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Book Reviews

The Grenville Province

Edited by J.M. Moore, A. Davidson and A.J. Baer
Geological Association of Canada
Special Paper 31
358 p., 1986; members $41.00, non-members $49.00, cloth

Reviewed by H.H. Helmstaedt
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Thanks to this magnificent volume, representing the latest on "the state of the Grenvillian art", the road to solving the "Grenville Problem" is clearer than ever. All doubts about the use of the terms "Grenville Supergroup", "Grenville Front", and "Grenvillian Orogeny" have been dispelled in this collection of 23 papers arising from a symposium on "New Perspectives on the Grenville Problem", held in May 1984 at the Annual Meeting of the Geological Association of Canada in London, Ontario.

Following an introduction by J.M. Moore, giving the historical perspective of geological studies in the Grenville Province, discussing the major developments of the last thirty years and reviewing the contributions to the present volume, the papers are arranged in 5 chapters covering facts (Regional aspects of Grenville geology (5 papers), The Grenville Front (3 papers), Geochronology (5 papers), Geophysics and Geochemistry (4 papers)) and fiction (Models, 5 papers) about the youngest orogenic belt of the Canadian Shield.

The five regional syntheses in the first chapter cover most of the Province, leaving some gaps only in the northern part of the Central Gneiss Belt and the southeastern part of the Eastern Grenville Province. As pointed out by Moore in the Introduction, a similar pattern has emerged along the entire Province. Relatively little affected, autochthonous rocks of the older provinces of the Shield, northwest of the Grenville Front, are in contact with an up to 150 km wide "parautochthonous" zone in which the rocks of the older provinces can still be recognized, although they have been strongly deformed and metamorphosed to higher-pressure mineral assemblages. To the southeast of the "parautochthonous" zone, the major part of the Province represents a broad zone of high-grade metamorphic "allochthonous" slices in which no clear counterparts of the rocks to the northwest can be recognized. Of particular interest are new interpretations of the high-grade gneisses in the southwestern part of the Province (by A. Davidson), viewing them as a segment of the lower crust thickened by northwest-directed stacking of large thrust slices along inclined ductile shear zones.

Definition and location of the Grenville Front are discussed in two papers. Both at the northeastern (Owen *et al.*) and southwestern ends (Davidson) of the Province, this front is now identified by mylonite zones marking the northwest limit of significant northwest-directed thrusting during the Grenvillian Orogeny (*ca.* 1100 Ma). All workers agree, however, that in detail a distinction between pre-Grenvillian and Grenvillian fabrics may be very difficult. In the area southwest of Sudbury, this structural definition places the Grenville Front (Davidson's front corresponds to that proposed by Lumbers, 1975) southeast of a suite of elongate mid-Proterozoic plutons (Killarney granitoid suite) and excludes these rocks from the Grenville Province. The third paper in the Grenville Front chapter (Hyodo *et al.*) shows that Grenvillian magnetic overprinting in Archean and Proterozic rocks did not extend for more than 2-3 km to the northwest of the front, in the Temagami area of Ontario.

The Geochronology chapter begins with a compilation of approximately 1460 radiometric age determinations reported in nearly 300 literature references between 1935 and May 1985 (Easton). Easton's remarkable effort, not only in compiling, but also in synthesizing, this highly diverse data set is a first for the Grenville, and his paper will be a must on the reading list of all present and future students of this Province. Three other papers in this chapter provide new U-Pb ages for rocks of the Eastern Grenville Province in Labrador (Thomas *et al.*), in the Central Gneiss Belt near Parry Sound, Ontario (van Breemen *et al.*), and in the southwestern part of the Central Metasedimentary Belt, near Bancroft, Ontario (Heamen *et al.*). An attempt in dating the age of mylonitization at the Grenville Front near Sudbury (La Tour and Fullagar) by the Rb-Sr method yielded "errorchron" dates of *ca.* 1600 Ma, *i.e.*, results which are in disagreement with field evidence that nearby Sudbury dykes were affected by the mylonite-forming event (Davidson's paper in the Grenville Front chapter).

The chapter on Geophysics and Geochemistry contains one geophysical paper (a short summary of the 1982 COCRUST seismic experiment across the western Grenville Front and the Ottawa-Bonnechere graben by Mereu *et al.*) and one geochemical paper (on metavolcanic rocks and dykes from the Central Metasedimentary Belt by Holm *et al.*). The other two papers deal with the petrology of sapphirine-bearing rocks (Herd *et al.*) and the only mineral-deposit-related topic of the book, the metallogenesis of uranium-thorium deposits in Peterborough County, Ontario (Haynes).

