

4. The fourth view, and probably the correct one, is that the apatite was formed in cavities in the pyroxenite, and that it became inclosed in the syenite during the intrusion of the latter. The objection to this view, as in the preceding, lies in the difficulty of accounting for the preservation of its crystallographic form. However, as the ellipsoidal rock evidently represents an early stage in the development of the gneissic structure, it is probable that the differential movement at this point was not so great but that the crystal was able to withstand the strain.

SIMILAR STRUCTURES IN OTHER ROCKS.

Analogous structures in mica-gneisses are well known. A variety called stengeliger-gneiss (wood-gneiss), according to Zirkel,* is characterized in some cases by bands of mica winding about the stalk-shaped or wreath-shaped feldspar-quartz masses, so that these are inclosed on all sides by the mica layers. On cross-fracture, therefore, these will show discoidal, ellipsoidal, elongated, roundish, trapezoidal figures formed by the mica bands. Up to this point the description applies very well to the Ottawa occurrences, except in the character of the mineral forming the bands. Beyond this, however, the analogy fails, as further alteration produces an asbestos-like structure which has no counterpart in the rocks under consideration.

Rothpletz has noted † a structure analogous to that here described in the greenstone-schists (actinolite-schists) of Hainchen, and Williams ‡ from northern Michigan. Both of these observers ascribe it to brecciation in situ, while the former explains the rounded character of the fragments and the production of much of the interstitial material by the rubbing together under the action of much orographic pressure of a mass already finely subdivided by cracks. Lawson has described similar occurrences in the Lake of the Woods region. §

CONCLUSION.

Reviewing now the different hypotheses in the light of all the evidence available, it is apparent that no one of them seems to offer a full and adequate explanation. The ellipsoidal and the gneissic structure in these rocks are clearly closely related in origin, and any conclusion affecting the one has a direct bearing upon the other. Our knowledge of the processes by which the ancient gneisses were formed is extremely limited. That they may be formed by dynamic processes has long been recognized, and it is now well established that a laminated structure comparable to that of the gneisses may be produced in deep-seated igneous

* Lehrbuch der Petrographie, band iii, p. 203.

† Zeitschrift der deutsch geology Gesell., vol. 31, pl. ix, x, 1879, pp. 374-397.

‡ Bull. 62, U. S. Geol. Survey, 1890, pp. 166-177.

§ Geol. and Nat. Hist. Survey of Canada, Ann. Rep., 1885, Rep. CC, p. 51.