The Rocky Mountain foreland of the central United States deserves its status as a classic orogenic belt, combining very good exposures with excellent subsurface information from the oil and gas industry. G.S.A. Memoir 171, *Interaction of the Rocky Mountain Foreland and the Cordilleran Thrust Belt*, has taken a different approach relative to previous memoirs on the Rocky Mountains by attempting to be as inclusive as possible, frequently at the expense of being contradictory. Its predecessor, GSA Memoir 151, *Laramide Folding Associated with Basement Block Faulting in the Western United States* edited by Matthews, presented a series of tight, focused arguments for the vertical uplift model of foreland uplifts based on field and theoretical research from the academic realm. This memoir provoked a strong backlash from the Rocky Mountain oil and gas industry, whose seismic and well evidence provided a resounding rejection of the vertical tectonic hypothesis in the 1983 Rocky Mountain Association of Geologists (RMAG) Memoir entitled *Rocky Mountain Foreland Basins and Uplifts* edited by Lowell, and the 1985 RMAG Folio *Seismic Exploration of the Rocky Mountain Region* edited by Gries & Dyer. One unfortunate consequence of this debate has been an unfortunate, yet partially deserved distrust of academic research by industry geoscientists.

GSA Memoir 171 addresses three major areas in its 32 chapters by different authors:

(1) reviews of Rocky Mountain basement-involved structures, showing the consistency between industry data and balancing criteria;

(2) description of the overlap region between thin-skinned and basement-involved thrusting; and

(3) sedimentologic and stratigraphic studies in the overlap province.

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(3) sedimentologic and stratigraphic studies in the overlap province.

I will concentrate on articles from the first two areas since the sedimentologic studies are mostly regional in implication and scope. However, the potential for testing complex structural chronologies with quantitative flexural subsidence analysis was clearly shown by Shuster and Steidtmann for the northern Green River basin which was loaded by both thin-skinned and basement thrusts.

Brown's largely descriptive summary of his extensive industry and academic experience in Rocky Mountain basement-involved uplifts provides a good illustration of the gaps in our understanding of these basement-cored structures. Reviews of Rocky Mountain tectonics by Hamilton and balancing constraints by Spane, Evans & Cook show the necessity for horizontal shortening on reverse and thrust faults underlying the folded cover strata while demonstrating the lack of consensus (and data) on the structural style at deeper structural levels. An intriguing paper by Chester, Spang & Logan compares analog experiments using cm-scale, layered rock models underlain by pre-cut faults with Laramide structures.

The bulk of the memoir (22 out of 32 papers) describes the geological constraints on the interaction of the basement-cored foreland uplifts with the Cordilleran thrust sheets. The differences in structural fabrics between the two provinces are well defined by Mitra *et al.* in their comparison of minimally deformed fabrics from the northern Wind River Mountains with thrust sheet fabrics immediately to the west. The complexity of the overlap province is immediately apparent from the geometric modelling of Kulik & Schmidt, Schmidt *et al.*, Kraig *et al.* and Skipp as well as the opposite interpretations presented in several pairs of papers. These papers show that geometric modelling based on field observations alone does not usually provide unique interpretations of structural sequence. Articles integrating additional evidence from fabric analysis (Craddock *et al.*, Bradley & Bruhn), industry subsurface and palynological data (Hunter), gravity modelling (Kulik & Perry) and paleomagnetic rotations (Eldredge & Van der Voo) provide the best constraints on the timing of foreland and thrust belt structures. These analyses show that the Cordilleran thrust belt and the basement-involved foreland uplifts were coincident in time, with the basement-cored foreland uplifts both buttressing advancing thrust sheets and deforming previously emplaced thrust sheets. Kulik & Schmidt convincingly argue that this coincidence in time and space indicates that both provinces share an underlying mechanism of horizontal compression, with variations in crustal decoupling causing the differences in structural style.