Papers on models discuss the Proterozoic evolution of the Grenville in eastern-central Labrador (Gower and Ryan), an intracratonic rift origin for the core zone of the Grenville Province (Woussen *et al.*), geosutures in the Grenville (Rondot), crustal thickening in the central Grenville Province (Martignole), and the comparative tectonics of the western Grenville and the western Himalaya (Windley). These papers show that traditional "Grenville problems" such as the geotectonic setting of the anorthosite intrusions, the origin of the rocks in the Central Metasedimentary Belt, and the tectonic assembly of the entire Province will be debated for some time and will provide the opportunity for plenty of work in the future.

Overall, the papers are well written, digest most of the old data, and provide plenty of new. The editors have succeeded in assembling a first-class volume that continues the high quality of the series of Special Papers published by the Geological Association of Canada. No student of the Grenville Province should be without this volume.

Paleopalynology

By Alfred Traverse
Unwin Hyman, Boston, Massachusetts
600 p., 1988; $75.00 US, cloth,
$34.95 US, paper

Reviewed by Martin J. Head
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The term paleopalynology has now come to mean the study of fossil plant spores and pollen, dinoflagellates, chitinozoans, acritarchs, scolecodonts and other assorted organic-walled microfossils; all are linked by their common resistance to hydrochloric/hydrofluoric acid digestion used during standard palynological treatment of rock or sediment samples. Traverse's book introduces the reader to all these microfossil groups (though not with equal coverage) and provides a most welcomed synthesis of the huge amount of data now available. *Paleopalynology* also reflects, through its very personal manner, the author's more than three decades of involvement with this young branch of science, including his dealings with fellow practitioners, and with his university teaching. Traverse writes with an easy-to-read and informal style, and he shares with the reader numerous interesting and often amusing anecdotes from his long career in palynology.

Despite its all-encompassing title, the main thrust of this book is directed toward the study of spores and pollen. A useful introduction to general aspects — including the history and philosophy of palynology, and the nature of sporopollenin (the substance that palynomorphs are made of) — is followed by detailed coverage of the morphology and biology of spores and pollen, in chapters two and three. The main body (11 chapters) of *Paleopalynology* is given to an account of the history of palynomorphs through time. Many geologic periods are given individual chapters and the reader is taken upward through the stratigraphic record, starting with the oldest palyniferous deposits in the Precambrian. Traverse necessarily has to digress as he encounters non-spore-pollen groups, for it is in these stratigraphic chapters that most of such groups are introduced. The morphologies of acritarchs, chitinozoans and scolecodonts are all thus briefly discussed in the "Precambrian, Cambrian and Ordovician" chapter, since this is where they make their debut in geologic time (acritarchs and scolcodonts, in fact, range to the present day). Moving into Devonian palynology, Traverse again digresses to discuss pollen *versus* spore morphology in the context of the evolving Paleozoic land plants, and this integrates nicely with the rest of the chapter. Range charts of useful Devonian and Lower Carboniferous spores are presented, but the Devonian spore ranges taken from Chaloner's 1967 paper are undoubtedly dated.

The Carboniferous-Permian chapter lucidly discusses Potonié's turmal system of supra-generic classification for spores and pollen, and provides an interesting discussion of the biological affinities of some of the spores discussed. I look in vain for a chart showing ranges of Upper Carboniferous spores. There are, however, some useful range charts given in the following chapter on Permo-Triassic spores and pollen.

Dinoflagellates do not become an important constituent of marine palynofloras until the Jurassic, and the morphology and biology of this group are briefly discussed under a chapter on Late "Mesophytic" "non-pollen" palynomorphs. It is unfortunate that dinoflagellates — a group of palynomorphs so important for biostratigraphy and paleoecology — are given rather superficial treatment in this, and successive, chapters. In contrast, the rise of the angiosperms, and establishment of Cretaceous palynofloral provinces are given detailed coverage with plenty of useful illustrations. Paleogene spores and pollen are dealt with next, and I was pleased to see not only a fair coverage of fungal spores (a group becoming increasingly useful for biostratigraphy), but also due homage paid to Bill Ilsik (Exxon Co., Houston), who, as Traverse recognizes, has been a prime mover in getting palynologists to look closely at this potentially useful group of palynomorphs. I was disappointed to see Wilfried Krutzsch (Berlin, GDR) receive little, if any, mention for the pioneering biostratigraphic work and prolific taxonomic studies carried out by him, during the late 1950s through to the early '70s, on Paleogene spores and pollens of Central Europe.

