brown tinge; soft to moderately hard; light to moderately heavy; resin-rings often very far apart, but, when present, very distinct; pithrays of two kinds, very fine and moderately thick, latter very distinct; pores large, scattered singly or in irregular groups of three to six; soft tissue in thin rings about pores. (Fig. 17.)

ALMON (Laguna to Sorsogon, Negros, Mindanao). Sapwood when fresh nearly white, turning grayish brown on exposure to light; heartwood pinkish to very pale red, fading to dull yellow on exposure (even when varnished); soft; light; resin-rings widely separated, and distinct; pores large, scattered singly or in groups of two to five; soft tissue in thin rings about pores and very fine, irregular, scattered crosslines between pithrays.

BAGTICAN. Sapwood gray; heartwood pale reddish brown; moderately hard; moderately heavy; fairly close grain; resin rings frequent; pithrays rather thin, not very distinct; pores rather small to moderately large, numerous, evenly scattered; soft tissue forming tangentially elongated patches about pores and numerous, short, irregularly scattered cross-lines.

MAYAPIS. Sapwood brownish or pinkish; heartwood light red

to red; soft to moderately hard; light to moderately heavy; finer and closer grain than any of preceding; resin-rings frequent and distinct; pithrays moderately thick; pores moderately large, irregularly scattered; soft tissue in slightly irregular rings about pores and forming an irregular network where pores are crowded.

TIAONG (Luzon). Sapwood pale, pinkish or brownish; heartwood bright red to pale brownish red; soft to moderately hard; light to moderately heavy; finer grain than red Lauan; resin canals in some specimens at quite regular intervals accompanied by belts of lighter and darker wood giving appearance of growth-rings; pithrays rather thin; pores small to moderately large, evenly scattered; soft tissue in thin rings about pores.

RED LAUAN (Luzon, Mindanao, Negros; abundant in last). Sapwood light grayish brown; heartwood pale red to dull brownish red; very soft to moderately hard; very light to moderately heavy; resin-rings numerous, distinct; pithrays moderately thick; pores medium to large, numerous, evenly scattered, sometimes with glistening deposits; soft tissue in very thin rings around pores and in thin, widely scattered and indistinct cross-lines between pithrays. (Fig. 18.)

TANGUILE. Sapwood grayish brown; heartwood pale red to dark brownish red; soft to moderately hard or hard; light to moderately heavy; resin-canals less frequent and smaller than in red Lauan; pithrays finer; pores smaller and less numerous; soft tissue as in red Lauan. The best grade of Tanguile is the hardest, heaviest, finest grained, and least liable to insect attacks of all the Lauans. (Fig. 19.)

PALOSAPIS GROUP.

Palosapis⁵ (several species with wood of uniform appearance and structure, widely distributed, but abundant only in Bataan). Sapwood nearly white, on exposure easily staining to dirty gray; heartwood pale yellow, often with rose streaks, sometimes completely rose-colored when perfectly fresh, but fading soon to almost uniform light yellowish brown; slight disagreeable odor, when fresh; soft to moderately hard; light to moderately heavy; finer grained than most of the Lauans; resin-rings very infrequent; pithrays numerous, of two kinds, fine and moderately thick, latter very distinct; pores medium size, very evenly scat-

⁵ This is the wood described by Foxworthy under "Mayapis."

tered; soft tissue inconspicuous, in rather irregular rings about pores.

THE APITONG GROUP.

APITONG (several species with same general appearance and structure). Sapwood gray or light brownish gray; heartwood pale ashy red to dark reddish brown; strong odor of resin when fresh, the odor noticeable even in old, dry specimens when worked over; moderately hard to hard; moderately heavy to heavy; grain variable, from fine to rather coarse, generally straight, but sometimes forming very regular waves diagonally across the face of a plank; resin-rings numerous and conspicuous; pithrays variable, in some specimens fairly uniform, in some distinctly of two sorts, fine and moderately thick; pores moderately large to large, irregularly scattered, often lined with glistening resin which is also evident in longitudinal sections; soft tissue very irregular, in rather thick irregular rings about pores, in irregular patches and in short, broken, ill-defined lines. (Fig. 20.)

