1875.

NEW ZEALAND.

# ADULTERATION OF WINES AND SPIRITS,

(REPORTS FROM THE COLONIAL LABORATORY ON).

*Presented to both Houses of the General Assembly by Command of His Excellency.*

The Hon. W. B. MANTELL to the Hon. the COLONIAL SECRETARY.

Geological Survey Office,
Wellington, 23rd February, 1875.

SIR,—

I have the honor to forward herewith a further report * by Mr. Skey, analyist to this department, on certain wines and spirits which have been chemically examined with a view to ascertaining whether they have been adulterated in any way.

I have, &c.,
W. B. MANTELL.

The Hon. the Colonial Secretary, Wellington.

## Enclosure.

FURTHER REPORT upon the CHEMICAL EXAMINATION of ARTICLES LIABLE to be ADULTERATED.

THIS report gives the results obtained by the analysis of a series of wines and spirits submitted to the Laboratory of the Geological Survey Department for examination. The series embraces—

(1.) Twenty-six samples of various wines from bulk in bond, supplied by order of the Commissioner of Customs, fourteen of which are from Christchurch, and the remainder from Wellington.

(2.) Eighty-three samples of spirits from various parts of Otago, furnished by the Commissioner of Police for that Province; also eleven samples of spirits in bond from the Hon. Commissioner of Customs.

### I.—WINES.

The wines are made up of 13 ports, 2 colonial wines, and 11 sherries, and in none of them have I been able to discover any substance of a deleterious character. With one or two exceptions, their specific gravity, percentage of alcohol, and general characters have been ascertained, and these will be found embodied in Table I. and notes, hereto appended.

*Port.*—From an inspection of Table I., it appears that while the samples of port wine vary considerably in density the amount of alcohol present in them, with two or three exceptions, is nearly alike. Thus their specific gravity varies from 1000·5 to 1019, and the gap between these numbers is filled up without any notable break, while the highest and lowest percentages of alcohol are 22·00 and 15·68 respectively, the next highest and lowest being 21·46 and 17·14, and the average of the whole percentage 19·06. The specific gravity of a number of these wines is greatly in excess of that which genuine port gives.

*Colonial Port.*—These ports (from Australia, I believe) are too few in number to allow of being usefully tabulated; they however vary but little in specific gravity, percentage of alcohol, or general character, and, as compared with the ports just described, exhibit a marked low specific gravity, also a low alcoholic strength.

*Sherry.*—In respect to the sherries, these wines in every instance but one (No. 599) are remarkably close to each other both in specific gravity and alcoholic richness, the former varying only from 985 to 996·7, and the latter, omitting the one specified, from 18·81 to 22·56, or but a difference of 3·75 per cent. of alcohol, with an average of 19·84 per cent. The one omitted only contains 10·81 per cent. of alcohol, which is not sufficient to enable such wine to keep.

* Former Report to the Hon. the Premier on 17th and 24th July.

TABLE I.—SAMPLES of WINES from bulk at HER MAJESTY'S CUSTOMS.