The Neogene *sensu stricto* is given part of one chapter and I was somewhat surprised to find the Pleistocene and Holocene included with it (today, the Neogene is normally taken to mean the Miocene and Pliocene only, with the Pleistocene and Holocene being assigned to the Quaternary). Traverse does give reasons for his approach (and, by way of an aside, I don't consider changes at the Pliocene/Pleistocene boundary to be nearly as geologically or climatically significant as those occurring within the later part of the Early Pleistocene.) Holocene interglacial palynology is given its own chapter, and plenty of pollen diagrams are shown and their interpretations given.

Traverse's book does not stop here. There are enlightening chapters on spores and pollen as sedimentary particles, on vegetational reconstructions, thermal maturation of palynomorphs (illustrated with a colour plate), paleoenvironmental interpretation using kerogen analysis, and an invaluable appendix on laboratory techniques. A very helpful glossary of terms occupies 30 pages near the end of the book.

In summary, *Paleopalynology* is, for the most part, a text book on theoretical and applied spore-pollen studies. It is more than a compilation of facts gleaned from the literature; almost every page contains valuable commentary and useful guidance to the student and professional alike. The integration of "non-spore-pollen group" morphology with the stratigraphic chapters worked well for me. Unfortunately, the text figures in this book are of uneven quality, and the photographic plates, despite being well reproduced, are often poorly composed with far too much wasted white space. This results in magnifications that are unnecessarily small so that important details of some illustrated specimens cannot be adequately seen. Sadly then, this book loses some of its practicability. Why is the front cover graced with a diseased tree-root (actually an uninspiring chitinozoan)? In the words of the TV ad, you only get one chance to make a first impression! Hopefully, the next edition will more appropriately figure a spore or pollen grain on the cover.

Who will buy this book? *Paleopalynology*, at 600 pages in length, with lots of quality both in information and explanation, and with its reasonable price tag, is too important a book not to buy. I recommend it for professionals, for graduate students and for those undergraduate students taking courses in spore-pollen palynology.

A View of the Sea. A Discussion between A Chief Engineer & An Oceanographer about the Machinery of the Ocean Circulation

By Henry Stommel
Princeton University Press, Princeton, NJ
165 p., 1987; $19.95 US, cloth

Reviewed by M.J.Keen
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Gustave-Gaspard Coriolis was pretty distinguished. He introduced the terms "work" and "kinetic energy" in their modern forms, he described the mathematics of the game of billiards, as did other classical physicists like Sommerfeld years later, and — following Laplace, perhaps, and Hadley of the Hadley cells — he made Newton's laws of motion work in the co-ordinates of a rotating sphere — our Earth. We celebrate the 200th anniversary of his birth in 1992 — that's a good year, the Geological Survey of Canada is 150 years old then too.

Coriolis rules all that moves on a rotating planet. Weather people know this. Air doesn't flow from a high to a low pressure region, but appears to turn to the right, clockwise around the high, anticlockwise around the low. Geologists know this — the banks of levées are higher on their right-hand side looking downstream, and this is on grand scale, too, in the turbidity-current channels of deep-sea fans and abyssal plains. Nansen noticed on his vessel *Fram* that ice drifts some 20° to 30° to the right of the wind, and so oceanographers have their Ekman spiral, because Ekman picked up the problem. Wind drives surface water forward, which moves to the right, and drags lower water forward, which moves to the right, and drags lower water forward, which ... and so the vectors of water velocity Ekman-spiral around to the right, decreasing in size with depth. Why do we have the oceanic gyres? And why are they assymetrical, with the Gulf Stream, the Kuroshio and the other intense surface currents on the western sides of the oceans?

