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IX. REMARKS *on a* MINERAL *from* GREENLAND, *supposed*  
*to be* CRYSTALLISED GADOLINITE. *By* THOMAS  
ALLAN, ESQ. F. R. S. ED.

[*Read 21st November 1808*].

**A**MONG a parcel of minerals which I procured last spring, there are specimens of two very rare fossils; one of them, the Cryolite, the other I believe a variety of the Gadolinite. The former, is accurately described in the different mineralogical works, and I have little to add to the information contained in them. But the Gadolinite appears to be very imperfectly known, and has never yet been described as a crystallised fossil.

THE minerals in question were found on board a Danish prize, captured on her passage from Iceland to Copenhagen, and were sold with the rest of her cargo at Leith. On examination, I was surprised to find they corresponded so little with the fossils which are usually brought from that island, and consequently endeavoured to trace from the ship's papers, any particulars that might lead to the knowledge of their geographic origin. All I could learn was, that they were sent from Davis' Straits by a Missionary.

I CONSIDER this limited information, however, sufficient to fix on the coast of Greenland as the place from whence they had  
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had been brought ; the only Cryolite known in Europe having been sent by a Missionary from Greenland to Copenhagen.

THE Gadolinite, from its extreme scarcity, is a mineral to be found in very few cabinets ; and when this collection fell into my hands, was one of those I knew only by description. I was led to suspect that some of the minerals in this parcel belonged to that species, by observing, imbedded in a piece of granite, some small shapeless masses, whose external characters appeared to correspond entirely with those assigned to the gadolinite ; but on reference to the mineralogical works which treat of this stone, I found more difficulty than could have been supposed in ascertaining whether they did so or not. The investigation, however, furnished a strong proof of the superiority of chemical test over external character ; for although the shape, lustre, fracture, and geognostic relations, left me scarcely any room to doubt, yet on applying the blow-pipe and acids, it was quite evident, that the stone I first tried could not be gadolinite. I examined with great care the rest of the parcel, and picked out several, which, though very different, resembled in various respects the one that originally attracted attention ; and with a view to satisfy myself, I sent duplicates to a friend in London, from whom I learnt, that one of those which I supposed to be gadolinite was certainly that mineral. Notwithstanding the very respectable authority I had obtained, to which I was inclined to pay the utmost deference, it was not till after minute and repeated investigations that I found myself disposed to submit to it ; the physical characters of the specimen in question differed so very widely from those I was taught to expect.

It is more than twenty years since the gadolinite was first observed by M. ARRHENIUS, in an old quarry at Roslagie, near Ytterby in Sweden. It was described by Mr GEYER, and by him considered as a black zeolite.

IN 1794, M. GADOLIN analysed it, and found that it contained 38 *per cent.* of an unknown earth, whose properties approached to aluminic in some respects, and to calcareous earth in others; but that it essentially differed from both, as well as from every other known earth.

IN 1797 M. EKEBERG repeated the analysis of M. GADOLIN, and obtained  $47\frac{1}{2}$  *per cent.* of the new earth. This increase of quantity he attributed to the greater purity of the specimens he submitted to experiment, and in consequence of having confirmed the discovery of GADOLIN, he called the stone after him, and gave the name of Yttria to the earth.

ANALYSES by VAUQUELEN and KLAPROTH have since appeared. The quantity of yttria observed by the former amounted only to 35 *per cent.*; but the latter states  $59\frac{3}{4}$  *per cent.*

THE small portions of this mineral, which, from its rarity, it is natural to conclude were at the disposal of these celebrated chemists, may in some measure account for the diversity of their results; but it is likewise by no means impossible, that the mineral itself may have varied in the proportions of its chemical ingredients.

THE difference which we find in the mineralogical descriptions of this fossil hitherto only found in one spot, is much more difficult to account for. If the information I have otherwise obtained be correct, of which I have not the slightest doubt, we cannot help attributing a certain degree of carelessness to some of the authors, particularly the French writers, who have such opportunities at command\*, of investigating every point relative to natural history. The great veneration

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\* LUCAS notes the Gadolinite as one of the minerals in the collection at the *Jardin de Plantes*.

they entertain for the talents and accuracy of the celebrated HAÜY, may induce them to think his observations require no concurring testimony ; and, on the other hand, the pupils of the German School, consider no mineral deserving a place in their system, till it has been examined and classed by their illustrious master, whose authority will be handed down by them with equal respect to posterity.

It is unnecessary to occupy the time of the Society, in giving a comparative view of the different descriptions of the Gadolinite. I shall only notice a few prominent features.

It is described by every one of the authors, as possessing a specific gravity of upwards of 4, and as acting powerfully upon the magnet. This last character is noticed by Professor JAMESON, in the first account he gives of the gadolinite ; but in the second it is omitted, along with some others. KLAPROTH takes no notice of its magnetic power, but states the specific gravity at 4.237.

