

Though the material covered is complex, the book is clearly written and well-illustrated with figures and excellent photographs, apparently all taken during the rare sunny days in the "home of the Trolls". I am less pleased with the Geologic Map (pl. 1), which should have been printed larger to allow differentiation of structure symbols of the several deformation phases in the western and southeastern parts of the map. Four field seasons and 207 pages of text deserve a more lucid map! Other minor criticisms include: (1) lack of agreement of the attitude of the nor-fold axial surface at 8 on figure 54 and those from presumably the same locality F plotted on figure 60b; (2) inclusion of the three-dimensional sketch of the "handfold" (fig. 47), which, though representing an abandoned interpretation, is more dramatic than figure 48 and may be uncritically remembered as THE structure of the Riar Basin; (3) scale differences between the sections (figs. 46, 48) and the Geologic Map (pl. 1).

*Strain Facies* should be useful to all geologists who have worked with unraveling several phases of deformation. Hansen's system includes a rigorous definition of terms to describe fold styles and symmetry, a summary and demonstration of previously known and new techniques for determining slip-line orientations in folded layers, and a thorough analysis of types of flow and how they might be determined from field data. More traditional geologists will search in vain for a type locality, or a genetic or geometric basis for the terms sahlfold, discfold, or norfold applied to the strain facies by Hansen—the terms are nonsense syllables (p. 26). Whatever the terms, Hansen has documented the fundamental geometric and kinematic differences between folds of different phases in one small area and has developed a model for the flow environment producing each. The strength of the book lies in its demonstration of an integrated system leading from the field to a qualitative understanding of strain in a flow environment.

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*Microtectonics along the western edge of the Blue Ridge, Maryland and Virginia*; by ERNST CLOOS. P. xiv, 234, 87 pls., 57 figs. Baltimore, Md., 1971 (The Johns Hopkins Press, Johns Hopkins University Studies in Geology, no. 20, \$12.50).—In 1947 Ernst Cloos published an article on deformed oöids and related structures in the Appalachian Great Valley and Blue Ridge of Maryland that quickly became a classic. From the data he had carefully assembled, he built up an overall picture of the deformation there—the South Mountain plan. In later years, he studied surrounding areas, showing that the plan can be carried in reconnaissance southward along strike as far as North Carolina but that it is replaced east and west by quite other types of deformation, for example, the brittle wedging, bedding slip, and related structures he has described so well in the Valley and Ridge folds at Roundtop and elsewhere in western Maryland. But finally he has returned to his South Mountain plan, refining his methods and applying them in detail over a large area in the Virginias. In the present book he has set out the results of these labors,

and it will certainly take its place beside his 1947 paper, which it supplements and complements.

As regards method, he has sharpened up his oöid studies, especially by insisting on distinctions between several "species", so that data from different areas may be truly comparable, and each type of oöid can contribute its share. Furthermore, he has sought out new types of information of several kinds, especially by using the orientation of striae on slickensided surfaces and of fibrous crystals growing in fractures during deformation. As regards results, he has provided new evidence for many of his earlier conclusions, for example, that the appearance of cleavage is closely related to increasing body deformation in the rock and that stratigraphic thicknesses can be seriously distorted by such deformation, and he has shown that the South Mountain plan is remarkably consistent over a body of rock 250 km long, 60 km wide, and perhaps 10 km thick—not less than 150,000 cubic km!

Professor Cloos concludes his introduction by remarking that "this study is a reconnaissance and probably points out more problems than it solves," but he has also started us along the road to solving them. His discussion of what happens mechanically when a subspherical oöid is distorted into an ellipsoid shows the complexities that actually underlie the "homogeneous strain" of continuum mechanics; perhaps for this reason there is less quantitative discussion of strain here than in the 1947 paper. The obvious involvement of the Blue Ridge basement in the South Mountain plan leads him into a stimulating discussion of the kinematics of Appalachian deformation and of the necessity to postulate true lateral shortening and to relegate gravity as a motive force to a secondary role. Finally, he points out that the plan affects all rocks from the Precambrian basement to the Silurian and Devonian strata of the Massanutten syncline, and hence he is apparently retreating from the conclusion he had reached in 1964, presumably in large part on the basis of geochronometric dating in the Piedmont, that the Blue Ridge anticlinorium and the South Mountain plan were produced during Ordovician deformation. A serious contradiction is thus posed that future work must resolve, perhaps by showing that the dating is incorrect or is irrelevant to the Blue Ridge or by showing that the deformation affecting the Silurian and Devonian was a later event, which happened to be coaxial with the South Mountain plan. In any case, more work is in order, both in the dating laboratory and in the field.

JOHN RODGERS

*Physical Geography—A Systems Approach*; by RICHARD J. CHORLEY and BARBARA A. KENNEDY. P. xxi, 370 figs., tables, references, index. London, 1971 (Prentice-Hall Internat., Inc. 2 pounds; cloth 4.25 pounds).—Ten years ago Richard J. Chorley introduced a wide audience to the advantages of applying general systems theory to geomorphology. The present volume is an amplification, elaboration, and extension of that theme. It presents a discussion of systems and their application to exam-