XII. *On the Strength, Durability, and Value of the Timber of the Blue Gum of Tasmania, and of some other* Eucalypti, *for Ship-building, &c. By* JAMES MITCHELL, *Esq., D. A. C. G.* [*Read* 12*th November,* 1851.]

THE experiments detailed in this paper were undertaken with the view of ascertaining the strength of the Blue Gum, known as the Ship-building Timber of this Colony, as compared with the results of similar experiments made upon the woods used for like purposes in England and India.

The details of the experiments upon the English and Indian woods will be found in Professor Barlow's "Essay on the Strength and Stress of Timber;" but at greater length on the latter in the condensed table of Capt. H. C. Baker's experiments under the article "Timber," in the last edition of the British Encyclopædia. Extracts have been taken from both these works for comparison.

The results are also given of a series of experiments on the Stringy-bark, a Gum wood extensively used in this and the neighbouring Colonies for house-building and general purposes. The specimens experimented upon were chosen because their ages were vouched by the gentlemen who supplied them, and not on account of their being specially calculated to sustain great weights. Pieces could, I have no doubt, be found capable of bearing greater weights than any I have recorded.

The apparatus used for testing the transverse strength consisted of two strong pieces of frame-work, 7 feet asunder, attached to the sides of a small building. The deflection was measured upon a scale attached to the wood by a silk thread stretched over the frame-work by plummets, in the same manner as described by Professor Barlow. The weights (56 lbs. and under) were obtained by permission from the Public Stores: they were placed upon a scale hung upon the middle of the wood by means of a half-inch iron eye, $2\frac{1}{2}$ inches square.

The weights were placed upon the scale until the deflection amounted to $\frac{1}{2}$ an inch, when they were removed, and the wood was permitted to resume its original straight form : the weights were then replaced, and removed at each succeeding $\frac{1}{8}$ of an inch of deflection, until the wood was observed to lose, however slightly, the power to recover its rectilineal form ; a failure in this respect, amounting to the diameter of the thread, was sufficient to determine its character for elasticity,—after which the weights were continued until the fracture took place. The elasticity and strength of the Blue Gum exceed, generally, those of all woods hitherto tested.

The apparatus used for ascertaining the direct cohesion was of a less complicated and expensive kind than that described in the Essay alluded to. Lengths of about 16 inches were cut from the pieces broken transversely, and turned in an ordinary lathe to about $1\frac{1}{2}$ inches diameter: about an inch in the middle was farther turned down to $\frac{3}{8}$ inch diameter, which was then carefully squared to $\frac{1}{4}$ of an inch with a fine file; and this in each case formed the portion to be tested. Through a hole accurately bored across the thick part of these pieces, near each end, short bolts were passed : to these bolts were attached short pieces of good rope, having eyes spliced in each end to receive them. A second piece of rope, passed through the first in the form of a link, sustained the scale at the lower end; and a similar one at the upper end hooked the beam which held the whole.

The appearance of the parts torn asunder leaves no room to doubt the fairness of the test. In some instances the smaller part drew 5 inches out of the ends, as far as the holes for the bolts, without breaking: this occurred generally in the wet or green pieces,—the substance of the wood between the fibres being doubtless less cohesive in this state than when dry.

In the Table l signifies the length.
- a the breadth.
- d the depth.
- Δ the deflection.
- S the value of the strength, without considering the deflection.
- S′ the value of the strength, the deflection considered.
- W the weight.
- C the cohesion.
- D the depth of the neutral axis.

The depth of the neutral axis is not given in many of the experiments, it being found impracticable to ascertain it with nicety, from the irregular nature of the fractures: these, however, always evinced compression and tension clearly enough, whether the pieces were broken short off or rent along the grain, which sometimes, though rarely, occurred.

The direct cohesion, by experiment, is given in each case, as preferable to that shown by the formula, the applicability of which, without reference to the discrepancies between the results, being, I think, questionable.

EXTRACTS FROM PROFESSOR BARLOW'S AND CAPTAIN BAKER'S TABLES.