| Brand. | Variety. | Locality. | Specific Gravity at 60° Fahr. | Alcohol per Cent. by Volume. |
|---|---|---|---|---|
| 190 | Port ... | Christchurch ... | 1004·4 | 19·02 |
| H.A. | „ ... | „ ... | 1000·5 | 20·92 |
| X 538 | „ ... | „ ... | 1006·3 | 20·81 |
| 419 | „ ... | „ ... | 1018·2 | 21·05 |
| 554 | „ ... | „ ... | 1008·4 | 20·40 |
| 692 | „ ... | „ ... | 1002·7 | 22·00 |
| 595 | „ ... | „ ... | 1009·0 | 20·86 |
| 454 | „ ... | „ ... | 1005·3 | 21·46 |
| 362 | „ ... | Wellington ... | 1019·0 | 19·82 |
| 526 | „ ... | „ ... | 1014·0 | 19·91 |
| 598 | „ ... | „ ... | 1016·0 | 18·74 |
| 820 | „ ... | „ ... | 1010·0 | 15·68 |
| 893 | „ ... | „ ... | 999·0 | 17·14 |
| 183 | Colonial Port | „ ... | 990·8 | 15·42 |
| 736 | „ ... | „ ... | 994·0 | 13·92 |
| 51 | Sherry ... | „ ... | 992·9 | 21·10 |
| 216 | „ ... | „ ... | 994·0 | 21·09 |
| 428 | „ ... | „ ... | 992·1 | 21·40 |
| 881 | „ ... | „ ... | 990·8 | 21·63 |
| 913 | „ ... | „ .. | 996·8 | 22·56 |
| 599 | „ ... | Christchurch ... | 993·5 | 10·81 |
| 668 | „ ... | „ ... | 985·0 | 21·14 |
| 448 | „ ... | „ ... | 988·6 | 18·10 |
| 56 | „ ... | „ ... | 989·8 | 21·51 |
| 585 | „ ... | „ ... | 990·1 | 18·81 |
| 421 | „ ... | „ ... | 992·2 | 20·06 |

NOTES upon WINES in TABLE I.

No. 190. Port.—Mellow, of medium colour, but slightly sweet.
H.A. „ Of excellent taste; very dark; much sediment of tartar.
No. 538. „ Very crusty; mellow, rather turbid.
No. 419. „ Dark colour, very sweet, slightly turbid.
No. 534. „ Light port colour, and smooth taste, slightly sweet; no sediment or crust.
No. 692. „ Very sweet and clear.
No. 595. „ Clear, of pure vinous flavour; crusty.
No. 454. „ Slightly turbid; has a light pleasant taste; large sediment of tartar.
No. 362. „ Per "Carrick Castle," from London—clear pale for port; very sweet.
No. 526. „ Ex "Wellington," from Onehunga—clear and dark; a little sweet.
No. 598. „ Ex "Peter Denny," from London—clear, feebly sweet, pale colour.
No. 820. „ Ex "Warwick," from London—rather astringent and faintly sweet, clear; good deposit of tartar.
No. 893. „ Ex "Wellington," from Auckland—turbid, feebly sweet; contains much tartar.
No. 183. Colonial Port.—Melbourne—clear, light colour; taste new, being very harsh and astringent.
No. 736. Colonial Wine.—Port, ex s.s. "Albion"—rather astringent, but faintly sweet; clear.
No. 51. Sherry.—Ex "Jessie Readman"—dry, clear pale colour.
No. 216. „ Ex "Lady Jocelyn"—colour pale, good full flavour; not acid.
No. 428. „ Ex "Himalaya," ship—pale, clear.
No. 881. „ Ex "City of Dunedin"—pale, clear, not sweet; has a brandy flavour.
No. 913. „ Ex "Vanguard," ship—dark and clear.
No. 599. „ Decidedly acid to the taste, and unpleasant; colour dark for sherry, and turbid.
No. 668. „ Appears of average quality, tasting strongly of brandy.
No. 448. „ Harsh flavour, feebly sour; much sediment of tartar.
No. 56. „ Of average quality.
Nos. 585. 421. „ In colour light; both are wines of fair average quality.

II.—SPIRITS.

The samples of spirits from Otago comprise forty-two of brandy and thirty-eight of whisky, and the ones from bond comprise four of brandy, three of whisky, three of rum, and one of geneva. These samples have all been carefully examined, with the exception of three, the labels of which were not sufficiently distinct to allow of being certainly recognized.

*Determination of Alcohol.*—The only quantitative analysis performed upon these samples has been the determination of their respective strengths, and the results of this will be found in Tables II. and III. attached.

*Brandies.*—It will be seen on reference to Table II. that the strength of the brandies is on the whole very satisfactory, averaging 51·34 per cent. of alcohol; that of the best brandies of commerce, such as Hennessey's, Martell's, &c., being 50·3, as is shown in my preliminary report upon the present

subject. But though the strength of these spirits is satisfactory when viewed in this way, there are several of them of so low a degree of strength as to show that they must have been adulterated with water, being below 17 per cent. under proof, and so, I believe, illegal. Four of these are notably under this strength—namely, Nos. 7, 15, 41, and 74.

