

Diffraction Patterns from Crystals.

THE attention given, in this laboratory and elsewhere, to the effects produced by passing a beam of Röntgen radiation through crystals suggested to me that it might be of interest to examine the image produced when a narrow pencil of ordinary light falls on a photographic plate after passing through a crystal. The lens was removed from a camera, and in place of it there was attached a tube about 30 cm. in length and 3 cm. in diameter. The tube was lined with black velvet, and provided with three diaphragms pierced with pinholes from one-half to three-quarters of a millimetre in diameter. In this way I endeavoured to secure that a cylindrical pencil of light of small cross-section should enter the camera. In consequence of diffraction at the last aperture the impression on the photographic plate, when no crystal was interposed, sometimes extended over a considerable area, resembling the diffraction images recently discussed by Mr. J. W. Gordon (Proc. Phys. Soc., vol. xxiv., p. 428, 1912).

The crystal to be investigated was placed at a distance of about 5 cm. from the last aperture, and about 20 cm. from the photographic plate. The resulting image often showed lines or streaks radiating from the centre at angles depending on the crystal and its orientation. These effects are obtained only



Selenite.



Phlogopite.

by giving a prolonged exposure or using an intense source of light. With a mercury-vapour lamp, five or six hours' exposure was given; with diffused daylight, several days' exposure was required; but by employing the direct light of an arc lamp an exposure of five or ten minutes was found sufficient.

I have only found such radial streaks in cases where the crystal showed a more or less streaky appearance when examined by the naked eye. It seems clear that the striations in the crystal act just like a diffraction grating. In the case of selenite the *complete* pattern resembles an eight-rayed star; the angles between the radial streaks seem to agree with the angles between the axes a and c and (possibly) the first and second median lines.

I desire to thank Dr. Sibly and Dr. Tutton, to whom some of the photographs were submitted, for crystallographic information. Dr. Tutton writes:—

"I should think the phenomenon of the streaks in the photograph is due to the well-known 'asterism.' Asterism is particularly well shown by mica, especially the variety known as phlogopite. It is due to fine enclosures arranged along the glide-planes, and parallel to the cleavage plane. It shows itself as a six-rayed star (or occasionally twelve-rayed) when the mica is held between the eye and a bright source of light. Calcite also shows asterism, certain crystals

held in front of a candle flame showing a radiating star of light. In this case, however, it is due to tubular cavities parallel to the glide-planes (the rhombohedron known as $e\{110\}$). Some sapphires also show asterism, and here again it is due to tubular cavities in planes parallel to the prism $\{10\bar{1}\}$. I am not aware that selenite has been studied for asterism. I should think it is very likely that certain specimens will show it, those rich in cavities or enclosures. The cavities would probably be parallel to the perfect cleavage plane (the symmetry plane $b\{010\}$ along which selenite crystals are tabular), and possibly along the two minor cleavage directions $a\{100\}$ and $n\{111\}$, the former of which would be parallel to the vertical axis c . They might also lie parallel to the inclined axis a . In this case your phenomenon would be at once explained."

Although the results obtained do not reveal any new physical phenomenon, I shall be glad if the experiments prove of interest to the crystallographer as affording him a convenient method of studying certain features of crystal structure.

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Bird Protection and the Collector.

THE protection and preservation of wild birds in Great Britain is in these days beset with difficulties of many kinds; but as regards especially the preservation of the rarer birds of our country, the one great and ominous danger is the individual whom Sir Herbert Maxwell has described as "the cursed collector." At this time of the year the professional collector of eggs infests the country wherever rare species are known or discovered to breed, and wherever clutches are to be had which have their value in the market. At all seasons of the year the professional collector of birds is despoiling the land of the noble, the beautiful, the unfamiliar forms of bird-life that hide in diminished numbers among little-frequented commons and heaths, mountains and lakes, woodlands and forests, or visit the country in small numbers and nest at their peril, with a price upon their heads and upon every egg they lay.

It may indeed be said that while a percentage of naturalists are working to protect birds, to keep up the number of our native species, and to bring about some comprehension of the living creature, others are eager only to secure for themselves, by hook or by crook, the skins and feathers, and the empty shells, to fill their cabinets or to sell or barter. As one of their number has written, with unconscious irony, the preservation of a bird should begin as soon as it is killed.

A correspondent of *The Times* wrote the other day of the egg-collector:—"These pests know no boundaries and observe no laws which stand between them and the objects of their rapacity." Could the experiences of some of the workers in this society be divulged the truth of that statement might be thoroughly demonstrated. Neither the "rarity" collector who values the "British-taken" bird or egg solely because it seldom occurs or is on the verge of extinction in Britain, nor the "rarity" collector to whom the speckles on an eggshell are things of absorbing interest, will stop at any artifice or any dodge in pursuit of his quest.

The problem lies in this, that the offenders are largely men of wealth and position, officers in the Army, clergymen, "ornithologists," popularly known for their interest in bird-life, and even for their pronouncements in print on bird protection; and that these collectors not only snap their fingers at the law and take pride in evading and transgressing its pro-