No. of Experiments of which the Mean Results are given.	WOOD, &c.	Specific Gravity.	Weight and Deflection while Elasticity remained perfect.		Breaking Weight.	Ultimate Deflection.	Depth of Neutral Axis.	Value of Ultimate Deflection.	Value of Elasticity.	Value of Strength.	Value of Strength.	Direct Cohesion on square inch.
			Weight in lbs.	Deflection in inches.	lbs. W.	inches Δ	D	V	E	S	S'	
	Captain Baker's Experiments on specimens of Morung Saul, 6 feet between the supports, and 2 inches square.											
*8	Cut clear of the heart	928	450	1·128	1121	4·34		602	9306382	2522		
*4	Ditto, near the outside ..	1054	450	1·175	1003	3·72		696	8934121	2267		
*3	Prime seasoned..........	928	450	1·116	1192	3·50		740	9406451	2684		
*3	Beam of Tully Gunge Bridge, built in 1812 re-built, 1819.	1052	300	1·016	863	3·33		778	6888188	1942		
*9	Young timber clear of heart	934	450	1·21	1040	3·7		704	8675702	2340		
*4	Ditto near the heart	842	300	·906	946	3 87		670	7724503	2128		
	Professor Barlow's Experiments on pieces 7 feet between the supports, and 2 inches square.											
3	Teak....................	745	300	1·151	938	4·32	1 2	818	9657802	2462	2488	15550
3	Poon....................	579	150	822	846	5·91	1·225	596	6759200	2221	2266	14787
3	English Oak	969	150	1·590	450	5·90	1·3	598	3494730	1181	1205	9836
3	Ditto	934	200	1·280	637	8·10	1·2	435	5806200	1672	1736	10853
3	Canadian ditto	872	225	1 080	673	6·	1·125	588	8595864	1766	1803	11428
3	Dantzig ditto............	756	200	1·590	560	4·86	1 2	724	4765750	1457	1477	7386
3	Adriatic ditto	993	150	1·430	526	5·73	1 2	610	3885700	1383	1409	8808
3	Ash	760	225	1·266	772	8·92	1 3	395	6580750	2026	2124	17337
3	Beech	696	150	1·026	593	5·73	1·2	615	5417266	1556	1586	9912
3	Elm	533	125	1·685	386	6·93	1·15	509	2799347	1013	1042	5767
3	Pitch Pine	660	150	1·134	622	6·	1·2	588	4900466	1632	1666	10415
3	Red Pine................	657	150	·755	511	5 83	1·26$\frac{2}{3}$	605	7359700	1341	1368	10000
3	New England Fir.........	553	150	·931	420	4·66	1·33	757	5967400	1102	1116	9947
3	Riga ditto	753	125	·870	422	6·	1·35	588	5314570	1108	1131	10707

* The above should be compared with the other experiments by the constant numbers; or, if by the breaking weights, they should be reduced in the ratio of 7 to 6.

No. of Experiment.	NAME OF WOOD, &c.	Specific Gravity.	Greatest Weight and Deflection while the Elasticity was perfect.		W. Breaking Weight.
			Weight lb. W 1	Deflection inches *d*.	lbs.
	1. BLUE GUM, 7 ft. long, 2 in. square.				
1	Green piece, newly cut	1027	349	2·125	755
2	Ditto ditto	1078	299	1·125	800
3	Piece seasoned about 3 years...........	1003	315	1·875	695
4	Ditto 8 months.........	1076	294	1·5	819
5	Ditto	1034	503	1·375	867
6	Ditto from 2 to 3 years...........	1054	472	1·375	1029
7	Ditto 4 to 5 years...........	1078	413	1·375	1043
8	Ditto 2 to 3 years...........	987	567	1·75	1113
9	Ditto 4 to 5 years...........	1071	434	1·375	1113
10	Ditto 3 years	942	496	1·625	1122
11	Ditto, yellow coloured	1018	623	2·625	1131
12	Ditto, brown ditto	997	679	1·625	1140
13	Ditto curly Gum	1005	776	1·75	1235
14	Ditto brown coloured	1008	654	1·625	1282
15	Ditto	1089	518	1·625	1330
	Separate Experiment.				
16	Piece of keel from a steamer, 5 ft. long, 1¾ in. square	1090	....	....	791
	Weight reduced to 7 ft. long and 2 in. square	....	....	....	842
	2. ASH, OR SWAMP GUM.				
1	Green piece, 7 ft. and 2 in. square......	967	310	1·5	688
2	Ditto....................................	1003	434	1·75	750
3	Seasoned piece, ditto	954	354	1·25	914
	3. STRINGY BARK.				
1	Green piece, brown coloured...........	919	326	1·25	707
2	Ditto reversed grain	919	314	1·25	736
3	Ditto white coloured	798	357	1·75	746
4	Ditto ditto	866	440	1·75	746
5	Seasoned upwards of 6 years	925	417	1·625	973
6	Ditto 16 years	864	552	2·5	972
7	Ditto 18 years	947	468	1·25	958
8	Ditto 20 years	847	427	1·625	977
9	Ditto ditto	838	451	1·625	990

