A NOTE ON THE LUMINESCENCE ANALYSIS OF BITUMENS

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An application of polarization of luminescence is attempted for the luminescence analysis of bitumens.

The use of luminescence analysis to the detection of bitumens in minerals, rocks and soils is well-known [1]. The bitumen content of the samples is mostly extracted by a convenient solvent (benzene, acetone, etc.), the solution is put in a test tube or dropped onto a filter paper and the colour of fluorescence under a mercury lamp is investigated. Fluorescence spectroscopy and fluorescence chromatography were also applied for indentification of different bitumens. From the presence of definite kinds of bitumens one may conclude the presence of mineral oil deposits. All these methods, however, may be used only in cases when the intensity of emission is fairly high.

Samples taken from the surface layer of soil may contain two fundamentally different kinds of bitumens, one is originated from the vapours of oil fields existing under the surface, the other is formed from different organic substances existing in the surface layer of soil. In such a case the usual methods of luminescence analysis mentioned above are not convenient for deciding the existence of the oil field, because of the small rate of bitumen quantity of „oil-origin".

A new method was attempted which seems to be sufficient for detecting of bitumens of oil-origin. The chief feature of this method is the application of polarization of luminescence for the luminescence analysis. The characteristics of polarized luminescence seemed to be very favourable for a distinction between the two fundamental kinds of bitumens mentioned above, because the *degree of polarization may be great at small concentrations and it depends on the shape (more correctly on the situation of different groups which influence the anisotropy) of molecules.* The greater is the asymmetry of molecules the more probable is a comparatively higher degree of polarization of their luminescence. The structure of the different bitumens is not exactly known and a given sample of an extraction contains different kinds of bitumens. Yet is seems very probable that the different kinds of bitumen molecules which are of oil-origin are of higher symmetry and consequently smal-

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ler anisotropy, therefore their luminescence has a smaller degree of polarization, as they were to migrate through a thick soil layer to reach the surface. The molecules of different bitumens originated from organic substances occuring in the surface layer of soil — because they were not to diffuse through a thick soil layer — are of less symmetrical shape and have consequently higher anisotropy, therefore their luminescence has a greater degree of polarization. The results seem to confirm this supposition.

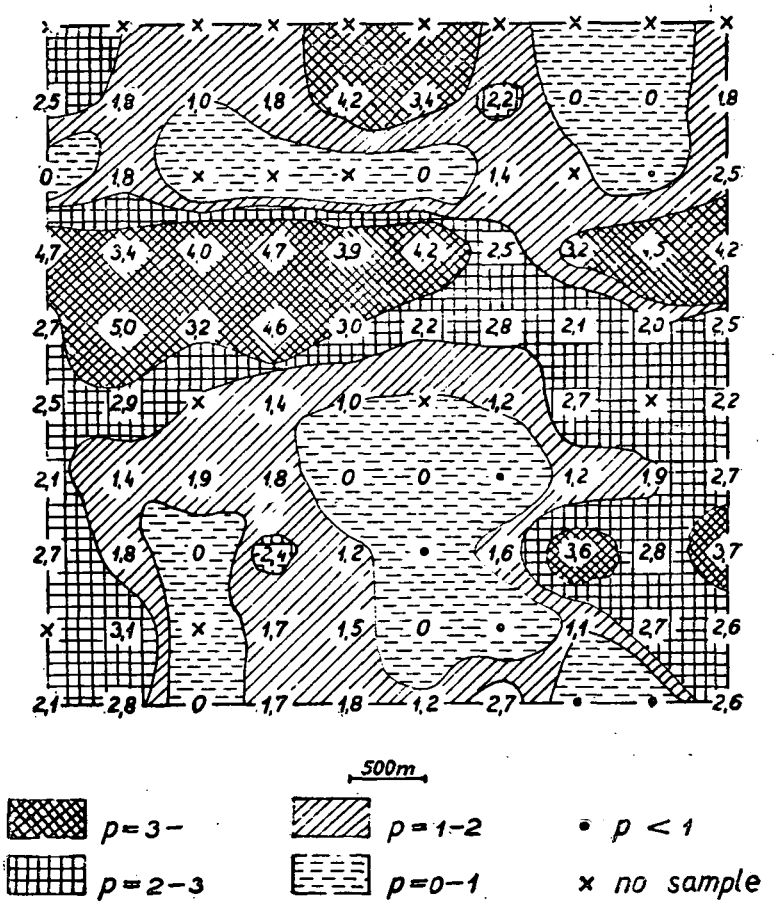

Fig. 1

A series of soil samples was taken from two meter depth and the fluorescence of an extraction by benzene was investigated. The samples were taken from the area to be investigated in 500 meter distances. The colourless or fairly yellowish solutions showed a greyish fluorescence the polarization of which was measured by a photoelectric polarization measuring apparatus [2]. More than 250 samples were investigated (the degree of polarization of

about 30 of them were not measurable because of the small intensity of fluorescence). The samples were taken from an area of about 60 km^2. The samples taken from places which are above known oil fields generally showed a zero degree of polarization, while those taken from areas known as free from oil fields showed a degree of polarization of about 3—5%. The method of the evaluation of measurements is shown in Fig. 1, where a schematic map of a part of the whole investigated area may be seen. The whole area was divided into smaller areas according to the degree of polarization of luminescence of samples, but all values of polarization were classified in four groups as shown in Fig. 1. The border of the smaller areas was stated by a linear interpolation between two actually measured value of polarization and was drawn by a solid line. If a reliable interpolation could not be carried out on account of lack of convenient samples, the situation of the border between neighbouring areas was estimated and drawn by a dotted line.

An evaluation of the whole experiment (taking the actual situation of known oil fields into consideration) made evident that the investigations in their present form would need a completion to give a really reliable result. It is very possible that the polarization measurements alone would not solve the problem of finding deepset oil fields: the geological conditions, the classical methods of investigations (including the common fluorescence tests too) will be necessary. The polarization measurements and the earlier methods, however, may complete one another, therefore this polarization method seemed worth while to mention. From N. D. ZHEVANDROV's earlier observations the recent results concerning the order of degrees of polarization seem to be confirmed (3).

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