GUIJO. Sapwood pale gray; heartwood ashy brown, often with distinct reddish tinge; faint odor of resin; hard; moderately heavy to heavy; grain fine, fairly straight, glossier than Apitong; also glossier than Apitong in cross-section; resin-rings frequent, narrower and more sharply defined than in Apitong; pithrays fine, not conspicuous; pores rather small, scattered; soft tissue less abundant than in Apitong, in thin, irregular rings about pores and in short, thin, tangential lines; ripple-marks sometimes present, but not conspicuous. All the elements in Guijo are smaller and more sharply defined, so that the cross-section has generally a cleaner look, so to speak, than that of Apitong. (Fig. 21.)

THE MANGACHAPUY GROUP.

MANGACHAPUY and DALINGDINGAN (several species, almost all provinces). Sapwood almost white; heartwood yellowish white to bright straw color, in some species with bright green streaks when fresh, rapidly turning to dark yellowish brown on exposure to light, the green streaks becoming dull; moderately hard to hard; moderately heavy to heavy; grain fine, generally very straight; easy to work; resin-rings widely separated, sometimes very conspicuous; pithrays rather fine, numerous; pores rather small, evenly scattered; soft tissue in very thin rings

about pores. The hardest sorts of Mangachapuy grade almost into the Yacals. (Fig. 22.)

THE YACAL GROUP.

YACAL. Sapwood pale yellowish brown; heartwood yellow to yellowish brown, turning dark brown on exposure; slight acid odor when fresh; hard to very hard; heavy to very heavy; grain fairly fine; surface of cross-section glossy; resin-rings frequent; pithrays fine, numerous, uniform; pores small, evenly scattered; soft tissue in thin rings about pores and in fine irregular cross lines between pithrays. (See illustration of Guisoc, Fig. 23.)

MALAYACAL (Mindanao). Very much like Yacal, but grain slightly coarser, pores somewhat larger, soft tissue more abundant, often forming longer tangential lines.

GUISOC (central and southern Luzon, Leyte, Mindanao). Very like Yacal, but somewhat finer of grain and darkening much less on exposure. (Fig. 23.)

NARIG (Luzon, Leyte, Mindanao). Sapwood rather large, pale yellowish white, easily staining to dirty grayish brown; heartwood pale straw color, sometimes with greenish streaks or mottlings and turning brown on exposure; hard to very hard; heavy to very heavy; grain extremely fine, dense and straight; pithrays numerous, of two sorts, moderately thick and very thin; pores smallest in the whole family; soft tissue almost absent; resin-canals very scarce, when present, very inconspicuous. (Fig. 24.)

BANABA FAMILY (*Lythraceae*).

BANABA (widely distributed, but scattered). Sapwood pinkish; heartwood pale red to dull reddish brown; hard; moderately heavy; grain fairly distinct; conspicuously ring-porous; pithrays fine, indistinct; pores at beginning of ring large, others small; dark, glistening deposits; soft tissue in conspicuous, wavy interrupted tangential lines. (Fig. 25.)

BATITINAN (same distribution). Sapwood grayish white; heartwood gray to brown with olive tinge; otherwise resembling Banaba, but belt of large pores wider, soft tissue more abundant and forming less wavy and more continuous concentric lines and larger rings about pores. *

PAGATPAT FAMILY (*Sonneratiaceae*).

PAGATPAT (mangrove swamps, most abundant in Mindanao). Sapwood pinkish or yellowish white to light brown; heartwood light brown to very dark brown; fishy or swampy

smell when fresh; distinct taste of salt; moderately hard to hard; heavy; grain fine, very even and straight; easy to work; pithrays fine, numerous, indistinct; pores small, evenly scattered, with a tendency to arrange themselves in radial rows; very rarely sulphur-yellow deposits; soft tissue scarcely noticeable. (Fig. 26.)

There is occasionally found in Mindanao a very light yellowish or pinkish wood of the same structure and other characteristics as Pagatpat; it may be a mere variety, or perhaps another species of the same genus.

BACAUAN FAMILY (*Rhizophoraceae*).