No. of Experiment.	NAME OF WOOD, &c.	Specific Gravity.	Greatest Weight and Deflection while the Elasticity was perfect. Weight lb. W'	Deflection inches d.	W. Breaking Weight. lbs.	Δ Ultimate Deflection. inches.	D Depth of Neutral Axis.	U Value of Ultimate Deflection.	E. Value of Elasticity. $L=\frac{l^3 w'}{ad^3 d}$	S. Value of Strength. $S=\frac{lw}{4ad^2}$	S'. Value of Strength. $S'=\frac{lw \sec^2 \Delta}{4ad^2}$	C. Value of direct Cohesion. $C=\frac{S' d^2}{(D-d)^2}$	Direct Cohesion on square inch from experiment. lbs.	REMARKS.
	1. BLUE GUM, 7 ft. long, 2 in. square.													
1	Green piece, newly cut	1027	349	2·125	755	8·5	1·25	415	6083932	1982	2063	14670	11232	Furnished by Mr. J. Degraves.
2	Ditto ditto	1078	299	1·125	800	7·75	....	457	9815472	2100	2135	....	18480	Ditto.
3	Piece seasoned about 3 years........	1003	315	1·875	695	6·75	....	523	6022637	1693	1737	....	....	Mr. Watson.—An inferior piece, having a portion of sap-wood in it.
4	Ditto 8 months........	1076	294	1·5	819	7·5	....	....	7260624	2149	2211	....	13104	Mr. Degraves.—Seasoned in a large well-aired barn or loft.
5	Ditto	1034	503	1·375	867	5·	1·25	705	13551368	2276	2291	16291	93408	Mr. Watson.—Outside piece, grain open from exposure.
6	Ditto from 2 to 3 years........	1051	472	1·375	1029	6·5	1·25	512	13625285	2701	2766	19669	28781	Mr. Degraves.—Seasoned in barn.
7	Ditto 4 to 5 years........	1078	413	1·375	1013	6·	1·25	588	11126670	2737	2793	19861	27440	Mr. Oldham.—Seasoned in timber yard.
8	Ditto 2 to 3 years........	987	567	1·75	1113	7·5	1·1875	470	12180827	2921	3015	18268	22064	Mr. Degraves.—Seasoned in barn; a portion of it sap-wood.
9	Ditto 4 to 5 years........	1671	434	1·375	1113	6·	1·1875	588	11692433	2921	2981	18063	27472	From the same piece as No. 7—outside.
10	Ditto 3 years	942	496	1·625	1122	5·25	1·125	781	14271872	2945	2996	15652	31088	Mr. Watson.—In testing cohesion a piece drew at 30576 several inches. A small portion of sap-wood.
11	Ditto, yellow coloured	1018	623	2·625	1131	7·5	....	470	8791776	2969	3064	....	20168	Mr. Degraves.—Dry and hard.
12	Ditto, brown ditto	997	679	1·625	1140	5·25	1·375	672	15478693	2992	3039	31119	27888	Piece of a banister from Mr. Degraves's mill, twenty years old. A portion of the sap remained slightly pierced by the beetle. The specific gravity of the sap was 814,—of the spine or proper wood, 1032.
13	Ditto curly Gum	1005	776	1·75	1235	6·	....	588	16426368	3242	3305	....	31024	Ditto, twenty years old.
14	Ditto brown coloured	1008	654	1·625	1282	5·	1·4	705	14908785	3365	3389	16735	35920	Mr. Oldham.—Part of an old joist, from a house in Liverpool-street, twenty-three years old.
15	Ditto	1089	518	1·625	1330	4·	....	882	13955185	3491	3522	....	28336	Part of a door-post from Mr. Degraves's mill, twenty years old.
	Separate Experiment.													
16	Piece of keel from a steamer, 5 ft. long, 1¾ in. square	1090	....	....	791	3·5	....	587	....	2213	2243	....	26288	Drew at 21752 while testing cohesion, about 4½ inches. This piece has been fourteen years under water. The grain oblique.
	Weight reduced to 7 ft. long and 2 in. square	....	....	....	842	....	....	....	....	2210	....	....	....	
	2. ASH, OR SWAMP GUM.													
1	Green piece, 7 ft. and 2 in. square........	967	310	1·5	688	6·25	....	564	7655760	1806	1846	....	18480	From Mr. Degraves.—The grain somewhat oblique.
2	Ditto........	1003	434	1·75	750	5·5	1·25	611	9186912	1968	2022	14378	18496	Ditto.—This piece drew 7½ inches out of the wood at 17792 without breaking.
3	Seasoned piece, ditto	954	354	1·25	914	6·	....	588	10490860	2399	2448	....	16888	From Mr. Oldham.—Great portion of sap-wood.
	3. STRINGY BARK.													
1	Green piece, brown coloured........	919	326	1·25	707	5·	....	705	9661075	1856	1882	....	21376	Furnished by Mr. Browne.
2	Ditto reversed grain	919	314	1·25	736	5·75	....	613	9305452	1932	1968	....	21376	Ditto.
3	Ditto white coloured	798	357	1·75	716	6·5	1·125	512	7556976	1958	2005	10487	20845	Ditto by Mr. Degraves, newly cut.
4	Ditto ditto	866	440	1·75	746	5·25	....	672	9313920	1958	1995	....	23290 18100	Ditto.
5	Seasoned upwards of 6 years	925	417	1·625	973	4·25	1·	830	9506060	2554	2584	10336	20168	Post of a dry stable.
6	Ditto 16 years	864	552	2·5	972	5·25	1·125	672	12583561	2551	2599	13578	12520	Furnished by Mr. Browne from a house on the Old Wharf.
7	Ditto 18 years	947	468	1·25	958	2·75	....	1283	13869273	2514	2525	....	18136	Ditto broke off short; a large weight having been too suddenly placed in the scale.
8	Ditto 20 years	847	427	1·625	977	5·75	1·1875	613	9927863	2564	2613	15832	27440	Mr. Oldham.—Rafter of an old house.
9	Ditto ditto	838	451	1·625	990	5·25	....	672	10281134	2598	2647	....	27440	Ditto.