The maximum and minimum percentage of alcohol in these brandies is 59·12 and 43·99 respectively.

*Whiskies.*—In regard to the whiskies, their average of spirits also appears satisfactory in the aggregate, being 52·52 per cent.; but the alcohol has a wider range, 43·62 to 62·34, and there are several samples of less strength than 17 under proof.

*Bonded Spirits.*—The bonded spirits (see Table III.), when compared with the previous ones, exhibit a marked difference in strength, and which is much in their favour, the highest and lowest strength of the brandies of this series being 57·64 and 53·72, the average strength 55·66; while for the whiskies the corresponding strengths are 61·34 and 60·20, with an average of 60·61.

The difference of averages is therefore 4·32 per cent. for the brandies, and 8·09 per cent. for the whiskies, in favour of the bonded spirits. If, therefore, these bonded spirits are sufficient in number to allow of an average being fairly struck, and are fair samples of the class of spirits sold for retail purposes in Otago, it will be seen that a considerable quantity of spirits vended by the publicans there has been adulterated with water, and to a serious extent.

The remaining spirits from bond not yet treated are one geneva, which contains 56·8 per cent. of alcohol; and three rums, the extremes of alcoholic strength for which are 56·01 and 70·11 per cent., and the average strength 61·45.

*Adulterants.*—In respect to the freedom or otherwise of these spirits from adulterants other than water, they have all been carefully tested for this, and although I had not a sufficient quantity of them in any case to allow of a general examination for everything of an improper nature likely or possible to be present, still every sample has been more or less examined, and with results which show that they are free from all substances specially prohibited; the spirits from Otago very frequently contain copper, also iron, and in two or three instances zinc. Besides these, I find sulphuric and hydrochloric acids are generally present, both of which are, however, in combination. These acids are, for a variety of reasons, so apt to enter into such spirits, that I do not attach much importance to the fact of their presence in them, particularly as in this state they are not at all noxious to health; hydrochloric acid, as is well known, being almost ubiquitous, while sulphuric acid, though possibly entering spirits by water or metallic compounds employed to adulterate them, may be entirely absent, or at least hardly detectable while both these adulterants are present, or, on the other hand, can be present without prejudice to either the honesty of the compounder of such or to the character of the spirits he produces. Thus, it can be the product of the combustion of sulphur employed, as it sometimes is, to cleanse the casks in which the spirit is stored, or it may be derived from water used for the same purpose, and which, having filled the pores of such casks, has been absorbed therefrom by the spirits afterwards introduced there.

The frequent presence of copper and iron in these spirits, however, certainly requires investigation. As regards the former metal, copper, the most cupreous of these spirits which I have examined gave this metal at the rate of 1·7 grain per gallon, which is equivalent to 4·33 grains of blue vitriol of commerce (hydrous sulphate of copper). As a rule, however, it exists in them only as traces; the average of quantity copper afforded by a large number of the brandies, taken indiscriminately, was ·77 of a grain per gallon, equivalent to 1·96 grain of blue vitriol; the whiskies did not contain so much.

In regard to the precise extent of the distribution of copper through these spirits, my results show that in those from Otago, 85 per cent. of the brandies and about 50 per cent. of the whiskies are more or less cupreous. This metal is not present in either the brandies or whiskies from bond, but is, to a small extent, in two out of the three rums from there; and, as it was shown in my former report on this subject to be present in two out of the five spirits of this kind which were examined for it, it would appear that copper is a very frequent ingredient of rum, whether from the hotelkeeper or from bond direct. At all events, as far as I have yet examined them, it is shown that 50 per cent. of our rums are cupreous.

