double negative charge by itself accounts for the existence of the acetylide ion[5].

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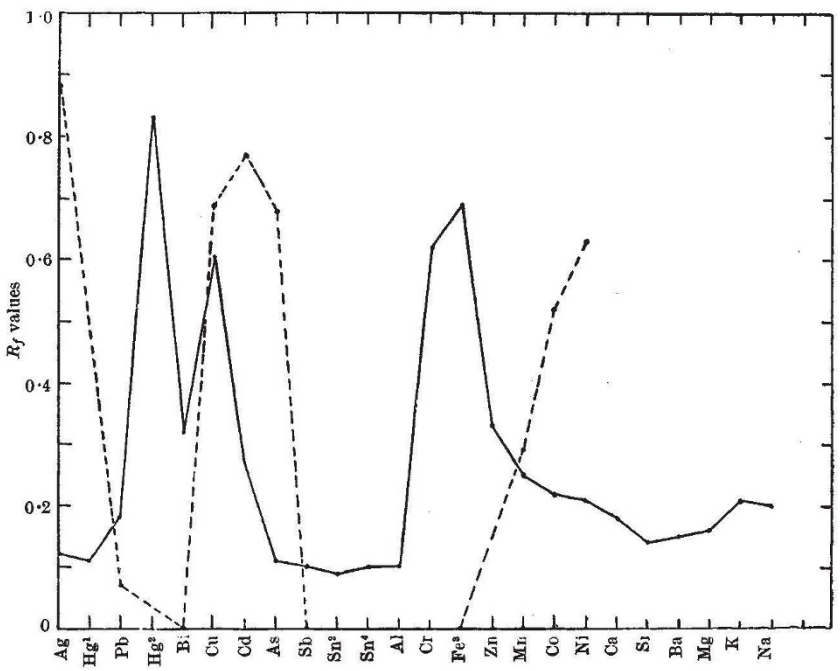
[1] Keller and Körösy, *Nature*, **162**, 580 (1948).
[2] *Bull. Soc. Chim.*, **7**, No. 5, 907 (1940).
[3] Jones and Kenner, *J. Chem. Soc.*, 1842 (1931).
[4] Cf. Pauling, "Nature of the Chemical Bond", 195 (1st edit., 1939).
[5] Cf. Allsop and Kenner, *J. Chem. Soc.*, 2299 (1923).

Inorganic Paper Chromatography and Detection of Cations by Fluorescence

THE importance and potentialities of the paper chromatographic separation of inorganic cations have already been indicated by recent communications of Linstead[1] and Lederer[2]. In this laboratory we have been working along similar lines, but with the object of finding general methods of separation and identification, rather than specific methods for two or three ions. Such a scheme has obvious advantages in qualitative analysis.

Our technique is essentially that already described for organic substances by Martin and Synge[3], using Whatman No. 1 filter paper; drops sufficient to give spots of ½ cm. in diameter being placed 4 cm. apart. The solutions were usually approximately $N/10$ in acetic acid. In this way, tests for at least twenty-four cations at a time can be performed and compared with the unknown.

A variety of solvents has been tried, and the relative R_f values, determined under the conditions of our experiments for two promising solvents, namely: *Solvent* 1, 50 per cent butanol, 10 per cent acetic acid, 5 per cent acetoacetic ester, 35 per cent water; *Solvent* 2, 50 per cent collidine fraction, 50 per cent water, are shown in the accompanying graph. This clearly illustrates the separations possible, and it will be seen that the differential effects of two solvents open up the possibility of two-way separations.



Full line, butanol mixture; broken line, collidine mixture

The location of the cations on the paper can be revealed by hydrogen sulphide in some cases; but we have found the use of fluorescence a very marked advantage, since with suitable spraying reagents we can detect nearly all the cations of the ordinary qualitative tables. Our procedure is to spray the dry paper with the selected reagent, allow it to dry and then examine it under the ultra-violet lamp; some of the spots fluoresce and others appear dark through quenching of the fluorescence. From a large number of trials, the following reagents proved most successful: kojic acid, *o*-aminobenzoic acid, morin, 1-naphthylamine-8-sulphonic acid, 2-naphthylamine-1-sulphonic acid. (*Note added in proof.* 8 hydroxyquinoline is extremely useful as a fluorescent reagent.) An interesting effect was noticed, particularly for kojic acid, on subsequent treatment of the paper with ammonia gas; this causes some dark spots to fluoresce (for example, Hg^{++}), quenches the fluorescence of others (for example, Mg^{++}), and makes others quite invisible (for example, As^{+++}). This was used to distinguish between various cations.

The mechanism involved in the separation seems to be essentially partition chromatography for the butanol mixtures, since water alone washes the ions down the paper, while butanol with 10 per cent glacial acetic acid produces almost no movement Small quantities of acetoacetic ester or glycerol in the butanol mixture tend to concentrate the spots and prevent tailing. For solvents such as collidine, complex formation and adsorption probably have the dominant roles.

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[1] Linstead, *Nature*, **162**, 691 (1948).
[2] Lederer, *Nature*, **162**, 777 (1948).
[3] Martin and Synge, *Biochem. J.*, **35**, 1358 (1941).

Drinking Spouts for Laboratory Animals

LABORATORY rats are usually allowed to obtain their water from an inverted glass bulb with a stem, or from an inverted bottle fitted with a bung and spout. The bulbs are awkward to clean and refill, and are very easily broken. The bottles are satisfactory; but the bungs and spouts jam and break, with frequent minor casualties to attendants. The extension of watering to mice, rabbits, guinea pigs,