

## THE GEOLOGICAL STRUCTURE OF SCANDINAVIA AND THE SCOTTISH HIGHLANDS.

THE obvious connection and analogy between the geological structure of the crystalline rocks of the Highlands of Scotland and those of Scandinavia have long engaged the attention of geologists. Among the northern observers to whose labours we are largely indebted for our knowledge of the Scandinavian regions, Dr. A. E. Törnebohm has proved himself a keen and indefatigable explorer of the Swedish uplands. Many years ago he showed that above clay-slates and limestones, with recognizable Silurian fossils, there lies a great thickness of quartzites, gneisses, and schists, called by him the Seve group. In more recently studying the relations of these rock-masses, he encountered some great difficulties, of which he sent me at the time an account. I could not pretend to solve them, but suggested, as at least a working hypothesis, that the Scandinavian structure might be fundamentally similar to that now recognized as characteristic of the North-West Highlands, where the apparent conformable superposition of a series of schists upon fossiliferous Lower Silurian strata has been produced by great terrestrial displacements, whereby the overlying rocks have been crushed and deformed, until they have assumed a new crystalline structure along the planes of movement, these stupendous changes having occurred at some time subsequent to the Lower Silurian period. I have recently received from Dr. Törnebohm the following letter, which he gives me leave to publish, and which will no doubt be read with interest by those who are aware of the recent progress of research in this subject:—"It will perhaps interest you to learn that your suggestion four years ago regarding the construction of our Scandinavian *fjelds* has turned out to be correct, at least in my opinion. My late researches have little by little driven me to the conclusion that the crystalline schists belonging to what I have called the 'Seve group' have been placed over Silurian strata by an enormous eastward thrust. I admit that I have most reluctantly come to this conclusion, knowing that it implied a horizontal thrust of enormous masses of rock for more than 100 kilometres. Such a stupendous movement of entire mountain-regions is hard to realize; but facts are stubborn things."

It will be observed that Dr. Törnebohm speaks of the movement having been towards the east, whereas in the north-west of Scotland it has been in the opposite direction. In a more recent letter, in reply to one in which I had called his attention to this difference, he says:—"Though in Scotland the great thrusts are westward, in Scandinavia it is quite the reverse. Here the chief movement has been to the east or south-east. In the region of Trondhjem, indeed, there have been lesser movements towards the north-west, but these may have taken place somewhat later. At least I rather suspect this, but am not prepared positively to affirm it." I may remark that in Scotland also there are districts where the thrusts have not come from the normal direction but from the westward. In the Island of Islay, for example, I recently found the limestones and quartzites piled up by sharply-cut thrust-planes which had a general westward inclination at lower angles than the displaced strata. One of the great problems in working out the complicated geology of the Highlands is the determination of the positions and extent of such thrust-planes, and the direction in which the displaced rock-masses have been moved. There can be little doubt that much mutual help in this research will be gained by a co-operation between the field geologists who are engaged in the study of these problems in Scotland and in Scandinavia.

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TIMBER, AND SOME OF ITS DISEASES.<sup>1</sup>

## VIII.

THERE is a large and important class of diseases of standing timber which start from the cortex and cambium so obviously that foresters and horticulturists, struck with the external symptoms, almost invariably term them "diseases of the bark"; and since most of them lead to the production of malformations and excrescences, often with outflowing of resinous and other fluids, a sort of rough superficial analogy to certain animal diseases has been supposed, and such terms as "canker," "cancer," and so forth, have been applied to them.

Confining our attention to the most common and typical cases, the following general statements may be made about these diseases. They usually result from imperfect healing of small wounds, the exposed cortex and cambium being attacked by some parasitic or semi-parasitic fungus, as it tries to heal over the wound. The local disturbances in growth kept up by the mycelium

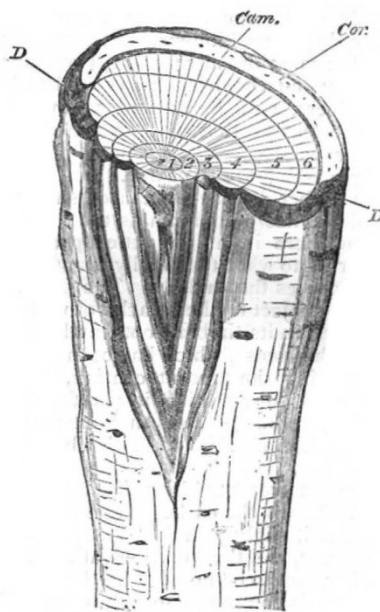


FIG. 28.—Piece of tree stem affected with "canker." The injury commenced after the two inner zones of wood (1 and 2) had been developed: it extended further in successive periods of growth, as shown by the receding zones 3, 4, 5, and 6, until all the cambium and cortex was destroyed except the pieces *D* to *D*. *Cam.*, cambium; *Cor.*, living cortex; *D, D*, dead tissues. At each period of growth the attempt has been made to heal over the wound, as shown by the successively receding lips.

feeding on the contents of the cells of these tissues lead to the irregular growths and hypertrophies referred to; the wounds are kept open and "sore," or even extended, and there is hardly any limit to the possibilities of damage to the timber thus exposed to a multitude of dangers.

In Fig. 28 is represented a portion of a tree stem affected with "canker": the transverse section shows the periods of growth numbered 1 to 6 from within outwards. When the stem was younger, and the cambium had already developed the zones marked 1 and 2, the cortex suffered some injury near the base of the dead twig, below the figure 1. This injury was aggravated by the ravages of fungus-mycelium, which penetrated to the cambium and destroyed it over a small area: in consequence of this, the next periodic zone of wood (marked 3) is of course incomplete over the damaged area, and the cortex and cambium strive to heal over the wound by lip-like callus at the margins. The healing is prevented,

<sup>1</sup> Continued from p. 111.