On the Occurrence of Sapphire in Scotland.

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At page 18 of Volume V. of the *Mineralogical Magazine* I gave an analysis of the red andalusite, which rarely occurs in quartzose veins in the schist of Clashnaree Hill, in Clova, Aberdeenshire.

Lately, in preparing a section of a crystal of this mineral, which section was cut at right angles to the main axis, I observed, after removing the section from the last smoothing plate, a spot which reflected light with extreme brilliancy. Examination with the lens showed that this spot, which had an intense blue colour, was most perfectly polished, while the crystal of andalusite which enclosed it hardly reflected light.

As noticed in the paper which gives the analysis, the crystals of red andalusite from this locality frequently have a central lozenge of a deeper and somewhat purple tint.

The minute blue crystal or spot lay near to the line of meeting of the two shades of red. It was surrounded by a narrow sheath of a white or pale yellow tint; and this sheath was markedly softer than even the andalusite, having been removed below the mean level of the slice by the rougher emery.

The section had to be rubbed for some time with the very finest "float-emery," before this sheath, the andalusite, and the blue crystal were brought nearly to a uniform level. It was then seen that the minute crystal was hexagonal, and that its centre was of a deeper blue than its main substance.

The above seemed to leave little doubt that it was a sapphire, and the first glance through the microscope, when the section was mounted, showed the conjecture to be a correct one.

It is a highly refractive, hexagonal crystal, of a pale blue tint, with a hexagonal deep blue centre, and an asteriated structure. Six rays of a blue, almost as intense as is the centre, pass outwards nearly to the circumference.

Revolution, under crossed nicols, deepens the blue of the paler portions, which colour changes to a reddish or brownish yellow on further revolution.

The uniaxial system of rings is well seen. Some portions of the triangular paler spaces are slightly biaxial.

The crystal is negative.

The diameter of the crystal of andalusite is about five-eighths of an inch; the central purplish lozenge occupies about one-third of its surface. The diameter of the crystal of sapphire is about one-thirtieth of an inch.

The sheath which separates it from the andalusite is colourless, highly refractive, and formed of plates or thick fibres, which are laid on parallel to the six sides of the hexagon of sapphire.

From their position no rings can be expected.

As fibrolite of high lustre is associated with the andalusite, and as this sheath was manifestly softer than the andalusite, it may consist of the more siliceous variety of fibrolite termed xenolite, the formula of which is $2Al_2O_3, 3SiO_2$.

The process—or the progress of the smoothing of this section—showed in a very marked manner the extreme difference in the hardness of minerals which are not far removed from each other in the numerical scale. As the sheath is probably the most siliceous variety of fibrolite, its hardness may be set down as 6. The red andalusite is very gem-like, clear, and free from all inclusions; 7·5 must be assigned to it; 9 to the sapphire. Yet at that stage of the smoothing at which the sapphire had a polish like that of a diamond, the surface of the andalusite was pitted all over, while to the lens the fibrolite looked like a dug-out trench.

In its higher grades the "the scale of hardness" is in no respect even approximately *relative*.

Probably, for the present, no better device is at our command than to ascertain, through the loss of weight, the amount abraded from a slab of orthoclase or of rock crystal by equal bulks of equally comminuted powders of the substances whose hardness is to be determined.

It must be noted, however, that the conclusions to be drawn from such a test would be to some extent vitiated by the toughness of such substances as chalcedony, jadeite, zircon and sapphire on the one hand—or by the brittleness or facile cleavage of rock crystal, topaz, euclase and diamond on the other.