The name Blue Gum appears to have been derived from the bluish gray colour of the whole plant in the earliest stages of its growth, which is occasioned by a covering of dust or bloom similar to that upon the sloe or damson. At this period the leaves are sessile, and opposite, their bases overlapping each other on either side of the stem. On different plants they vary in size from four to eight inches in length, and from two to four inches in breadth, with distinct upper and under surfaces. From the junction of the leaf with the stem two slight ridges run down the stem to the next pair, giving the smaller branches a square appearance. The duration of this series of leaves is uncertain, or dependent upon the position, soil, or variety. In one variety the second series made its appearance in the third year; but there are many of several years' evident growth to be found bearing the sessile leaves only.

The second series of leaves is entirely different, being petiolate, alternate, and pendulous. When this leaf is about an inch and a half in length, and yet young, a half turn or twist is observed to occur in the petiole or leafstalk, by which both sides of the leaf are brought into a vertical position: when full grown, it varies from about six to ten inches in length, and from one to two in breadth, being long, narrow, tapering, and curved downwards towards the point or apex: it then becomes difficult to distinguish any difference between the two sides, both being equally smooth, equally marked by the nerves, and apparently suited to perform similar functions in the natural economy of the tree. When a tree is felled, or a large branch lopped, and shoots spring from the stump, the first series of leaves are sessile, as in the young plant: it is therefore not uncommon to see old trees as well as young with both kinds of leaves upon them, which I imagine has led to the name "*diversifolia*" being applied to what appears to be the same variety as "*pulverulenta*," and several others, named from the dust or bloom which always covers the sessile leaves.

It is a common opinion that this tree sheds its bark annually: it is, however, only the outer layer which dries and peels off in long strips at certain periods. This casting of the outer bark does not take place upon the young plants during the persistence of the sessile leaves: when it falls from the tree, the next layer is left perfectly smooth, of a bright buff colour, which soon changes to a leaden gray, or ash of different hues. In some trees the outer bark comes off in short dry curled chips, from which the trunk seems never free: this does not, however, appear to be the case in those of large size.

The bark upon the full-grown tree is very compact, and of a woody fibrous texture, in which the layers are not readily distinguished. The piece upon the table is from a tolerably-sized tree, and though scarcely an inch in thickness is composed of 49 layers: the section of the outer one is always green, which arises, no doubt, from the action of light.

The alburnum, or sapwood, is seldom more than an inch in thickness; but the sap appears to ascend through a small portion of the inner wood also. The concentric layers of the inner wood or spine differ considerably; but from the means of a number of measurements an average may be taken of about $\frac{1}{12}$ of an inch, at which rate a tree six feet in diameter in the medium butt would require 432 years to attain that size. Much, however, depends upon the position, and other circumstances. Timber from the hills is of much closer grain, and therefore of better quality than that grown in the ravines or gullies; and in this respect it resembles the oak and other timber trees.

