

*On a Variety of Glaucophane from the Val Chisone (Cottian Alps).*

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AS I was descending the Val Chisone from the Col de Sestrières last summer, my eye was attracted by the peculiar colour of an erratic, which was lying on the hillside very near the road. The violet-blue tint, generally indicating the presence of glaucophane, was perceptible, especially in certain lights, but, as it was much less strongly marked than in rocks in which I had previously observed the mineral, I felt doubtful. However, I secured a good specimen, and now find on microscopic examination that glaucophane is present, though it is a pale coloured variety, differing from those which I have hitherto examined.<sup>1</sup>

The block was a fairly large one, perhaps more than a square yard in area, and a couple of feet thick. I did not, however, take measurements, as the exact size was unimportant. There was no like rock visible in the neighbourhood for a considerable distance, so that I cannot say whether it had been brought down from the upper part of the Val Chisone, or along the line of a small gully from somewhere on the mountain above. Time did not permit me to attempt a search for the parent rock, which would certainly have occupied hours, and it might be days. The erratic is very near Fresnières, in the Commune of Pragelas.<sup>2</sup>

The rock was tough and difficult to break. The specific gravity is 3.10.<sup>3</sup> It is holocrystalline, rather fine-grained, and, on examination with a lens, appears composed of a dark purplish-coloured, a green, and a whitish mineral, the last being the least abundant. There is a slight, but only a very slight, approach to a foliated structure, such as may be seen in certain diorites which have been modified under pressure subsequent to their original consolidation.

Microscopic examination shows that the constituents are not now in their original condition. The principal are the glaucophane, a rather dirty-

<sup>1</sup> *Min. Mag.* Vol. VII. p. 1, and p. 150.

<sup>2</sup> The nearest locality on record, so far as I know, is the Val di Lauzo, where pebbles of glaucophane rock were found near Germagnano. *Williams, N. Jahrb.* 1882, Bd. II. p. 201.

<sup>3</sup> Kindly determined for me by Dr. Plimpton, in the University College Laboratory.

looking yellowish-green mineral, and some feldspar. The glaucophane occurs abundantly in transparent flakes, like those of chlorite, or needle-like actinolite, often about  $\cdot 01''$  by  $\cdot 0015''$ , and frequently grouped in slightly diverging bundles. It has, in short, an actinolitic habit; cross sections showing the characteristic cleavages of hornblende are rare. The tints are pale, but there is a distinct dichroism; the long sections changing from a pale violet-blue, with vibrations parallel with the vertical axis, to a barely perceptible bluish-grey, with vibrations perpendicular to it. Transverse sections afford a moderately strong violet tint with vibrations parallel with the orthodiagonal axis, and with those perpendicular to it an extremely faint purplish or reddish-grey tint, being almost colourless. With crossed nicols the extinction angles in longitudinal sections are small, as is usual with glaucophane.<sup>1</sup> With ordinary light these sections exhibit a distinct though pale violet-blue tint, while a cross section is much paler, but more distinctly purple in its tint.

The yellowish-green mineral has a dirty look, as if full of dust, and so is difficult to examine. Its external form is not very definite. It often exhibits traces of a close platy cleavage, and reminds me of an altered diallage, while in other grains two cleavages may be observed, which occasionally resemble those of hornblende, but more often seem to cross at high angles as in augite. Locally we get a little green hornblende associated with this mineral. Its dichroism is very feeble, the extinction angles are inconstant, generally suggesting a hornblende, but occasionally large enough for an augite. After careful study of the mineral, I am of opinion that it was once an augite (probably aluminous), but has undergone considerable alteration. In many cases a platy structure has been set up. Further change has caused the separation of a constituent—probably the aluminous silicate—in very minute microliths, and a process of 'uralitization' has converted the remainder more or less completely into a variety of hornblende. Feldspar (species indeterminable) can now and then be recognised, and there are many small grains in the slide which are probably this mineral or some alteration product. A grain or two of epidote is probably present, and I think I recognise a little quartz. There are also many small patches and granules, clustered or single, brownish or greyish, more or less opaque or earthy looking. Of the former, some may be a kaolinic residue after feldspar; others, decomposition products after an iron-oxide—perhaps in part ilmenite.

The glaucophane is generally in close relation with the uralitic mineral,

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<sup>1</sup> *Lasaulx, Précis de Petrographie, s.v. Glaucophane.*

often bordering it or even apparently in crystalline continuity with it. I cannot doubt that the glaucophane is a secondary product in the rock. The structure of this has been greatly obscured by subsequent molecular changes, but the arrangement of the uralitic mineral suggests that the original structure was more or less 'ophitic.' I believe, then, that the rock was once a dolerite, consisting chiefly of a felspar, such as labradorite, and an augite (probably a variety rather rich in alumina). The formation of an actinolitic variety of hornblende in dolerites and gabbros is a mode of change in these rocks with which we have now become familiar. In this case, however, I imagine that some of the constituents of the augite entered into combination with the soda constituent in the adjacent felspar, and produced along the border line an actinolitic glaucophane instead of an ordinary actinolite. Thus, by the molecular rearrangement of the constituents of an aluminous augite and labradorite, has resulted a glaucophane and (probably) a felspar akin to anorthite.

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