Schmidt & Perry are to be commended for the inclusive nature of this volume. They have attempted to air all points of view, allowing the readers to make their own conclusions. However, the inclusiveness of this volume results in a very large book (582 pages) with highly variable manuscript quality, some of which would not have been published in major geological journals. GSA Memoir 171 is a valuable addition to the libraries of institutions and individuals puzzling the complexities of thrust interactions. The memoir, like previous memoirs on the Rocky Mountains, will serve to focus international attention on the structural geology of the region. The sparse industry representation and data (only one small seismic line) is largely the result of the industry downturn which focused attention away from the Rocky Mountains. Those interested in the area are urged to complement Memoir 171 with the industry-based Rocky Mountain Association of Geologists volumes on the Cordilleran thrust belt and Rocky Mountain foreland provinces. Memoir 171, *Interaction of the Rocky Mountain Foreland and the Cordilleran Thrust Belt*, breaks no new theoretical ground, but does a good job describing the complex geometries resulting from the overlap of thin-skinned and thick-skinned thrust faulting in the Rocky Mountains.

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Celebrating the Scandinavian Caledonides

Gayer, R. A. (editor) 1989. *The Caledonide Geology of Scandinavia.* Graham & Trotman, London, U.K. 312 pp. Price £95, $159.

This volume contains an edited selection of some 25 papers presented during a conference at University College, Cardiff, U.K., in September 1987.

From the title, readers might reasonably expect a book to complement the 1978–1979 review volume on the British sector of the Caledonide Orogen—*The Caledonides of the British Isles Reviewed* edited by A. L. Harris, C. H. Holland & B. E. Leake (*Spec. Publs geol. Soc. Lond.* **8**). Instead the scope and coverage are much more limited, with some 14 out of the 20 papers on the Scandinavian Caledonides being concerned with various aspects of the understanding of the Caledonian evolution of Finnmark and adjacent areas of northern Norway and Sweden. Indeed, a specific section is devoted to papers concerned with controversies surrounding the timing, status and characterization of the Finnmarkian "Orogeny"—the early tectonometamorphic phase (or phases) which affected the leading edge of the Baltic plate in northern Norway prior to the eventual closure of Iapetus Ocean and its collision with the Laurentian continental plate during the climactic stage of the Caledonian orogeny.

This special emphasis stems from the fact that the Cardiff conference was held to celebrate the 25th anniversary of the Norwegian Caledonides research group at University College, Cardiff. Hence the coverage in this volume strongly refects the direct interests and important contributions made to the understanding of the Caledonides in northern Scandinavia, by the Cardiff research group, led in recent years by Rodney Gayer—the editor of this volume.

In terms of both size and coverage, this latest volume certainly pales alongside the 1266 page two-part tome *The Caledonide Orogen—Scandinavia and Related Areas* edited by D. G. Gee & B. A. Sturt (John Wiley, Chichester, U.K. 1985), based on papers read at the major symposium held in Uppsala, Sweden, in 1981. However, a largely different authorship has ensured that there is in fact little overlap in content with this earlier, more comprehensive, review text.

In view of the title, it does, however, come as a surprise to find included a section containing five papers on the East Greenland Caledonides.

Within this volume, papers are grouped into seven parts. The opening and most specific and unique part is entitled *Finnmarkian geology*, and comprises five papers. The first by R. B. Pederson, G. R. Dunning & B. Robins provides new zircon ages from nepheline syenite pegmatites in the synorogenic Seiland igneous province which suggests that deformation in this region had ceased by mid to late Cambrian times. R. D. Dallmayer, A. Reuter, N. Clauer & N. Liewig provide K–Ar and ^{40}Ar–^{39}Ar ages for illites formed during low-grade metamorphism of the Lower Allochton and Autochthon in Finnmark which refute previous suggestions of a Finnmarkian history. From nappe correlation in NE Troms and W. Finnmark, R. E. Binns questions previous age data and the existence of the Finnmarkian orogeny. However, in the following paper, D. Tietzsch-Tyler presents evidence for an early Caledonian deformation in central Norway suggested to correlate with the Finnmarkian orogeny. In the final paper of this section, C. Townsend & R. A. Gayer present a summary of data, ideas and problems concerning the timing of orogenesis in Finnmark. The consensus view presented is that a Finnmarkian "orogeny" at 540–490 Ma, as previously defined, did not occur as such. Rather, evidence indicates two or possibly three distinct pre-Silurian phases of orogenesis in this region.