THE French writers describe the colour as black and reddish black. The German as raven or greenish black. These variations, with several others which may be observed on referring to the different authors, shew that some incorrectness must exist. But the most remarkable of all is, that the gadolinite, if *ever* magnetic, is not always so ; for the specimens in the possession of the COUNT DE BOURNON are not, nor, as he informs me, are any that he has ever seen. It is therefore reasonable to conclude, that magnetism in the gadolinite may depend on accidental causes.

THE following is the description of the fossil, which I suppose to be that substance in a crystallised state ; although nothing short of analysis can afford indisputable testimony of the identity of any mineral so little known.

**SPECIFIC GRAVITY**, 3.4802. The specimen weighed 1136.39 grains. Its surface is a little decomposed, and it has also some minute particles of felspar intermixed with it; both of which would affect the result in some degree; but neither were of such amount as to do so in any considerable degree.

**HARDNESS**: sufficient to resist steel, and scratch glass, but not quartz.

**LUSTRE**: shining, approaching to resinous.

**FRACTURE**: uneven, verging to flat conchoidal.

**COLOUR**: pitch black, which I consider velvet black with a shade of brown; when pounded, of a greenish grey colour.

**FIGURE**: it occurs crystallised. The simplest figure, and perhaps the primitive form, is a rhomboidal prism, whose planes meet under angles of  $120^\circ$  and  $60^\circ$ . In some of the specimens, the acute angle is replaced by one face, in others by two, thereby forming six and eight sided prisms. All the specimens I possess are only fragments of crystals none of which retain any part of a termination. They occur imbedded in felspar, probably granite.

**CHEMICAL CHARACTERS**: before the blow-pipe froths up, and melts, but only partially, leaving a brown scoria; with borax it melts into a black glass. When pounded, and heated in diluted nitric acid, it tinges the liquid of a straw colour; and, some time after cooling, gelatinates.

THE principal distinguishing character of the gadolinite, is its forming a jelly with acid, a character belonging to few other minerals. The Mezotype Lazulite, Apophyllite,  $\text{\AA}$ delite, and Oxide of Zinc, so far as I know, alone possess the same quality; and it cannot easily be mistaken for any of them.

It has not the smallest attraction for the magnet; it does not decrepitate and disperse when exposed to the blow-pipe; it is not in any shape transparent.

THE Swedish fossil occurs in roundish amorphous masses, imbedded and disseminated in a granitic rock, having the external surfaces covered with a slight whitish coating, perhaps from the attachment of micaceous particles. There is no such appearance on the surface of the crystallised gadolinite.

THE situation which this mineral should hold in the system has been a matter of difficulty among mineralogists. HAÜY has placed it in the class of Earthy Fossils, immediately after his Anatase and Diopase,—rather an unfortunate situation, both these having been recognised as ores of known metals, titanium and copper, since the publication of his admirable treatise.

WERNER, on account of its weight, has classed it among the metals; and from its natural alliances, and chemical composition, has given it a place among the irons\*. If weight entitled it to be classed among the metals, several other minerals have an equal claim to the same situation. Of its natural alliances we know very little, farther than that the Swedish district where it is found abounds in iron; and as to its chemical composition, if  $17\frac{1}{2}$  per cent. of iron be sufficient to counterbalance  $59\frac{3}{4}$ ths of a new earth, it would be right to arrange it accordingly. The analyses of so many chemists of known celebrity, are certainly sufficient to justify the constitution of a new species for its reception. WERNER, however, may feel himself licensed in this arrangement, as he does not consider it necessary that a mineral compound shall preserve the characters of its components; but that any of the components may give to the composition characters sufficiently marked, to determine its relations. It is upon this distinction that he founds the difference between the predominant and characteristic principles †.

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\* JAMESON, vol. ii. p. 613.

† BROCHANT, vol. i. p. 44.

THE arrangement of BRONGNIART appears much more judicious; he has placed it at the commencement of the Earthy Minerals, and assigns as a reason, that it is unique in its composition; and if placed in any other situation, it would interrupt the series, either in respect to its composition or external characters.

OF the Cryolite I have very little to observe, in addition to the descriptions given in the different mineralogical works. The specific gravity I found to be 2.961; HAÜY states it at 2.949. Among the various masses I examined, there was no trace of crystallization, farther than the cleavage, which is threefold, and nearly at right angles. The masses broke in two directions, (which may be supposed the sides of the prism), with great facility, leaving a very smooth surface; but the transverse cleavage was more difficult, and by no means so smooth. Several of the specimens being mixed with galena, pyrites, and crystals of sparry iron-ore, it would appear that the cryolite is a vein-stone; but I was not so fortunate as to find any of it attached to a rock specimen, so as to throw light on its geognostic relations.

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