in the case of Iraq petroleum (Table 2) and of the Palestinian shale-oil (Table 3).

The usefulness of the method is evident. It gave information about the interesting phenomenon of azeotropic distillation of aliphatic and aromatic hydrocarbons, which will be studied in greater detail at a later date, and about the aromatization involved in cracking experiments. It may also be noted that the spectrographic method may well contribute to the elucidation of the structure of lubricating oils, which are assumed to be alkylated and partly hydrogenated polycyclic ring-systems; in many cases, dehydrogenation previous to the spectrographic investigation, seems to be useful.

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[1] Recently, new methods of the same type have been suggested by A. v. Grosse, *Ind. Eng. Chem.*, Analyt. Edition, **11**, 614 (1939), and by Jostes, *Oel, Kohle, Erdel, Teer*, **14**, 1012 (1938).

[2] Hoog, Verhuis and Zuiderweg, *Trans. Faraday Soc.*, **35**, 993, 1008 (1939).

A Patterson Analysis derived from the Cyclol C_2 Skeleton

I AM grateful to Dr. D. Wrinch for pointing out an error in my previous communication on this subject with Dr. Fankuchen[1]. A check of the calculations showed that our previous Fig. 3 was, in fact, derived from an arrangement of the cyclol molecules with a tilt of 36°, as Dr. Wrinch states[2], and not with a tilt of 6° as we had, by an unfortunate misunderstanding, assumed. This arose from a wrong choice of reference line to define the tilt, suggested, although certainly quite unjustifiably, by Dr. Wrinch's original packing diagram.

I have therefore recalculated numerically the Patterson map obtained by placing the cyclols in the insulin unit-cell with a tilt of 6°, and the essential part of the resulting contour diagram, namely, the triangle between origin peaks, is shown in Fig. 1. The only peak in the field is the large diffuse peak *A*, while *B* is a region of low density. The agreement with the experimentally derived basal Patterson projection of Crowfoot[3], which is reproduced in essentials in Fig. 2, is not very close. The low density region *B* compares with the region *C* in Crowfoot's diagram, but such a large central peak as *A* is not present in the latter case. The experimentally derived Patterson projection has a trigonal arrangement of three well-defined peaks (*B*) around the centre,

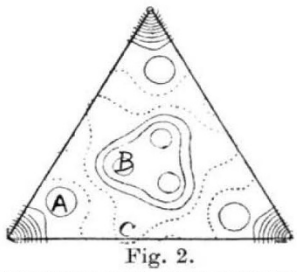

Fig. 2.

DERIVED PATTERSON MAP WITH CYCLOLS AT TILT OF 6°. CONTOURS AT ONE ARBITRARY UNIT APART. *A* IS A PEAK AND *B* IS A LOW DENSITY REGION.

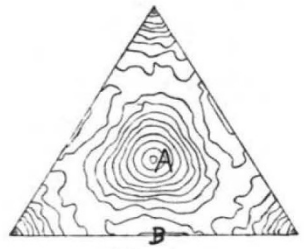

Fig. 1.

EXPERIMENTALLY DERIVED BASAL PATTERSON PROJECTION FOR INSULIN (AFTER CROWFOOT).

corresponding to interatomic vectors of 22 A. in this projection. In so far as the peak *A* in Fig. 1 be considered as compounded of three such 20 A. peaks, then it is clear from the calculation that these are due to vectors between the *sides* of the cyclol fabric, and do not arise from vectors between the 'slits' of the octahedron. Approximate working indicated that this central peak *A* would tend to be resolved with an arbitrary tilt of 10° or so. A calculation with $\alpha = 13°$ showed this resolution to be very small, and this tilt also destroys the *B* region of low density. Small deviations from the tilt of 6° therefore do not better the agreement with Crowfoot's projection, and the map obtained with an extreme tilt of 36° has already been discussed. Another unsatisfactory feature of Fig. 1 is the absence of a defined 10 A. peak corresponding to Crowfoot's peak *A*, and a strong 10 A. spacing is a characteristic property of most proteins. I therefore consider that this new derived Patterson analysis is not in nearly sufficient agreement with the experimental data for insulin to afford evidence in favour of the cyclol hypothesis.

In conclusion, I should like to point out that Dr. Fankuchen and myself have never claimed "to have disproved the structure C_2 predicted for the insulin molecule". We were concerned only with investigating the claims by Wrinch and Langmuir[4] of the confirmation of the cyclol hypothesis in the case of insulin by the X-ray data. The work done clearly showed that their primary assumption of approximating the cyclol C_2 molecule by an octahedral arrangement of scattering masses situated at the 'slits' of the cyclol fabric was not even approximately justified. Logically, therefore, their argument was invalidated even without Bernal's criticism[5] or without consideration of the second part of our previous paper or of this communication. I appreciate Dr. Wrinch's criticism of our work on the grounds that only the carbon and nitrogen atoms of the skeleton were considered. Reasons why this should not affect the general validity of the work were given in our paper. In circumstances other than those obtaining at present, it would undoubtedly be most desirable to recalculate the Patterson map having included the oxygen and C_β atoms, in order to settle the matter. In the meanwhile, I would enter a plea for this detailed type of working in comparing any proposed models of protein molecules with the X-ray data, otherwise it is often difficult to separate evidence from speculation.

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Department of Mineralogy,
Oxford. July 24.

[1] NATURE, **143**, 648 (1939).
[2] NATURE, **145**, 1018 (1940).
[3] *Proc. Roy. Soc.*, A, **164**, 580 (1938).
[4] *J. Amer. Chem. Soc.*, **60**, 2247 (1938).
[5] NATURE, **143**, 74 (1939).