A knowledge of these facts, as to the general cupreous condition of the spirits from Otago, led me to suppose that copper had got admixed with them while being compounded, either accidentally or otherwise, and I accordingly informed the Director of this department of the results here detailed, and at the same time requested for analysis samples of the raw spirits manufactured at the Dunedin Distillery, and of the materials employed there for compounding them. My application was forwarded to the Customs authorities here, and on the 28th November last I received a sample of spirits of wine, No. 1653, from the above Distillery, also two of the compounding materials—oil of cognac (1654 *a*) and essence of prunes (1654 *b*).

The spirits proved to be free from copper, but in the oil of cognac I readily detected this substance: its colour was leek-green, and was entirely due to the copper present. The quantity of this oil at my disposal was unfortunately insufficient to allow of a quantitative determination of the copper therein, as the whole of it only yielded so small a quantity of inorganic matters, that had these been wholly oxide of this metal, one gallon of the oil would only contain 16 grains of copper. By far the greater portion of these matters, however, was evidently of an alkaline nature. The other compounding substance was of a reddish colour, and contained 1·1 grain of sesquioxide of iron per fluid ounce, without a trace of copper, and to it I attribute the iron found in these samples.

It appears, therefore, that at any rate the less cupreous of these spirits may have had this character conferred on them solely by the oil of cognac; but as I have no data as to the quantity of this oil used to a certain bulk of spirit, and have not completely analyzed it, I cannot form an opinion as to the extent to which it is proper to assign to the oil in question this condition of the remainder of such samples—that is, the more cupreous ones.

It should be stated here that there are ways other than those cited in which copper may get accidentally into compounded spirits. It may, I think, get into brandies and rums by the caramel or treacle employed to colour them, owing to the custom of preparing these substances in copper pans, as

unless great cleanliness and certain precautions are observed, a portion of the metal of these vessels becomes dissolved during the operation. Copper can also find its way into spirits distilled in copper stills, as evidenced by my experience in them; but, as already stated, I believe that, at least in the majority of these cases, it has done so solely through the oil of cognac.

As to the question of whether the copper has been purposely added to this oil, I think it has, and entirely for chromatic effect; it appears to exist therein as a component part of some kind of soap.

Although in none of these spirits is copper present in quantities palpably dangerous, still the presence of this metal in spirits, even as traces only, is very objectionable, as this metal is a cumulative poison, "bringing on colic, loss of appetite, and ultimately jaundice and affection of the brain," so that those in the habit of taking cupreous spirits freely will necessarily accumulate considerable quantities of copper in their system, a circumstance which must greatly interfere, for the reason above given, with their health.

*Fusel Oil.*—It has been considered by some that the inferior quality of several of our spirits, or even their deleterious nature in a few instances, may be due to the presence of fusel oil in them; but I have not detected this substance in quantity amongst any of the present samples. As one of the volatile products, however, of alcoholic fermentation when grain or roots is employed, the oil generally occurs in the spirits produced thus even when carefully rectified, and in quantity more or less according as they are distilled off at a low or a high strength.

No useful effects would therefore accrue from the estimation of this oil in any of the present samples.

I herewith append a list of samples of spirits examined in which copper was present in sufficient quantity to allow of its being readily detected:—

*Brandy.*—Nos. 5, 7, 9, 21, 25, 28, 38, 44, 50, 54, 56, 62, 64, 66, 72.

*Whisky.*—Nos. 14, 18, 22, 29, 39, 42, 43.

*Rum.*—Nos. 5, 6.

TABLE II.—SPIRITS from DUNEDIN.