Unlike the Oak, the Gum is stronger when dry than when green, which must be occasioned by the greater shrinking of the latter during the period of seasoning. Much attention is not given to seasoning in the Colonies, the wood being suitable for ship-building in a half-seasoned or even green state. A saving of time is effected when it is used green, and it then works more easily; but it is questionable whether properly seasoned timber would not, in regard to durability, be the best—though in this respect it is boasted that the age of the Colony is not sufficient to test it. In ship-building, however, a surface coating of tar is almost invariably used, which is stated to prevent opening or rending. It probably, by checking undue evaporation at the surface, causes the seasoning to progress more uniformly. The plank for the topsides of ships and flooring-boards of houses ordinarily undergoes a seasoning of from one to three years previous to use. The Table of Experiments shows that the longer it is seasoned the stronger it becomes.

The *rationale* of seasoning appears to be simply this:—A tree, at the time when it is felled, is filled with moisture from the sap and juices peculiar to its kind: these are mostly subject to fermentation, and consequently contain within them germs of vegetation. The object is to check this power of vegetation, and to bring the wood as nearly as possible into a state of unvarying density. This is effected by drying; and the slower the process is conducted, the better for the quality of the wood, which, when once thoroughly dried and preserved so, will remain sound for centuries. But vegetation, though checked in this way, is not destroyed—the principle remains dormant, as in the case of the mummy wheat; and will spring into action on the approach and continued presence of moisture. A small fungus is then generated, usually termed the rot, which feeds upon the substance of the wood, destroying the cohesion of the fibre, and converting the whole into its own residuum or dust.

The juices of trees appear to be of lighter specific gravity than water: hence a water-seasoning, when the wood is sunk, is of great benefit,—for the water, displacing the sap, removes in a great degree the causes of decay. In the case of the Gum woods, it partially dissolves the brown astringent substance which fills the pores, and carries off the acid; and by thus rendering them more open the subsequent drying goes on faster, and so uniformly, that the rents and openings which so materially damage this timber in the estimation of those *unacquainted with its qualities* are mainly prevented.

Almost all writers on timber, I believe, recommend a short water-seasoning, and remark upon the absence of rents in the subsequent drying. When a piece of green Gum is placed in water, after a few weeks the water acquires a colour resembling that of brown sherry, and a scum rises to the surface: if the liquor be evaporated, an extract similar to the substance found in the pores is obtained in considerable quantity.

Water-seasoning for long periods is said to impair the strength in a slight degree, as boiling and steaming are also said to do: but the last two are only adopted for particular purposes. It is also said that they prevent dry rot; but the only sure preventative seems to be the solution of corrosive sublimate, well known as destructive to vegetation:—this is the principle of the celebrated process of Kyanizing.

From the foregoing it will be readily understood that wood in a green state should not be shipped in vessels carrying wool; the heated state of their holds being favourable to fermentation.

It would be desirable to try some pieces after a good salt-water seasoning: they should be entirely free from sapwood and heart—the former being subject to decay, and the latter liable to rend in seasoning.

By the kindness of Messrs. Degraves and Watson, I have procured blocks of the Blue Gum, Swamp Gum, and Stringy-

Bark, in order to test the loss they may sustain in weight and dimensions during a thorough seasoning: but as this will be a matter of observation, extending over a period of years, I propose placing them in the Museum, where they may be weighed and measured at fixed periods, and the results finally tabled.

The value of Blue Gum in Hobart Town, supposing a considerable order were to be met, is stated by Mr. Oldham to be,—for crooked timbers, from 4*s.* to 10*s.* each; planking, from £2 10*s.* to £3 per 50 cubic feet, in lengths from 25 to 50 feet. Mr. Watson states £4 for the load of 50 cubic feet for crooks and timbers, and 10*s.* per 100 superficial feet of planking. Extra lengths, which may be obtained easily of 140 feet, would of course be of greater value.

From its abundance in this Colony, there is much waste of this valuable timber. Near the ground, the spreading of the bole into the roots enlarges the diameter enormously. Persons employed to fell this timber erect, therefore, a stage about 10 or 12 feet above these, where the proper stem usually commences,—and here the cut is made: all below, although the most valuable for crooks, is left in the ground; the saving of labour being deemed more than equivalent to the loss. It is cut at all seasons; and no observation has been made as to any difference in quality between winter and summer-felled timber.