BACAUAN, BACAUAN LALAKI, BUSAIN, LANGARAI, POTOTAN, and POTOTAN LALAKI (all mangrove swamps). Sapwood yellowish white, sometimes rather sharply distinguished, but generally merging through all shades of yellowish red and red into the (in large trees) dark reddish brown heartwood; hard to very hard; heavy to very heavy; fine, straight grain; rather difficult to work; pithrays fine, numerous, wavy, rather conspicuous in radial section; pores small, rather few, often divided by thin partitions; soft tissue very scanty, surrounding pores. (Fig. 27.)

TALISAY FAMILY (*Combretaceae*).

BINGGAS (widely distributed, but scarce). Sapwood nearly white to very pale brown, not sharply distinguished from heartwood; heartwood dark gray or grayish brown with irregular dark purplish streaks; hard; heavy; fine grained; growth-rings present, thin, not sharply defined nor conspicuous; pithrays very fine, indistinct except some white ones that show clearly; pores small, arranged in broad concentric bands along growth-rings; soft tissue in ill-defined, small rings about pores.

CALUMPIT (almost all provinces, but not abundant). Sapwood yellow to pale yellowish brown; heartwood light reddish brown; gives dirty straw color to water; moderately hard; moderately heavy; fairly fine, often wavy grain; growth-rings present, but generally ill-defined; pithrays fine, indistinct; arrangement of pores somewhat like Binggas; soft tissue surrounding and sometimes connecting pores.

DALINSI (Luzon, Palawan). Very like Calumpit, but darker brown, harder, heavier and finer grained; pores smaller; soft tissue much less prominent; colors water pale yellow.

SACAT (widely distributed, but scarce). Sapwood brownish, sometimes bright yellow; heartwood grayish or yellowish brown; colors water pale yellow; moderately hard; moderately heavy;

indistinct growth-rings; pithrays fine, fairly distinct; pores moderately large, rather evenly scattered, some with dark glistening and some with whitish deposits; soft tissue not conspicuous, surrounding pores and forming longer and shorter concentric lines of varying width.

TALISAY (beaches and river bottoms everywhere). Sapwood light yellowish brown; heartwood clear reddish brown; colors water yellow; moderately hard; moderately heavy; growth-rings bounded by a narrow band of darker, denser wood; pithrays fine; pores medium size; soft tissue in thin rings about pores and irregular, wavy, tangential lines joining the pores.

TOOG (Sorsogon, Samar, Leyte, Masbate, Agusan). Sapwood grayish to pale red, rather sharply marked off from bright brownish red heartwood; moderately hard; moderately heavy; growth-rings very broad, marked by a band of darker, but not denser wood; pithrays moderately thick; pores moderately large, evenly scattered or in groups of two to four; soft tissue in thin rings about pores and forming an irregular, but evenly distributed net-work of fine, irregular, short lines between pores and pithrays.

MACAASIM FAMILY (*Myrtaceae*).

MACAASIM and MALARUHAT (probably in all islands, but nowhere abundant). The woods that come into the market under these names come from a number of species and vary considerably in color, hardness, and grain, but their structure is fairly uniform; sapwood commonly gray or pale brown, sometimes distinctly yellowish; heartwood generally gray or grayish brown, sometimes with greenish, yellowish or reddish tinge; faint acid odor; fine, straight grain; pithrays very fine; pores small to medium, scattered; soft tissue in numerous, fine, wavy, irregular and interrupted tangential lines surrounding and connecting the pores. (Fig. 28.)

MANCONO (Mindanao, Palawan, Leyte, Ticao, Sibuyan). Sapwood small, pinkish; heartwood yellowish brown to dark brown; hardest and heaviest wood in the Islands; extremely difficult to work; pithrays very fine; pores very few, small, scattered; soft tissue hardly noticeable. (Fig. 29.)

BETIS FAMILY (*Sapotaceae*).

BANSALAGUIN (widely distributed, but rather scarce). Sapwood very pale red; heartwood deep red; distinct bitter taste; lathers when rubbed with water or saliva; very fine, glossy grain; very hard; very heavy; difficult to work; pithrays very fine, indistinct; pores small, in straight or oblique radial rows, with scant

yellowish deposits; soft tissue about pores and forming very numerous, wavy, and interrupted concentric lines.