| No. | Variety. | Alcohol per Cent. by Volume. | No. | Variety. | Alcohol per Cent. by Volume. |
|---|---|---|---|---|---|
| 1 | Brandy ... ... | 47·61 | 44 | Brandy ... ... | 47·82 |
| 3 | „ ... ... | 48·29 | 46 | „ ... ... | 55·41 |
| 5 | „ ... ... | 47·82 | 49 | „ ... ... | 50·42 |
| 7 | „ ... ... | 44·84 | 50 | „ ... ... | 56·04 |
| 9 | „ ... ... | 48·79 | 53 | „ ... ... | 52·11 |
| 11 | „ ... ... | | 54 | „ ... ... | 53·42 |
| 13 | „ ... ... | 47·74 | 56 | „ ... ... | 55·29 |
| 15 | „ ... ... | 44·78 | 59 | „ ... ... | 54·14 |
| 17 | „ ... ... | 50·73 | 60 | „ ... ... | 54·21 |
| 19 | „ ... ... | 59·12 | 62 | „ ... ... | 47·57 |
| 23 | „ ... ... | 56·61 | 64 | „ ... ... | 46·80 |
| 25 | „ ... ... | 58·54 | 66 | „ ... ... | 58·64 |
| 27 | „ ... ... | 54·24 | 67 | „ ... ... | 48·19 |
| 28 | „ ... ... | 53·77 | 70 | „ ... ... | 58·88 |
| 30 | „ ... ... | 51·92 | 72 | „ ... ... | 53·54 |
| 32 | „ ... ... | 50·10 | 74 | „ ... ... | 45·11 |
| 34 | „ ... ... | 56·01 | 76 | „ ... ... | 47·09 |
| 36 | „ ... ... | 47·91 | 78 | „ ... ... | 54·91 |
| 38 | „ ... ... | 56·14 | 81 | „ ... ... | 47·10 |
| 41 | „ ... ... | 43·99 | 83 | „ ... ... | 53·24 |
| 42 | „ ... ... | 50·11 | | | |
| 2 | Whisky ... ... | 49·51 | 42 | Whisky ... ... | 43·98 |
| 4 | „ ... ... | ... | 43 | „ ... ... | 50·43 |
| 6 | „ ... ... | 50·61 | 45 | „ ... ... | 50·46 |
| 8 | „ ... ... | 48·64 | 47 | „ ... ... | 47·51 |
| 10 | „ ... ... | 50·90 | 48 | „ ... ... | 53·62 |
| 12 | „ ... ... | 46·47 | 51 | „ ... ... | 53·64 |
| 14 | „ ... ... | 56·71 | 52 | „ ... ... | 56·49 |
| 16 | „ ... ... | 58·42 | 55 | „ ... ... | 56·99 |
| 18 | „ ... ... | 48·75 | 57 | „ ... ... | 45·98 |
| 20 | „ ... ... | ... | 58 | „ ... ... | 53·72 |
| 22 | „ ... ... | 51·56 | 61 | „ ... ... | 58·41 |
| 24 | „ ... ... | 48·71 | 65 | „ ... ... | 54·27 |
| 26 | „ ... ... | 51·92 | 69 | „ ... ... | 62·34 |
| 29 | „ ... ... | 57·64 | 71 | „ ... ... | 56·62 |
| 31 | „ ... ... | 50·14 | 73 | „ ... ... | 61·19 |
| 33 | „ ... ... | 54·69 | 75 | „ ... ... | 48·21 |
| 35 | „ ... ... | 43·62 | 77 | „ ... ... | 58·42 |
| 37 | „ ... ... | 48·81 | 79 | „ ... ... | 49·27 |
| 39 | „ ... ... | 49·99 | 82 | „ ... ... | 52·31 |

TABLE III.—SPIRITS from BOND.

| No. | Variety. | Alcohol per Cent. by Volume. | No. | Variety. | Alcohol per Cent. by Volume. |
|---|---|---|---|---|---|
| 1 | Whisky ... ... | 60·31 | 7 | Gin ... ... | 56·81 |
| 2 | „ ... ... | 60·20 | 8 | Brandy ... ... | 55·63 |
| 3 | „ ... ... | 61·34 | 9 | „ ... ... | 55·65 |
| 4 | Rum ... ... | 70·11 | 10 | „ ... ... | 57·64 |
| 5 | „ ... ... | 56·01 | 11 | „ ... ... | 53·72 |
| 6 | „ ... ... | 58·24 | 12 | Missing ... ... | |

WILLIAM SKEY.

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1875.

*Price 6d.*]