A young Henry Stommel, with a B.A. from Yale and a rejection from the graduate school at Scripp's Institute of Oceanography behind him, realized in 1948 that a Coriolis force changing with latitude will lead to intense currents on the western sides of the oceans of both hemispheres. So simple — but the best till then had not thought this through. Geologists owe him a particular debt because he later predicted the existence of the deep western boundary currents transporting cold polar waters toward the equator, and these were then sought and found, using the — then revolutionary — neutrally buoyant "Swallow" floats in 1957.

The water in the middle of the oceanic gyres is surrounded and protected by currents. How can it escape? It has no place to go but down, and Stommel predicted that this escape would be in the form of a spiral, and observable in the geometry of density interfaces within the gyres. *View of the Sea* is an account of his search for this spiral, the rotation at depth of density interfaces and of the velocities which arise to balance horizontal pressure gradients and Coriolis forces. The circulation of the oceans is not yet well understood and the search for this spiral, the "beta-spiral" for the aficionados, is one of the avenues to understanding.

Stommel and the Ocean Gyres
(*View of the Sea*, p. 20)

"... In the equilibrium case, the lower the latitude the faster a particle is moving in absolute space. So if a particle of water wants to move toward the equator it must speed up. Unless there is some force that can accelerate it, it cannot speed up. Here is where the pressure anomaly comes to the rescue. As the eastward-moving particle turns toward the south ... it gets accelerated eastward (in absolute space) to keep up with the faster-moving (in absolute space) water there. We do not see that acceleration because we are observers moving with the earth itself. So the water seems to move southward on the eastern flank of the high pressure region. Then it turns westward ... and then turns northward, where the pressure gradient now conveniently decelerates it (in absolute space) so that it can join the eastward flow at higher latitude and complete the circuit. In this marvellous way water can be in equilibrium as it flows around an isolated pressure anomaly. And the pressure anomaly does not spread out. The same thing is true in the atmosphere; all weather maps show the circulation around atmospheric high and low pressure regions."

"The Chief says that he will need time to digest this stuff, and later they down their gin, and go in to supper, where: "As always, the food on Woods Hole vessels is good and the servings are ample"."

Stommel's life has been the sea, on it, or near it at home in Woods Hole, Massachusetts. He sailed with many ship's masters, and many bosuns, and many chief engineers, so that it is natural that Stommel describes his search for watery truth as an imaginary conversation with a sort of composite Chief Engineer, a man who knows engines well, and might look for a rather nuts-and-bolts, or boilers-and-fireboxes, approach to understanding the oceans. They are on the last of a series of cruises made between 1978 and 1981 in the eastern North Atlantic, away from the complexities of the Gulf Stream far to the west. The theory has been formulated — with his collaborators like Fritz Schott, and later Jim Luyten — and now data must be sought at sea. The observations are simple conceptually — we measure the electrical conductivity and temperature of seawater at known co-ordinates in time and space. Conductivity is a proxy for salinity, and the observations let us map seawater's density field. Simple in principle, but expensive conducting cable seven thousand metres long might break through careless winching, and calibrations must be right. Ships are dangerous places to work, with rotating machines and unholy motions, and accidents must be avoided. Stommel involves his Chief in all the phases of the investigations, from the early approaches to the survey area to the explorations of the consequences on personal computers when they get home. "Basic" programs for exploring Coriolis and the beta-spiral are listed in the book, and disks are available to the reader from a bookstore in Falmouth, Massachusetts. I didn't have the disks, but I will type in the programs from the book. They should be fun.

The Chief Engineer saw the programs running in July of 1985 or 1986, a year or two after Stommel had bought his first PC and so freed himself from the tyranny of mainframes. The Chief's "working model" would be cast in iron or brass, and perhaps hiss and rumble. The idea of a silent program as a model for exploring the ocean at home is rather novel, but he couldn't resist taking the paper output home. Does the Chief work — does he help our understanding? Well, the idea is rather exploratory counterpoint, with the bugs not worked out. Early musical counterpoint was rather primitive — a second vocal or instrumental line would be added to a section of plain chant and would move in step with it, and only centuries later did counterpoint reach successful heights of great complexity. A simpler Chief, a Chief more useful to many readers as Stommel's foil, would have asked questions like: "What do all these words mean? what is beta? or the beta-plane?" Next time please, Dr. Stommel.

