of the sandstone, from leucoxene, which in turn has been derived from other titaniferous minerals, chiefly ilmenite.

There is another possible source of the anatase. Both my friend Mr. Thomas and myself, while working on the Triassic sandstones, were struck by the great scarcity of sphene, which from its widespread occurrence in igneous rocks, might be expected to be abundant. That this may be accounted for by supposing that some of the anatase has been derived from this mineral, either with or without the formation of leucoxene as an intermediary stage, is very probable, seeing that Diller has described anatase after sphene in amphibole-granite and in 'Schalstein[1].'

In these Triassic sandstones, then, we have, first, leucoxene after ilmenite, then anatase after leucoxene, and lastly secondary quartz deposited on the anatase. Why the leucoxene should afford anatase instead of sphene, an alteration common in other rocks, cannot be explained, seeing that the conditions under which the change took place cannot have been far removed from those of ordinary weathering. Were we dealing with contact metamorphism the problem would be comparatively simple; indeed in the case of the re-crystallization of rutile as anatase, described by Mr. Maynard Hutchings[2], and as brookite, described by Beck in the Silurian clays of Saxony[3], the experiments of Hautefeuille can be profitably appealed to; but in this case, where the conditions cannot have been such as Hautefeuille demanded for the artificial formation of rutile, or even those under which the experiments of Daubrée and Deville were conducted, we must accept the phenomenon as an instance of the unaccountable vagaries of titaniferous minerals, whose only conception of order seems to be a tendency towards the form rutile.

In conclusion, I must record my indebtedness to those who have offered me their assistance, especially to Mr. Allan Dick, and to Mr. Maynard Hutchings, who has placed at my disposal his preparations described in the 'Quarterly Journal of the Geological Society' and in the 'Geological Magazine.'

2. *A peculiar occurrence of Magnetite in the Upper Bunter Sands.*

The specimen of Upper Bunter Sands, in which this magnetite occurs, was collected at Hinksford (Staffordshire), near Stourbridge. It is a white, very loosely coherent sand of medium grain; and contains,

[1] Neues Jahrb. Min., 1883, vol. i, pp. 187, 189.
[2] Geol. Mag., 1891, p. 459.
[3] Min. petr. Mitt. (Tschermak), 1893, vol. xiii, p. 290.

as was found by separating the constituents in mercury-potassium iodide, turbid orthoclase, microcline, fragments of the micro-crystalline ground-mass of acid lavas or intrusive rocks, quartz, staurolite, tourmaline, garnet, zircon, rutile, muscovite, a little haematite, and abundant magnetite.

The grains of magnetite are very minute, averaging 0·067 mm., but nevertheless they present, with very few exceptions, a perfect crystal outline, that of a simple cube, or, in a few rare cases, that of a regular octahedron. That the mineral is magnetite can be demonstrated both by its behaviour with reagents and by the possibility of separating it from the other grains by a weak magnet. By strong reflected light the dull black surface is in some cases seen to be traversed by a single set of striae parallel to the cubic edge; while on others a red colour can be discerned at the corners of the cubes, which suggests an admixture of a small amount of haematite.

There are two possible explanations of this occurrence. It may, for the sake of argument, be assumed that the grains of the rock were formerly cemented by chalybite, which by oxidization became converted into magnetite, having a form similar to that of the minute cubes described by Sjögren from the Mossgrufva, Nordmark[1]. Apart from the difference of the mode of occurrence, there is, however, an important distinction between the Mossgrufva crystals and those under discussion. The former have their cube faces crossed by a double set of striae at right angles to one another and parallel to the edges, whereas the Hinksford crystals only show one set, which instantly recalls the hemihedral striae of pyrites. This apparently hemihedral striation suggests the second, and I believe the more probable view, namely that the magnetite is pseudomorphous after pyrites, a replacement of which only one record[2], and that a doubtful one[3], can be found in the British Isles, that given in Hall's 'Mineralogist's Directory,' the locality being Tarbet in Argyllshire.

[1] Hj. Sjögren, 'Contributions to Swedish Mineralogy.' Bull. Geol. Inst. Univ. Upsala, 1895, vol. ii, p. 63.

[2] T. M. Hall, 'Mineralogist's Directory,' 1868, p. 132.

[3] H. A. Miers, Min. Mag., 1897, vol. xi, p. 277.