Like many other woods, the Blue Gum is subject to the sea worm (*Teredo navalis*), which attains to great size in it when an entrance is once effected. In a piece taken from the keel of the Commissariat steamer *Derwent*, (see experiment No. 16), the removal of which was occasioned by the action of the *Teredo* at one spot, where the wood was exposed to its attacks in consequence of the copper having been accidentally rubbed off, some of the perforations were nearly an inch in diameter; but where the copper was left, the wood appeared to be as sound as ever. A specimen was not obtained large enough for testing, the piece having been roughly cut out before it was known to be required for the experiment.

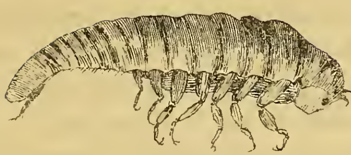
Another most destructive marine animal, though of very minute size, and which appears to be a species of *Limnoria*, attacks this and other woods in these seas, from the water's edge downwards. It is about $\frac{1}{10}$ of an inch in length, and is supposed by some to dissolve or soften the wood by means of a glutinous substance which it is thought to have the power of producing, and to make its way through it by this means rather than by boring. I have observed in it the appearance of very minute boring mandibles, with which it may probably gnaw its way; but it is rather difficult to distinguish them, even with a good instrument. A viscid fluid seems to attach the ova to its under surface and between its legs, whence they sometimes protrude. A figure of this little creature, which answers to the description given by naturalists of that found on the coasts of England and Holland, is appended to this paper.

Where it has entered, the wood appears to be literally alive, and honeycombed in every direction. Several of the piles on the Wharf, though apparently sound above high water-mark, are completely eaten away by it under water.

It does not appear that any preventive means to its attack have ever been tried, except coppering; but the surface seems to be effectually preserved by charring. The piece of charred wood upon the table was part of the mast of a vessel accidentally destroyed by fire about ten years ago in this harbour. It has since been used as portion of a floating stage or raft for repairing vessels in Mr. Watson's yard. The *Limnoriæ* do not appear in any of the charred parts,

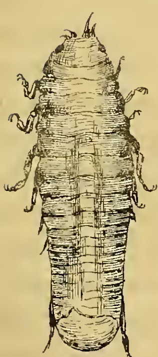
LIMNORIA

Magnified.



Nat: Size.

The legs are drawn down — they are generally doubled up under the Animal.



Back.

Under Surface — with eggs.

The legs generally overlap the eggs.

although their ravages are abundant enough immediately beneath, the entrance having apparently been effected in other spots. Mr. Watson has, within the last month, submerged some charred Blue Gum with the view of testing this remedy. The result will be communicated to the Society hereafter.

Besides the *Limnoria,* there is also found in its perforations a small millipede from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch in length, the body of which is composed of about fifty segments, each supplied with the usual pair of legs, which are furnished with tufts of hair, and impel the animal through the water with great activity. I am unable to say whether it perforates the wood itself, or merely occupies the holes made by the *Limnoria:* it appears to be armed, however, with a formidable pair of forceps.

The sapwood of all the *Eucalypti* is subject to the attacks of small worms, which are usually the larvæ of beetles and flies. The dusty powder which is seen so frequently to fall from the rafters of houses, and furniture made from the Gum, is mostly produced by the larvæ of a minute beetle. The beetle is of the same habits, and is found deep in the sapwood, which is generally wholly reduced to powder—with the exception of a thin shell of the outside—before the harder wood is attacked. The beetle escapes through a small pinhole : it is, like most of its class, beautifully marked, and with its larvæ seems to subsist upon the sapwood, for piercing which it has a powerful apparatus.

The operation of freeing timber from the sapwood is sometimes not thought of: but where durability is an object, or when used for furniture or fittings, this should certainly be done, as it is invariably attacked by this insect.

The growing timber is also attacked by numerous insects of different kinds. When the tree has passed its prime, the heart decays, and openings are formed near the ground be-

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tween the spurs of the roots through which they have access; and in these cases destruction goes steadily on from the centre upwards and outwards until a mere shell of the trunk is left standing. Trees are sometimes felled partially affected, and good sound timber is obtained from the untouched parts: in other cases, small perforations are found at intervals throughout a considerable length of the tree—this is termed "specky timber" in the ship-yards, and never used for important purposes. Many of the insects leave earthy deposits in their borings, to which the decayed heart of the tree assimilates; so that it is not uncommon to find the centre of trees filled with fine mould before their fall, which crumbles and disintegrates with the concussion. This of course refers to aged trees.