Stommel's interests are wide. French-speaking Canadians won't be surprised with his observation "Can this be a confusion...?" when, in his book *Lost Islands*, he tells us of the title of the British Admiralty Chart 7484 "A Chart of the Indian Ocean, Improved from the chart of M. *d'Après* de Mannevillette ... ." He and his wife Elizabeth have told the story in book and article of the disastrous eruption of the volcano Tambora in 1815, which cooled

the world with its stratospheric aerosols, and the summer of 1816 became for farmers in Cape Breton, Nova Scotia, and vintners in Bordeaux the dreadful summer that never was.

Henry Stommel's colleague Arnold Arons wrote of him on his sixtieth birthday: "With consummate artistry he constructs a model having just the right idealizations to make it tractable and just the right physical content to make it illuminating; then with the simplest mathematical methods he extracts the deep and significant physical insights that hitherto had not been attained." *A View of the Sea* itself illuminates Arons' praise. The cruises were successful: " ... we were the first to establish that there really is a clockwise rotation of the density slopes with depth in a northern hemisphere subtropical oceanic gyre. We were able to get an estimate of how steady this configuration is in time. ... Our beta-cruise data have enabled us to do the diagnostic studies of real data and to demonstrate that the ... rules actually do, to a measurable degree, apply in mid-ocean."

A View of the Sea is not light reading — you have to want to know about the oceans if you are to gain. Ken Hsü's *The Mediterranean was a Desert* is also published by Princeton, and it too tells us how science really works — of the unexpected success which waits for the observant, and of the extended vision which successful ideas provide. It's a little easier to read than Stommel's. *A View of the Sea* complements a book like Peter Medawar's *Advice to a Young Scientist*, but demands more. I wonder if Stommel wrote the book for his friends, or if he had a wider audience in his mind? Surely all students of the sea are friends of Henry Stommel's, and so he wrote it for all of us. *A View of the Sea* is marvellous as an introduction to the work of one of the world's best oceanographers, and I am glad I have read it, a lesson in good experimental work in the real physical world.

Henry Stommel started his career with the fundamental problem of asymmetry of ocean currents. Forty years later, he has tackled the fundamental problem of finding absolute water velocities from density data — the oceanographer's problem of the "level of no motion," the level at which they assume no motion so they can calculate velocities in the layers above. Reading the book and reading around the book is a lesson in awful ignorance — a lesson telling us how little we still really know of the workings of this world, and how much we have to learn if we are to manage the planet as a system. Henry Stommel's fictitious Chief Engineer died. How will our real race make out?

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Handbook of the Canadian Rockies: geology, plants, animals, history and recreation from Waterton Glacier to the Yukon

By Ben Gadd
Corax Press, Box 1557, Jasper, Alberta
876 p., 1986; $25.00, paper

Reviewed by Elizabeth Turner
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Having had the unqualified joy of using this book in the field, confining my enthusiastic ravings to a readable format is quite a task. It is hard to know where to begin describing this book; it is even more difficult to convey just what a feat its creation represents. As the author himself writes, "Someone had to write this book". It took a naturalist with passion and vast experience to come up with a veritable encyclopedia of the Rockies.

The book is sturdily bound and copiously illustrated with both photographs and line drawings. It combines, into one compact and entertaining volume, every possible field guide, a detailed geologic history, hiking, climbing and skiing guides, mountain safety and emergency advice, climatological information, and practical commentary (my favourite: a philosophical, and occasionally useful, foray into three ways to respond to disgruntled bears). Carrying it in the field, rarely a day went by that it did not get used to explain some baffling phenomenon. Using this book in the field enriches one's awareness and understanding in an immediate and cumulative way. Not once did this book fail to include and elucidate the obscure or the obvious: it is a challenge to find something missing. Moreover, this book and its author have become the standard authority on just about all Rocky Mountain phenomena, not to mention an inexhaustible source of trivia with which to amuse and perplex one's snowbound tentmates. "Ben's book" becomes your most valued possession in the mountains; it is known to everyone.

Priority is given to the exhaustive geologic descriptions and diagrams which satisfy the curiosity of both amateur and professional. Diagrams of mountain views common from the highway illustrate the formations and structures exposed. Each section of the book is abundantly referenced, though for the most part *Handbook to the Canadian Rockies* makes them all but obsolete.

This book is ideal for throwing in your pack as you prepare for a stint in the wilderness. It makes great reading at night, and answers all those questions you wondered about all day long. On the other hand, to the escapist who rarely or never gets out in the mountains, this book makes lovely recreational reading. The author evokes in a sympathetic, chatty, yet somehow still scientific fashion an otherwise complex and overwhelming environment.

