

The remaining papers in the structural section form three geographically defined groups. From Trondheim (after a gap of some 500 km without description), there are accounts of contiguous regions in Nordland, Sørfolda and Sulitjelma. Each manages almost entirely to ignore the sequences and structures of the other, and they have only two references in common. The Sulitjelma paper is one that would have qualified for inclusion in a section on the ophiolites of the fold belt, had there been one. A further group of three papers, deals with an area stretching across the fold belt in the latitude of Narvik. Two concentrate on lower structural units towards its east end. The third links the Precambrian Lofoten-Veterålen Massif and Caledonian sequences on the mainland. The two papers on Troms, between Narvik and Finnmark, one a review and the other concerning relative detail, have broad interest. This arises because it is in Troms that the Finnmarkian sequences meet those recognized in the southern part of the fold belt. The suggestion is made that nappes of the two sequences are interleaved and that no single surface will do to separate them.

At least half a dozen articles in other sections could be added to the nine arranged under the heading 'Igneous Activity', all based on chemical data from basic igneous rocks. The review of igneous activity and the succeeding review of ophiolitic bodies in the Scandinavian Caledonides have much in common with the review in the section 'Tectonic Evolution', and another paper in this section investigating the plate context of magmatism through igneous rock composition, for Troms and Finnmark. Attention has already been drawn to a previous cluster of papers on ophiolites (formation, emplacement, deformation, erosion, etc.). Two accounts on the Bergen district fall into this category. The article on the Fongen-Hyllingen layered basic intrusion of the Trondheim area seems to be the only one primarily concerned with an igneous body itself. That on the Artfjall Gabbro which follows it, concentrates like the majority, on what may be learned of the metamorphism and structures of the country rock from a study of the major magmatic body it contains.

The section 'Metamorphism' is dominated by the study of eclogitic rocks. This is natural, given the scale of the Caledonian high pressure metamorphism they have revealed, but it must remain a matter of regret that apart from the opening review only one paper deals with a different type of metamorphism. This is on medium-grade regional metamorphism, locally raised to higher levels in the aureole of the Krutfjell gabbro (Upper Allochthon); the location is obscure as neither latitude, longitude, grid references nor locality map are provided. One field of study that must be due to grow is that of metamorphism in the fold belt.

'Tectonic Evolution' is a short section comprising three roughly comparable papers, already mentioned under Igneous Activity, on volcanism and its environmental significance, the geochemistry of igneous rocks in Troms and Finnmark, and the evolution of the so-called eugeoclinal elements of the orogen. The fourth article, quite different from any other in these volumes, is on the evolution of the morphology of Scandinavia during the Mesozoic and Cenozoic.

The third section *Related Caledonian Areas* begins with an account of Svalbard, followed by eight articles on Greenland (comprising about half the section and 5% of the whole compilation). One of these articles is by John Haller, whose tragically early death preceded its publication. They are succeeded by an account of the Caledonides of Britain and Ireland, two papers on Shetland, one on the Moine Thrust Zone, articles on the non-Caledonian character of the Ligurian Orogeny, the possibly Caledonian rocks of Sardinia, the regional geology of a large part of Soviet Asia and of the northern Appalachians. The section ends with articles on the extent of the early (Finnmarkian) orogenic phase in Scandinavia and lastly on the distinction of phases such as Caledonian and Variscan.

What words can be used to sum up my reaction to such a large body of work? Two points may be made. First the volumes provide a very convenient entry point to a now voluminous literature and contain a wealth of data and opinion. Major libraries cannot afford to be without them. Second the matter of price: are they worth £150? I am inclined to say the price begins to seem reasonable when described as about 2.5% of the lowest level in the pay scale of a lecturer at a British university.

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Fractured media

R. Engman and Z. Jaeger, 1986. *Fragmentation, Form and Flow in Fractured Media*. Volume 8 of *Annals of Israel Physical Society*. 628 pp. Adam Hilger, Bristol, U.K. Price: £49.50.

This book contains the proceedings of the F³ Conference held at Neve Ilam (Israel) in January 1986, to which participants were invited personally, and whose papers were not refereed. Peer review was by audience questioning. The aim of the conference was to bring together materials engineers and scientists experienced in fragmentation, with physicists interested in probabilistic processes. The major topics considered were geometry and topology of voids and cracks, the blasting process and post-explosion flow. Some of the sub-topics which caught my eye as being of geological or geophysical interest included: scaling between macro- and microcracks; conductive and mechanical properties, their dependence on crack density; fractal form of surfaces and of broken solids; effect of sample size; particle size distributions and texture in fragmented media; flow in near-percolative media; permeability-porosity relations by effective medium theories and beyond; hydraulic fracture enhancement of flow; what are the laws of interactions between cracks? Rock was the most widely considered material at the conference, and I was struck by the attempts being made to apply percolation theory and fractal theory to rock fragmentation and fracture—albeit that the work is still mainly theoretical and inconclusive. The published volume will be a useful reference source for those who wish to enter this field. However, it has an eclectic flavour, and could not be described as exhaustive or authoritative—perhaps because of the limited attendance at the conference.

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A video of ice deformation

Dynamic Processes in Shear of Ice as a Rock Analogue, presented by Chris Wilson. University of Melbourne, Australia. 30 min colour video. Price: PAL Aus.\$120; NTSC and SECAM Aus.\$130.

Videos of this type which allow us to observe the dynamics of geological processes are a welcome addition to teaching material. The experience of watching crystals deform and develop characteristic internal structures is an exciting one akin to accompanying Professor Lindenberg on a microstructural journey to the centre of an orogenic zone. The deformation features which are usually static and frozen in thin sections are here transformed into active and mobile elements all contending for a place in the final structure.

The evolution of the suite of microstructures developed by intracrystalline deformation is illustrated by time lapse photography of a thin ice sheet deforming between two glass plates under an optical microscope. The generation of slip bands, undulatory extinction and kink bands, together with examples of the grain boundary migration processes involved in dynamic recrystallization, are all observable in the sequences shown. In addition, the development of the crystallographic preferred orientations which accompany the deformation are included and the differences between the preferred orientations developed by simple shear and pure shear described. A final sequence demonstrates the grain boundary adjustments to the fabric which take place during an annealing event.

Having produced a similar video using para-dichlorobenzene as the analogue material I appreciate and applaud the effort which Chris Wilson and team have made with this one. The visual impact of the video is excellent and the experimental sequences are backed up by some clear graphics. The addition of some pointers to highlight the location of critical features would have helped a number of the sequences where rather a lot takes place quickly. In general the commentary is informative, but slightly repetitive and perhaps too detailed in one or two places where the action is too fast to allow easy assessment of the important events. Although slightly expensive at some £55, the tape does provide an important insight into the processes of intracrystalline deformation and a super teaching aid.

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