The Swamp Gum grows to the largest size of any of this family in Van Diemen's Land. Its growth is nearly twice as rapid as that of the Blue Gum: the annular layers are sometimes very large; but the bark, and the whole tree indeed, is so like the Blue Gum, as not to be easily distinguished from it in outward appearance. The leaves, though of the same form in the Swamp Gum, are, however, much smaller and thinner, and the bark not much more than a third of the thickness of that of the Blue Gum. It grows best in moist places, which may probably have given rise to its name. Some extraordinary dimensions have been recorded of trees of this species. I lately measured an apparently sound one, and found it 21 feet in circumference at 8 feet from the ground, and 87 feet to the first branches. Another was 18½ feet in circumference at 10 feet from the ground, and 213 feet to the highest branch, or extreme top. A third reached the height of 251 feet to the highest branch: but I am told that these are pigmies compared to the giants of even the Blue Gum species found in the southern districts.

The wood of the Swamp Gum, being of opener grain, and not so strong as that of the Blue Gum, is not so much prized; but it seems in the best varieties to be extremely valuable, and considered by some equal to Ash, by which name it is sometimes distinguished. It is very straight in grain, easily worked, and, except when very green, its specific gravity is always under 1000. It is sometimes used by wheelwrights, and if properly selected would no doubt answer well for making oars and other articles now usually imported.

The Stringy-bark,* as its name implies, has a fibrous rough bark, in thickness equal to, and often far exceeding, that of the Blue Gum; about one-third of which on the outside is always perfectly dry, and easily separable into layers and fibrous threads, very similar in appearance to the husk of the cocoa-nut: but, unfortunately, the fibres are without tenacity. The innermost layers are compact, like those of the bark of the other trees mentioned. The layers of the wood are nearly equal to those of the Blue Gum—rather more open; but when good specimens are placed by the side of Blue Gum, the difference is not readily perceived. There are many varieties, however; some of them very inferior, and subject to what are termed gum-cracks. These are fissures between the concentric layers, two or three of which seem sometimes to have been broken,—probably by violent gusts of wind, or other effects of weather: they are filled with an

* The stupendous magnitude of the Blue Gum and Swamp Gum trees having been recorded, I may mention that on the north coast of Tasmania, a mile or two inland, and in the vicinity of the Cam River, I measured a Stringy-bark, which, at four feet from the ground, was 64 feet in girth: the tree was perfectly sound, and had somewhat the appearance of a squared log with the angles bevelled, carrying up its enormous column, which diminished in a finely graduated proportion, to about 200 feet, where the trunk had been broken short off immediately above the projection of a large limb. The solid contents of this tree would be little short of 200 tons; nor is it a solitary instance of the kind;—the species is therefore well named *gigantea* by Hooker *fil.*—J. M.

astringent substance or gum of the consistency of thick tar, when green; but this becomes a concrete mass as the wood dries: where they occur the wood is of course weakened. They are sometimes the thickness of a single layer only, and run half round the tree, as if one layer had shrunk from the other, and secretions were produced to fill up the void.

The leaves of this tree are never sessile, but always of the same character as the second series of the Blue Gum. Its leaves exhibit no bloom, but are always of a rich dark green, particularly in the early stages of its growth.

I have failed to trace any authentic cause for the prejudice which exists against the use of this timber for ship-building purposes. In a letter from Mr. Watson, appended to these observations, he states its shrinking to be the cause: but it seems never to have been fairly tried in this respect. Its durability in houses, when free of sap, is very great,—the shingles, of which great quantities are made from it, being considered good for 20 years. As a ship-building timber it would have the advantage of lightness over the Blue Gum, its specific gravity being under 1000, except sometimes when green;—whereas the Blue Gum never floats when free from sap. This is a fair criterion by which to judge between the Blue Gum and the other species of timber when seasoned. The inferior Stringy-bark is said to have been exported to the neighbouring Colonies as Blue Gum in the earlier years of the trade, by which the character of the timber generally has been impaired. In New South Wales it is still undervalued.

There are several varieties of each of the three preceding species of timber more or less valuable, to notice which in detail would require much close observation. There are also many members of the *Eucalyptus* family of inferior importance in the Colony, the timber of which may no doubt be turned to account, but which books do not define with sufficient precision to enable me to designate specifically

The Peppermint, Iron Wood, Mountain Gum, Weeping Gum, Black-butted Gum, White Gum, Myrtle-leaved Gum, are a few of the names by which they are peculiarly known to wood-cutters, charcoal-burners, &c. &c. The family is an extensive and interesting one, presenting in its various filiations ample material for observation and remark from other Members of the Society, and of a character more scientific than I have been enabled to bestow on that part of the subject considered in this paper.

