8×10^{-7} amp. The diameter of the irradiated area of the target was less than 50μ.

The observed variation of the X-ray yield with electron energy is in excellent agreement with Archard's[1] theoretical predictions. The absolute values of the yields, other than that from beryllium, are 5–15 per cent higher than those given by Archard's theory, provided that the latter is modified by using Burhop's[2] formula for the fluorescence yield; the beryllium yield is about half that predicted. The carbon and aluminium yields are about half those reported by Dolby[3].

Apart from their significance as a test of the theory of X-ray emission from solid targets, the results indicate that X-ray microanalysis of all elements of atomic number higher than 3 is now theoretically and technically feasible. A full account and discussion of the work is being prepared for publication elsewhere.

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Errors involved in using the Rayleigh Equation for Interpretation of Light-Scattering Data beyond its Normally Accepted Limits

For a non-absorbing, spherical particle which is very small compared with the wave-length of the incident light, the intensity of the scattered light may be calculated from the Rayleigh equation, which assumes that the particle may be represented by a single vibrating electric dipole. The limit normally associated with its use is a radius, r, of $0{\cdot}05\lambda$, where λ is the wave-length of the radiation in the medium surrounding the particle. This corresponds to a value of the size parameter $\alpha = 2\pi r/\lambda$ of 0·3 approximately. When the particle is comparable in size to the wave-length of the incident light, account must be taken of the electric multipoles and the induced magnetic multipoles. The solution of this problem was originally proposed by Mie[1] for any values of α and m, where m is the refractive index of the particle relative to that of the medium, and involves complicated expressions which are laborious to evaluate.

However, in certain cases this can be avoided. When the scattering functions calculated from the Rayleigh equation for $\alpha > 0{\cdot}3$ are compared with published values obtained using the Mie formulæ, it is found that the errors involved in using the Rayleigh equation are not significant for values of m in the region of 1·5 and for $\alpha < 1{\cdot}0$. The limit beyond which use of the Rayleigh equation introduces an appreciable error is dependent on the value of m as illustrated for the scattering coefficient K in Fig. 1. (Similar calculations, but in a more restricted range of m values, have been reported earlier[2].) This is also shown for the total intensity at 90° in Table 1 using the limited number of reliable Mie values available.

Table 1. Percentage Error involved in using the Rayleigh Equation to evaluate the Total Intensity of Scattered Light at 90°

(Reference is given to the sources of Mie values used in the calculations)

α	$m = 1{\cdot}33$ (ref. 4)	$m = 1{\cdot}44$ (ref. 4)	$m = 1{\cdot}55$ (ref. 4)	$m = 1{\cdot}75$ (ref. 8)
0·5	+ 2·68	+ 0·37	− 1·69	—
0·6	+ 4·41	+ 1·28	− 1·74	− 6·37
1·0	+22·5	+15·1	+ 8·73	− 1·26
1·2	+45	+37	+29	+17·2

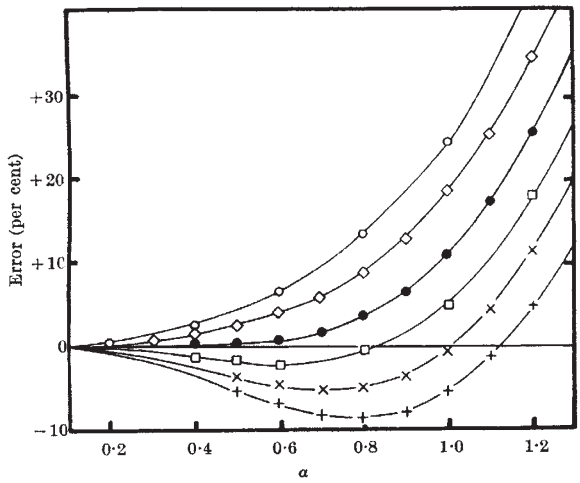

Fig. 1. Percentage error involved in using the Rayleigh equation to evaluate the scattering coefficient K (Reference is given to the sources of Mie values used in the calculations.) ⊙, $m = 1{\cdot}25$ (ref. 3); ◇, $m = 1{\cdot}33$ (refs. 4 and 5); ●, $m = 1{\cdot}44$ (refs. 4 and 5); □, $m = 1{\cdot}55$ (refs. 4 and 6); ×, $m = 1{\cdot}65$ (ref. 7); +, $m = 1{\cdot}75$ (ref. 7)

Clearly the limit to which the Rayleigh equation can be usefully applied in the range $1{\cdot}3 \leqslant m \leqslant 1{\cdot}75$ is higher than that usually quoted. Fortunately, many of the colloid systems of current interest lie in this range.

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GEOLOGY

Study of Natural Glasses through their Behaviour as Membrane Electrodes

The low-temperature chemical alteration of natural glass occurs in two stages: an initial stage in which it remains glassy but absorbs as much as 6 per cent water[1], and a final stage in which devitrification to clay minerals, with release of silica, occurs[2,3]. During the first stage the composition of the glass may change, with gain of K_2O and water and loss of Na_2O (Smith, R. L., personal communication). This change is due to ion exchange.