Part II on *Regional geology* comprises six papers presenting structural and lithostratigraphic data on various parts of northern Norway and Sweden. The Middle Allochthon at Västerbotten and Kvikkjokk in northern Sweden, is documented in papers by R. O. Greiling and R. O. Greiling & R. Kumpulainen. L. Hansen describes age relationships between normal and thrust faults in autochthonous Cambrian sediments in tunnel sections at the Vietas hydropower station in northern Sweden. M. W. Anderson analyses the structure and metamorphic grade in a series of tectonic windows through the Upper Allochthon in Troms, northern Norway. C. Townsend, A. H. N. Rice & A. Mackay describe the structure and stratigraphy of part of the Gaissa Thrust Belt and the Kalek Nappe Complex in Finnmark. R. A. Gayer & A. H. N. Rice describe the tectonic controls of pre- to syn-Iapetus rifting on sedimentary deposition in the Finnmark Caledonides.

The short section on *Igneous geology* contains papers by T. F. Emmett on the geochemistry and timing of emplacement of basic igneous rocks in part of the Jotun Nappe in SW Norway, by A. P. Boyle on the geochemistry and tectonic implications of the Sulitjelma ophiolite and associated basic volcanics, and by J. M. Leaver, M. C. Bennett & B. Robins on upper mantle derived ultramafic xenoliths from alkali olivine dykes in the Seiland province.

Part IV on *Metamorphic geology* contains an interesting mix of four papers spanning the range from low- (anchizone) to high-grade (eclogite facies) conditions. A. H. N. Rice, R. E. Bevins, D. Robinson & D. Roberts describe the low-grade metamorphic evolution in a large pelite sample suite from Finnmark. A. J. Barker reviews the tectonometamorphic evolution of Caledonian nappes from Tysfjord to Trømso and quantifies the peak metamorphic conditions. H. L. H. van Roermund documents two contrasting types of high-pressure ultramafic rocks in the Seve Nappe Complex, interpreted as partly retrograded sub-continental upper mantle material and prograde metamorphosed ophiolitic material, respectively. Finally, in this section I. Bryhni discusses the status and metamorphic history of supracrustal rocks in the Western Gneiss Region of SW Norway.

Parts V and VI on *Palaeontology and biostratigraphy* and *Devonian geology* are both restricted to single contributions. In the former, D. L. Bruton, D. A. T. Harper & J. E. Repetski describe the Cambro-Ordovican faunas of the Parautochthon and Lower Allochthon in S. Norway. Sediments and faunas in the thrust sheets indicate a diachronous influx of turbidite facies during the Arenig which may be related to early Caledonian deformation of high nappes to the west. The paper by A. Chauvet and M. Seranne makes an important contribution to the debate concerning the tectonic significance of the Devonian basins along the west coast of Norway, through demonstrating microtectonic evidence that major extensional shear detachment beneath these basins has controlled the syntectonic sedimentation.

Finally Part VII contains five papers on *East Greenland Caledonian Geology* with an emphasis of the late Proterozoic sedimentary record and its structural setting. The scene is set in the first paper by M. J. Hambrey which outlines the late Proterozoic sedimentary record of East Greenland. P. M. Herrington & I. J. Fairchild then discuss carbonate shelf and slope environments in pre-Vendian rocks of the Eleonare Bay Group and point to tectonic influences on slope instability. I. J. Fairchild draws comparisons between dolomitic, stromatolite-bearing, units with storm deposits in East Greenland and in the Scottish Dalradian. A. C. M. Moncrieff documents the Varangian tillite occurrences and discusses the implications for late Proterozoic palaeogeography. Finally, G. M. Manby & M. J. Hambrey discuss the structural setting of the late Proterozoic tillites and emphasize the importance of westward-directed Caledonian thrusting.

Overall the standard of presentation and editing in this volume is excellent but reflected in the high cost (£95) which is likely to confine sales to educational and professional institutions, and just a few individuals with major interests in the geology of northern Scandinavia and especially the Finnmark area.

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