Sir,—In reply to yours, wherein you require my opinion in reference to the Timber of Van Diemen's Land for the purpose of shipbuilding, I beg to state the following particulars as the result of an experience of twelve years:—

"I have found the Blue Gum, of which almost any quantity can be procured, equal to English Oak in durability, and superior to it on account of the great lengths that can be obtained: there is no difficulty in procuring lengths of 70 and 80 feet, and if required it could be procured upwards of 100. The trees selected for ship-building should be of the largest size, about four or five feet in diameter: when required for large pieces, a cut should be put down the middle, when it could be converted into logs of 18 × 24 inches; the heart of the tree requiring to be taken out entirely, as in a tree of that size there is generally 12 inches of heart. For kelson pieces, lower or upper deck beams, wale-planks, and stringers, I consider it to be unrivalled;—it takes the steam well, and there is no fear of its spauling in working round a full bow. It requires at least two years to season before it is fit to put in a ship, according to the present system of felling and cutting up directly. Timber that I have had placed in the water three or four months, then taken out and exposed to the air for about the same time, I have found to stand equal to Oak. I have remarked when I have had a tree cut up which had been killed standing, that it required a much less time for seasoning, and would not check or fly in the sun as it would had it been cut up in a green state. I have no doubt if the trees were killed in the month of May and left standing for six months, then felled and cut into plank or log, and put in the water for three months, that the timber would be equal to any in the world. Fine crooks for rising floors, keel-knees, and breast-hooks for the largest ships built, could be obtained of this Gum. In all my experience in repairs of Colonial-built vessels, I have never observed any appearance of dry rot. For masts and spars, trees can be procured in sufficient lengths and sizes for the largest vessels built: but I cannot recommend them for this purpose on account of their weight, except in cases where pine could not be procured. The Ash Gum is to be preferred for masts, &c., not being so liable to rents as the White, nor is it so heavy as the Blue Gum. The Lightwood, though obtainable in large quantities, is far less plentiful than Gum. It grows to about the size and length of English Oak, and is a valuable wood for the finishing work of a vessel, as it may be used a few months after being cut: it will not shrink, and gets very hard when seasoned, although an easy wood to work. It is well adapted for bulwarks, combings, capstans, trussel trees, cheeks, and caps for ships of largest dimensions; and for the above purposes I consider it a very durable wood. Fine crooks can be obtained of it.

"The Huon or Macquarie Harbour Pine can be used for any purpose about a ship. When seasoned, it becomes much harder than the Baltic or American Pine. I have never seen an instance of decay in it. In repairing a vessel twelve years old, built almost entirely of it, which I had occasion to open, the timbers and plank appeared as fresh as when first put in. It is an excellent wood for boat-building, being much tougher than any other Pine I have seen. Not having been at the part of the Island where it grows, I cannot say to what extent it is to be procured; but I understand from persons who have been there, that there is a great quantity about Macquarie Harbour, and that fine spars and crooks could be readily obtained there. It can be got about 30 feet long by 2 to 3 feet diameter.

"Myrtle* very much resembles English Beech, and can be procured about 30 feet long; 3 feet diameter. It is well adapted for blocks and dead-eyes; but it is not fit to use about a ship for any other purpose than what Beech or Elm would be applied to in ships built in England.

"Stringy-bark grows to about the size of Blue Gum, and is as plentiful: it is not used for ship-building here, nor do I consider it fit, for it shrinks very much, and when exposed to the damp swells greatly. Spars of largest size could be procured of it; but it is very liable to rents.

"I am, Sir, &c.,

"J. WATSON."

* [Mr. Watson says that he has not seen the Huon Pine in its native forests. It is quite clear that he has never witnessed the Myrtle tree in the dense forests on the western and north-western parts of Van Diemen's Land. There, Myrtle trees often measure 30 feet round at 4 feet from the ground, and rise to 150 feet in height;—at the same time it must be observed, that full-grown trees are not unfrequently hollow at the butt. The remark that the timber of the Tasmanian Myrtle resembles that of the English Beech is creditable to Mr. Watson's observation, and lends weight to his opinions,—for this tree is really a Beech —the *Fagus Cunninghamii* of botanists.—J. M.]