rocks are intensely foliated and lineated and the lineations and the majority of the folds plunge parallel to the dip of the thrust planes; there is frequently a submaximum of fold axes with trend parallel to the strike of the thrusts (Balk, 1953). Balk regards the lineation as a type of slickensides, parallel to the direction of movement on the thrust. He considers that the fabric was produced entirely by flattening normal to the foliation with intense elongation parallel to the lineation, and that the folds originated by slight movement of blocks of rocks in a direction normal to the main direction of movement:

> The origin of the lineation and lamination is believed to be identical with that of corresponding structures in rolled steel and glass.
>
> However, the formation of folds with axes parallel to the direction of thrust requires an additional shear stress acting perpendicularly to the direction of thrusting. The inhomogeneous composition, strength and mobility of the flooring rocks are pointed out, and it is suggested that unequal rates of yielding of local rock masses below the thrust block generated these supplementary stresses, producing slight movements of small masses sideways [1953, p. 102].

Cloos (1946) holds a similar view on the origin of what he describes as "folds in *a*." He cites the Assynt area and certain areas in Scandinavia and Lapland as affording examples of folds of this type (pp. 26–29). He states that "the principle involved is the same as that used in the machinal folding of maps, the making of corrugated iron, rain gutters, and other folds accompanied by lateral shortening normal to the principal movement" (p. 28). Cloos considers that the main movement *and transport* in the Moine schists of the Assynt area were toward the northwest, parallel to the lineation; the orientation of the lineation varies slightly in different parts of the area, and the author attributes this to variations in the direction of movement, produced by local restriction of transport in certain parts of the area. Cloos also concludes that there may have been subordinate movement perpendicular to the general west-northwest direction of advance.

The movement postulated by Balk and Cloos is similar to that I infer for the second (orthorhombic) phase of the primary deformation, but my analysis of the fabric of the Moine schists and the primary mylonitic rocks of the Assynt area indicates that the folding was not produced during this phase of deformation, as Cloos has claimed. Some of the folds, such as those in the primary mylonitic rocks of the Knockan Crag area, indicate shortening normal to the fold axis without much tectonic transport, but the symmetry and the style of the folding in the other areas examined indicate that there was considerable translative movement normal to the fold axes before the orthorhombic imprint.

Age of the Movements

My conclusions on the relative age of the different groups of fold structures in the Moine schists and the mylonitic rocks are essentially the same as those advanced by Read (1931), but the evidence set out in the foregoing sections proves that the geological ages of the two phases of deformation are not as Read inferred. It has been shown above that the east-southeast–plunging folds and lineations (B) were produced during the regional metamorphism of the Moine schists, and also that this deformation and metamorphism date from post-Cambrian times. The regional metamorphism of the Moine schists, then, was not pre-

Torridonian, as claimed by Read (1934), Phillips (1937, 1949, 1951), and Wilson (1953, but entirely "Caledonian" (that is, post-Cambrian, and pre–Middle Old Red Sandstone). There was movement along the Moine thrust during the Moine metamorphism and deformation; the primary mylonitic rocks formed a movement horizon or zone along which the deforming and recrystallizing Moines were transported over the rigid basement. The "dislocation" effects described by Read (1931), and the "brittle" structures referred to by Wilson (1953) and McIntyre (discussion of Wilson, 1953; 1954), were produced during a later phase of deformation, when the north-trending folds in the thrust zone were formed. It is not possible to determine an upper age limit for these later movements; they may, as McIntyre has suggested, be of Hercynian or even Tertiary age, for the Permian dike in the mylonitic rocks of A'Mhoine (McIntyre, 1954, pp. 216–217) cuts primary mylonitic rocks. If, however, there is a genetic ($B \perp B'$) relationship between the B-structures in the Moine schists and the north-trending folds in the thrust zone, as suggested above, then the westward movement on the thrusts must have followed closely on the primary movements. Thus it is possible that the secondary deformation of the Moine schists and the mylonites and the westward movements on the thrusts also date from the Caledonian orogeny.