in plane sections, the ordinary rule of 'foreshortening,' as taught in all Schools of Art, will amply suffice.

I have found in practice that a shadow cast by sunlight on a paper properly inclined gives the true result most simply. It is, however, worthy of remark that the outcrop of a cylindrical stratum on a plane surface cannot differ from the outcrop of a plane stratum on a cylindrical hill, or in a hollow cylindrical valley; and is therefore reducible to "Sopwith's models."

Next, in assuming that the trail outcrop had a definite direction on either side of the railway cutting, does not Mr. Fisher assume that the trail lies in one plane?

Under these circumstances a straight rod placed at the one outcrop parallel to the other outcrop satisfactorily determines the strike and dip of the stratum.

As regards the equation $\tan \phi = \cos \beta \tan \alpha$ (2)

I subjoin a short proof.

Let $A\,B$ $C\,D$ be horizontal (strike) lines in the inclined plane.

$B\,E$ vertical, $C\,D\,E$ a horizontal plane.

Then $\angle\ B\,C\,E = \phi$

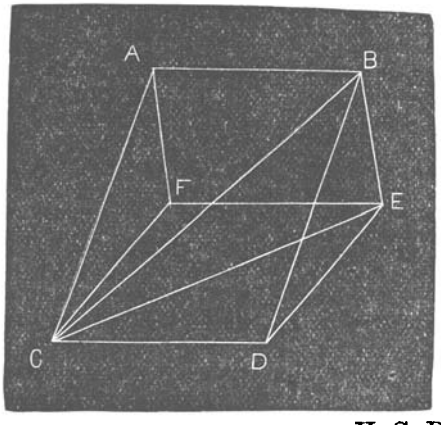
$B\,D\,E = \alpha$

$C\,E\,D = \beta$

Also $C\,D\,E$ is right angle.

Hence $\tan \phi = \dfrac{B\,E}{C\,E} = \dfrac{B\,E \cos \beta}{E\,D}$

$= \tan \quad \cos \beta$



H. G. Day, M.A.

THE PRE-CAMBRIAN ROCKS OF BRITAIN AND BOHEMIA.

Sir,—In Dr. Callaway's letter on this subject (Geol. Mag. Feb. 1881), there are some passages which are to my mind a little misleading in regard to the Dimetian rocks at St. Davids. The main portion of the group consists of what appears to be a massive granitoid rock, but on closer examination traces of foliation are

abundant. Indeed, throughout the whole group there is a schistose character developed, so that in consequence the most massive portions are found to be utterly worthless for dressing, either for building or paving purposes. This fact, though a species of rough evidence, is found to be very valuable in distinguishing many of the metamorphic rocks from those of igneous origin. In the latter the even admixture of the constituents and the regular crystallization enable them to be readily dressed in blocks, whilst the former, except where they consist of limestone or such-like sediments, are seldom sufficiently even in character through any thickness for this purpose. Hence the intrusive granites, greenstones, and various lava flows are frequently used for building and paving purposes, but the metamorphic rocks but seldom. The term gneissic or schistose may certainly be applied to the St. Davids Dimetian rocks throughout, but perhaps more especially to the middle portion of the group, seen in the valley between the Camp and Ponthclaish. Here the beds are usually less massive than at the base, or in the upper or more quartzose portion, and on very slight weathering the foliated character is very marked. Thin lines of nearly pure white felspar are also common, and a tolerably clear gneissic appearance exhibited.

It must not be expected that in these attempts at correlation anything like an absolute identity in character can be found in different areas. Certain general resemblances in mineral character, combined with the physical evidences indicative of contemporaneous deposition, are all we can expect, especially if, as I presume, I may take for granted, that most will now allow that these metamorphic rocks must have had at first an aqueous origin, and were deposited in successive layers of various materials like the alternating sediments found in more recent groups. If we examine closely any of the unaltered groups, capable of being correlated by their fossils, we readily recognize some general mineral resemblances over very considerable areas, and Mr. Marr has particularly referred to some of these in his very excellent and highly suggestive paper. But there are, on the other hand, many minor differences, and this is especially the case where the sediments have been deposited in rather shallow water. For instance, the Harlech group at St. Davids and in the Harlech mountains is mainly composed of sandstones, whilst in Carnarvonshire it consists chiefly of slates, and in the north-west of Scotland of conglomerate and grits. Now if we suppose, as I believe was the case, that the Dimetian group was chiefly deposited in shallow water, the differences so well marked in the unaltered rocks of the Harlech group are exactly those which would, under the influence of metamorphism, produce a massive granitoidite at one place, a quartzose gneiss or micaceous schist at another, and yet a general resemblance indicating the prevalence of tolerably similar physical conditions at the time would be retained in the group in each area.

On these considerations I think Mr. Marr was fully justified in classing the quartzose gneisses of Bohemia with the Dimetian rather

than with any other known European Pre-Cambrian group, especially as he found them overlaid unconformably by rocks similar to those found in the Pebidian group. Certainly from his descriptions they could not be classed with the dark hornblendic and red gneisses which the Scotch geologists have invariably claimed to be characteristic of the Hebridean or Lewisian group. Moreover, the very fact that most of the gneisses in the central highlands were found, like the Dimetian of Wales, to be highly quartzose in character, formed one of the chief stumbling-blocks to their being recognized as of Pre-Cambrian age: even Nicol found this a difficulty. Now, however, since the Dimetian rocks in Wales have been recognised, this need offer no difficulty in future, and I feel convinced that ere long the Dimetian and Pebidian groups will be as easily separated from one another even in Scotland as has been the case now in Bohemia through Mr. Marr's researches.

Hendon, N.W., *Feb.* 7, 1881. H. Hicks.

DISTURBANCES IN THE CHALK OF NORFOLK.

Sir,—I am indebted to Mr. H. B. Woodward for pointing out that Mr. J. E. Taylor was subsequently inclined to suggest a different age and cause for the disturbance at Whitlingham. This had escaped my notice, but supposing that Mr. Taylor's later view, now endorsed by Mr. Woodward, is correct, it does not follow that all disturbances of the Chalk in Norfolk are due to the same cause. The passage of ice has no doubt disturbed and broken up the Chalk in many places; but I still submit that it is difficult to conceive of any *surface* agency being capable of producing such a sharp contortion in a solid scar of chalk like that at Trimmingham.

A. J. Jukes-Browne.

Highgate, *Feb.* 4.

SHRINKAGE FISSURES.

Sir,—I would direct the special attention of geologists to the chasms due to the subsidence in Cheshire; of which an excellent sketch recently appeared in the *Graphic*. From these shrinkage fissures we learn how gorges or cañons can be made without denudation—because if such a small thing as the vacancy in a salt mine produces such marked results, how much greater must be the results from vacancies caused by vulcanicity and other natural phenomena? The sketch has an aspect very similar to some of the maps of cañons in Dr. Hayden's magnificent reports.

G. H. Kinahan.

We regret to record the death of two well-known and highly-esteemed geologists, namely:—Dr. J. J. Bigsby, F.R.S., F.G.S.; and Prof. James Tennant, F.G.S. Notices of these veterans will be given next month.