BETIS (Luzon, Samar). In all respects similar to Bansalaguin, except that it is of a duller red color, slightly softer, lighter and coarser grained, and less glossy. (Fig. 30.)

NATO, MALACMALAC, and MANICNIC (one or more of these three and other species in probably all provinces). Sapwood whitish to very pale red; heartwood grayish red to red; some kinds lather slightly, at least when fresh; soft to moderately hard; light to moderately heavy; fine grain, often very regularly wavy; easy to work; pithrays fine, indistinct; pores small to medium, in short, straight radial rows sometimes with whitish deposits; soft tissue as in Bansalaguin, but more conspicuous. (Fig. 31.)

EBONY FAMILY (*Ebenaceae*).

ATA-ATA (Visayan Islands, Mindanao). Sapwood large, white when fresh, turning grayish in seasoning; heartwood very small, dead black or with grayish streaks; hard to very hard; heavy to very heavy; fairly fine grain; pithrays extremely fine; pores very small, scattered or in short radial lines; soft tissue in very numerous, fine concentric lines.

CAMAGON, or MABOLO, and BOLONGETA (probably all provinces, but not abundant). Sapwood reddish, in the former slightly lighter and finer grained; heartwood black with ashy, reddish or brownish streaks; other properties and structure as in Ata-ata.

EBONY (almost all islands, but scarce). Sapwood almost white when fresh, turning very light gray in seasoning, generally very sharply distinguished from heartwood; heartwood jet-black, sometimes with grayish streaks; harder, heavier, finer grained than preceding three woods; structure the same. (Fig. 32.)

DITA FAMILY (*Apocynaceae*).

LANETE (several species, in probably all islands). Sapwood and heartwood not distinguishable; whitish to ivory; slightly disagreeable odor when fresh; soft to moderately hard; moderately heavy; grain very fine, straight; pithrays very fine, indistinct; pores very small in short radial rows; soft tissue scarcely perceptible. (Fig. 33.)

MOLAVE FAMILY (*Verbenaceae*).

MOLAVE (probably all provinces). Sapwood hardly distinct from heartwood; yellowish white to pale brown, often with greenish tints; turns greenish yellow when treated with an alkali and colors water greenish yellow; slight bitter taste; slight characteristic odor; hard to very hard; grain very fine, often crossed; not difficult to work; growth-rings sometimes obscure,

sometimes very distinct; pithrays fine to very fine, indistinct; pores small, scattered; soft tissue inconspicuous, forming very thin rings about pores, and scattered. (Fig. 34.)

TEAK (not native, planted in southern islands; commercial wood imported). Sapwood dirty white or yellowish; heartwood dark golden yellow, darkening to brown or almost black with age; characteristic aromatic odor; ring-porous; pithrays moderately thick; an irregular row of large pores at beginning of ring; soft tissue in rather irregular rings about pores. (Fig. 35.)

BANCAL FAMILY (*Rubiaceae*).

CALAMANSANAY (several species, probably almost all islands). Sapwood yellowish or pinkish when fresh, turning to very pale yellowish brown; heartwood yellow with irregular pink or red mottlings, some of a uniform pink or red, but always fading to a more or less mottled yellow or dull yellowish brown; hard; heavy; fine, often crossed grain; rather difficult to work; pithrays very fine, numerous, indistinct; pores small, numerous, scattered; soft tissue inconspicuous, scattered. (Fig. 36.)

A bright yellow wood with the structures of Calamansanay, though slightly coarser, is found in southern Luzon, Samar, and Leyte. The species that produces it is not known, but it is evidently of this family. It is called Pantauon and Tiroron in Bicol and Alintatao in Visaya. Although it seems to be common in the regions mentioned, it is practically unknown in the Manila market and has no accepted commercial or official name.

We ascribe beauty to that which is simple; which has no superfluous parts; which exactly answers its end; which is related to all things; which is the mean of many extremes. Things may be pretty, rich, graceful, handsome and still lack beauty.—G. BALDWIN BROWN.

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The striving for artistic effect is as instinctive in childhood as in primitive man, and no worker ever loses it until he loses all pride in his handiwork. It is the source of every fine art. It is self-expression, which is at its best when bodied forth on doing things worth doing well.—*Selected*.