COPYING MANUSCRIPTS ON MOTION PICTURE FILM

In Dr. Seidell's article,[1] "Reforms in Chemical Publication (Documentation)," reference was made to the increased probability of the fulfilment of his aim if there was available suitable apparatus for photographing manuscripts on 16 mm film.

Such a device known as a "copying camera" using 35 mm film, 100 foot lengths, was developed at the Sterling Library, Yale University, some months ago by Messrs. F. G. Ludwig and L. H. Ott. It proved so satisfactory that since that time they have built a number for use in various other institutions, such as the Library of Congress and the New York Public Library. The camera at the last-mentioned institution has been used for making permanent records of newspapers, which of course would survive only a short period of actual handling.

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[1] Science, 80: 2064, 70–72, 1934.

SPECIAL ARTICLES

DEUTERIUM CONTENT OF NATURAL BUTANE

Several examples of deuterium enrichment in products of plant and animal life have been reported.[1] As the result of an investigation which we have had under way for some months we find that natural butane from the Burbank (Oklahoma) oil field contains approximately 30 per cent. more deuterium than corresponds to the deuterium content of ordinary hydrogen. This figure is in almost exact agreement with that reported by Dole[2] for Oklahoma kerosene, which indicates a probable typical enrichment of Oklahoma oil and gas deposits. It is also in agreement with the figure more recently reported by Greene and Voskuyl[3] for natural gas from northern Pennsylvania.

The question naturally arises as to whether this enrichment is typical of the deuterium distribution of the geological age in which these deposits were formed, or of the chemistry either of the growth or decay of the organic life responsible for the deposits. If the results obtained by Scott,[4] for free water associated with Pennsylvania petroleum, can be correlated properly with those for the Oklahoma deposits it would appear that the chemical explanation is the more plausible.

The butane which we employed was obtained by fractional distillation of natural gas condensate from the Burbank, Oklahoma, field and consisted of approximately 98 per cent. n-butane and 2 per cent. iso-butane.

The butane was burned at a quartz jet out of contact with the atmosphere in an excess of tank oxygen (prepared by the Linde process). The hot gases were passed through a quartz tube filled with copper oxide and heated to about 900° C., to insure complete oxidation. The steam was condensed in a Pyrex bulb surrounded with ice and water and provided with a condenser through which ice water was circulated. Two successive samples of about 100 cc each were collected. The deuterium content of the water of combustion was determined by means of the buoyancy balance.[5] Prior to the measurement final purification was effected by distillation from alkaline permanganate. The two 100 cc samples of the water were reduced to approximately 40 cc each by three successive distillations from Pyrex stills, with 10 cc discarded at the beginning and end of each distillation. The first two distillations were carried out in the presence of potassium permanganate and potassium hydroxide, the last without any added reagent.

The results are shown in Table I, in which the first line gives the results obtained with the water as it was collected from the still and the second line, the readings obtained after boiling out the samples to remove possible air or CO_2 contamination. The apparent change in Sample 1 is not regarded as significant. After the readings recorded in the second line the samples were mixed and refluxed over night with alkaline permanganate, in a Pyrex still. After two subsequent distillations, the second without permanganate, in which equal end portions were discarded as before the density was redetermined with the result shown in the third line of the table. The straight average of these five determinations was taken as the most reliable value.

TABLE I

Beckmann Readings at Which the Float Balanced in the Purified Water of Combustion

	Sample 1	Sample 2
Direct from still	3.310 ± 0.002°	3.310 ± 0.002°
After boiling out	3.315 ± 0.002	3.311 ± 0.002
After refluxing	3.313 ± 0.001	
Value chosen	3.312 ± 0.002	

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[1] Washburn and Smith, Science, 79: 188, 1934.

[2] Dole, *Jour. Chem. Physics*, 2: 337, 1934; *Jour. Am. Chem. Soc.*, 56: 999, 1934.

[3] Greene and Voskuyl, *Jour. Am. Chem. Soc.*, 56, 1649, 1934.

[4] Scott, Science, 79: 565, 1933.

[5] Lewis and MacDonald, *Jour. Chem. Physics*, 1: 341, 1933.