corresponding elevation of continents (Arldt and Enquist).
4. Intensive volcanic activity with accompanying soot clouds (Sarasin).
5. Slight eccentricity of the earth's orbit (Hildebrandt).
6. Passing of the solar system through regions of the universe in which there were no stars (Noelke).
7. Decreased heat radiation of the sun (Philippi). } Accessory.
8. Lesser inclinations of the ecliptic (Eckholm).
9. Decrease of carbon dioxide content in the air (Chamberlain and Salisbury).
10. Distribution of land and sea according to Kerner's view.

Pliothermal or warm interglacial periods occurred under the following circumstances:

1. Chiefly as a result of low flat continents,
2. Through absence of deep basins,
3. Rising of sea floor and depression of continents,
4. Volcanic inactivity,
5. Great eccentricity of the earth's orbit,
6. Passing of the solar system through regions of the universe abounding in stars,
7. Great radiation of heat from the sun,
8. Great inclination of the ecliptic,
9. Increase of the carbon dioxide content of the air.

It is utterly improbable that the interior of the earth contributed to the climatic changes. Polar dislocations are also out of the question, so long as we can not prove that they followed any particular direction. All attempts, likewise, at explaining change in climate from one cause alone are futile. Although at first sight these theories may appear attractive, they can not stand the test of keener criticism. Moreover, nature is too complex to permit its being compressed into a single formula.

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SPECIAL ARTICLES

OBSERVATIONS ON THE ACCUMULATION OF CARBON DIOXIDE FROM STRAWBERRIES IN REFRIGERATOR CARS

DURING the years 1918 and 1919 and in connection with shipping tests of strawberries in refrigerator cars being made under the direction of Mr. H. J. Ramsay and Mr. V. W. Ridley then of the Bureau of Markets, the writer was able to make observations on the carbon dioxide and oxygen content of the air in refrigerator cars and the effect of ventilation on the accumulation of carbon dioxide. A brief summary of the results follows:

The percentage of carbon dioxide and of oxygen was determined by means of a commercial Orasatt apparatus—samples being drawn through lead tubing one end of which was placed in the part of the car from which it was desired to take samples and the other run out at one corner of the door. During transit analyses were made at icing stations and at other times when the train stopped long enough. Duplicate analyses were made when time permitted, and in all cases several hundred cubic centimeters were thrown away before the sample was drawn for analysis.

The results of the analyses made during three of these tests are summarized in Table I. In the tests of 1918 the berries were loaded at a temperature of about 68° to 70° F. and one car was ventilated by raising the hatches at diagonal corners of the car. The berries loaded in the test of 1919 were at a temperature of 76°–78° F., one car being ventilated by raised hatches, and the other that reported in the last column of Table I., by two six-inch pipes, installed at opposite ends of the car.

From the table it is apparent that there is no great accumulation of carbon dioxide in the air of the unventilated cars in transit. The maximum amount 2.5 per cent., was reached in a car loaded at Monett, Mo., seven hours after the doors were closed. When the car was re-iced the carbon dioxide content dropped to 0.7 per cent. From this it increased again to 1.3 per cent., but at the next icing it dropped to 0.6 per cent. and never exceeded this amount during the remainder of the trip.

The accumulation of carbon dioxide in unventilated refrigerator cars loaded with strawberries has been found not to exceed 2.5 per

cent. by volume and is usually less. Moreover, when the cars are re-iced the air in the cars is renewed to some extent and the accumulated carbon dioxide largely swept away. In ventilated refrigerator cars the percentage of carbon dioxide is lower. It may, while the cars are standing after being loaded, become nearly or quite as great as in unventilated cars. When the cars are moved it drops to 0.2–0.4 per cent. and rarely exceeds that amount.

TABLE I

Accumulated Carbon Dioxide, Expressed in per cent. by Volume, in Refrigerator Cars Loaded with Strawberries

Approximate Number of Hours After Loading	Shipment Monett, Mo., to St. Paul, Minn., 1918		Shipment Bowling Green, Ky., to Pittsburgh, Pa., 1919		Shipment Bowling Green, Ky., to Pittsburgh, Pa., 1919	
	Unventilated	Ventilated	Unventilated	Ventilated	Unventilated	Ventilated
1	1.6	—	1.0	0.7	0.7	0.2
2	—	0.2	1.1	1.0	1.0	—
3	—	0.2	1.3	—	—	—
4	1.8	—	1.4	1.4	—	—
5	—	—	—	—	—	0.3
8	2.5 0.7[1]	—	—	—	—	—
9	—	—	—	—	1.4	—
11	—	—	0,4[1]	0.4[1]	—	—
19	1.3 0.6[1]	0.6	0.3	0,2	0.3[2]	—
30	—	—	—	—	0.4	0.4
34 (also) 47	—	—	0.3	0.2	—	—

The accumulation of carbon dioxide in unventiated refrigerator cars is apparently not sufficient, with strawberries, to cause injury to the berries.

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(*Continued*)

The preparation and analysis of a cattle food consisting of hydrolyzed sawdust: E. C. Sherrard and G. W. Blanco. Investigations carried out at the Forest Products Laboratory indicate that a cattle food can be prepared from eastern white pine sawdust and that it has considerable food value. The cattle food was prepared by digesting the sawdust for 15 to 20 minutes with 1.8 per cent. sulphuric acid at a steam pressure of about 120 pounds per square inch. After cooking the sugars were extracted with water and the acid removed from the solution by means of lime. The liquor containing the sugar was evaporated to a thick syrup and mixed with the digested residue which had been previously dried. The whole was then dried to a moisture content of 15 per cent. It is shown that when the product has a greater moisture content than 15 per cent. the keeping qualities are not good. Leaching experiments removed all but 2.04 per cent. of the total acid and all but 7.16 per cent. of the total sugar. A comparative analysis of the wood before and after conversion shows that cold water soluble, hot water soluble and NaOH soluble substances are greatly increased but the ether soluble substances are almost unchanged by the treatment. The pentoses are reduced 46.4 per cent. while the methyl pentosans are not affected. The total cellulose is reduced by 21.68 per cent. The sugars produced correspond to 71.5 per cent. of the cellulose removed by the digestion. The lignin content is unchanged. The crude fiber corresponds to about 75 per cent. of that in the original wood. The cellulose is greatly altered by the treatment. Practically the whole of the cellulose obtained is soluble in 17.5 per cent. alkali. It is reprecipitated from the alkaline solution by dilution with water. After filtering no precipitation of beta-cellulose is obtained upon acidification with strong acetic acid.

A comparison of wood cellulose and cotton cellulose: S. A. Mahood and D. E. Cable. Samples of wood cellulose and cotton cellulose which had been subjected to various conditions of cooking and bleaching were analyzed by determining a number of constants on them, including ash, moisture, alkali solubility, pentosan and methyl pentosan content, methyoxy content, ether extract, cellulose, lignin and "copper number"; for the purpose (1) of following the changes which take place in wood cellulose on successive cooking and bleaching treatment with a view to increasing the yields of purified cellulose by varying these conditions and (2) to determine so far as possible the points of similarity or difference of cellulose from wood and

[1] Immediately after re-icing.
[2] Car re-iced seven hours previous.