Journal of Chromatography, 169 (1979) 482–484

CHROM. 11,460

Note

Thin-layer chromatography of amber samples

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(Received September 15th, 1978)

Amber is a natural fossil resin. It has been known for thousands of years, but its composition is uncertain and the data from different laboratories show notable differences, possibly because these are different ambers of similar external appearance and physical or physicochemical features.

As yet there is no amber classification system, and the probable modifications are classified by geographical district and sometimes by the appearance and the fundamental physical properties (specific gravity, hardness, colour etc.).

The chemical investigation of amber is limited by its low solubility. For ambers of the Baltic sea area Beck *et al.*[1] found that a band at *ca.* 1150 cm^{-1} is a common feature in the infrared spectra. Other chemical studies have included only the examination of the soluble ingredients[2], characterized by instrumental methods of analysis. In our work the resin and its insoluble components are separately investigated[3,4]. We decided to divide the soluble parts of amber using chromatography; thin-layer chromatography (TLC) has proved to be the best method. Thus Lebez[5] differentiated archaeological samples, pointing out their differences from the Baltic amber. Lebez used the solvent system proposed by Stahl[6] for resins (benzene–methanol, 95:5). Our studies have shown that this solvent system does not separate the components well enough for them to be treated as separate chemical entities.

MATERIALS AND METHODS

After powdering, resins were extracted with ethanol in a Soxhlet apparatus (Table I). The extracts were concentrated and desiccated before separation.

TABLE I

SOLUBILITY OF BALTIC AMBER AND DAMMAR RESIN IN ETHANOL

Resin	*Solubility (%)*
Transparent amber ($d = 1.09$)	23
Opaque amber ($d < 1.00$)	16
Translucent amber from the blue earth of Sambia	18
Dammar	90

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Glass plates (10 × 10 cm) coated with silica gel G were used for TLC. After development and drying, the spots were located in iodine vapour and by inspection under UV light, always under a nitrogen atmosphere. Several new solvent systems were examined, containing benzene and more polar solvents (*e.g.*, ethyl acetate, acetone, methanol) or petroleum ether and more polar components. Interesting results were obtained with the following solvents: benzene–methanol–ethyl acetate, 85:5:10; benzene–methanol, 98:2; benzene–acetone, 80:20.

The best separation was achieved with petroleum ether–benzene–methanol, 2:6:1; this system was used in the preparative TLC. The petroleum ether is a light gasoline fraction, boiling range 50–60°.

Preparative TLC was carried out on glass plates (15 × 15 cm), coated with silica gel G, by applying the ethanol extract in band form. Spotting and drying was carried out under nitrogen. After developing, the plates were observed under UV light; after marking, the separated bands were scraped off and eluted with ethanol.

RESULTS AND DISCUSSION

TLC separations of the investigated samples show notable differences. Three samples from the same area (the southern Baltic coast) differing in appearance and specific gravity, produce different chromatograms. Transparent amber has the largest number of bands, followed by the opaque variety. Translucent amber originating from the blue earth of the Sambia Peninsula has only four bands.

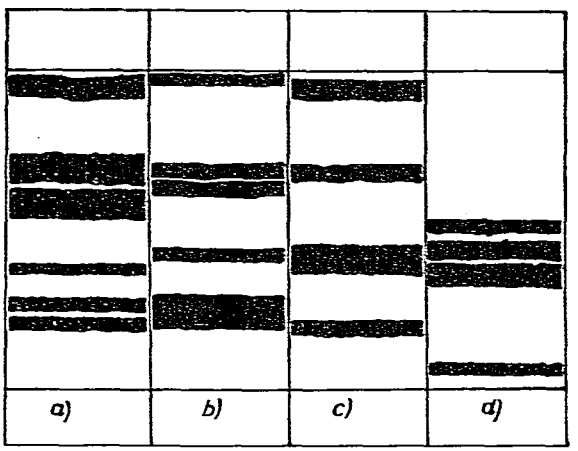

Fig. 1. Thin-layer chromatogram of: (a) transparent amber; (b) opaque amber; (c) amber from the blue earth of Sambia; (d) dammar resin. Solvent system: petroleum ether–benzene–methanol (2:6:1).

The Dammar resin, separated in the same way, shows a different chromatogram from amber, although it has the same number of bands as the amber from Sambia.

These results show that Lebez's work is not conclusive. When he compared the chromatograms of archaeological and Baltic amber, Lebez concluded that the archaeological sample could not originate from the Baltic coast.

We would like to draw attention to the differences between the samples from the Baltic area. As amber first formed 30–40 millions years ago[7] and its origin is not clear (the pine resin or resin of the tree fam. Araucariaceae, *e.g. Agathis*, from which Dammar is obtained), it is possibile that chemically different ambers occur in the same area. Chromatography of the soluble components of amber may assist objective classification.

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