Oil Notes

By Rick Bass
Collin, London
172 p., 1989; £11.95, paper

Reviewed by William A.S. Sarjeant
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Normally, after reading a book for a review, one finds oneself in a clear-cut frame of mind and quite ready to write about it. The book was enjoyable, informative, interesting; the book was accurate, or flawed, or profoundly inaccurate; the writing style was good, mediocre, or downright bad; the proof-checking was excellent, generally good, generally poor; the illustration was splendid, adequate or unsatisfactory; the typography and format were attractive, marred by imperfections, or awful; and the title and cover design were well conceived, indifferently conceived, or tiresomely unsuitable. Mentally, one can go through such lists of alternative reactions and, without any difficulty, circle the ones that apply.

Not so, I find, with this book. Oh yes, there are a few clear-cut decisions I can make. The proof-checking, for example, was excellent. This is not a book stressing factual information, but I have no quarrel with such facts as are presented. As to the typography and illustration, both are quite attractive.

So far, so good; but, after that, uncertainty begins. The title, now; yes, in a sense it is accurate, for the text *is* more or less in note form; but doesn't it sound rather too much like a teaching aid for first-year undergraduates in petroleum geology or engineering? Then, the cover design; yes, quite an attractive photograph, but why so small and why of such a subject? Is it the author's Montana ranch, maybe? — I don't know, but there is no obvious *oil* relevance. As for the layout of the text; well, yes, generous and spacious, if one views it that way; but is it not as over-ample as a beer-belly on an aging engineer? (Quite one-fifth of the pages in the book must be blank). Yet I have the uneasy feeling that the emptinesses are, by intent, meaningful...

Well, now, what about the writing style? Here again, I find myself hesitating. Basically I'm a traditionalist in my expectations from a writer. Someone who does his best to avoid semicolons, who uses commas minimally, and who (in many passages, though not in all) fires words and short sentences at you like a Capone gunman aiming a Sten-gun at a competitor, is just about as unwelcome to me as he would be to that gunman's victim. Nor is a habit of beginning sentences with "Plus", "Which", "And" and "But" a stylistic trait likely to endear any writer to me.

Well, Rick Bass is an American and usages are permissible in current American literature that would have guaranteed failure in any English School Certificate examination. Consequently, though one might find the above traits hard to accept, one should, no doubt, strive to conquer one's prejudices and try to keep smiling through. Indeed, at times these staccato passages *do* attain an immediacy that more conventional texts might not (even though, conversely, such passages deter any re-reading).

Mr. Bass is also an oil geologist, with a delight in his craft that must charm any reader with like concerns. Indeed, his love for his task of finding oil is the principal theme of his book, along with his expression of a general delight in wildlife and the outdoors and the *leitmotiv* of his passionate love for artist Elizabeth. In writing a review for this journal, I must consider those latter concerns irrelevant; but Mr. Bass' overbrimming excitement in geology *is* very relevant. For example, let us take his attempt to explain the pleasure of finding oil (p. 5, 6):

> It is one of the few things in the world that is not governed by paradox. It's an art, the crudest of the sciences there is, perhaps. It's even called an "earth science" — mud, dirt, rock, greasy oil, smelly gas; but except for an occasional tilted water table, it usually, hell, almost always — plays by the rules. None of this *i*-before-*e*-except-after-*c* business, or anything like that. It's consistent, and you can count on it, and in general a sturdy kind of man or woman does it. You live or die by your own lights. The rules always stay the same, though.
>
> It's an adrenaline [*sic*] rush, tracking that oil, curling the contours on the maps you draw up and down and around subtle structures, pausing, thinking there may be an anticline below section 36, but then merely nosing, dipping and going on over into the next township. SP character, depth of invasion, fault traces, gravity data amplitude anomalies, wavelets, slickenslides, an old farmer who swears his water well burns a flare — all these things and about a thousand wonderful more go through your slow old human brain as your thick old human hand continues to drift, gripping a number HB pencil, across your map. Oh yeah, sure, that part's fun, that's the native drink and sunrise part for sure, too.
>
> But when you move the rig in and rig up and drill down and strike the oil ... there is no letdown.

We learn of other enthusiasms; for example, the unusual enjoyment he gains from well-logging (p. 302) and his curious passion for "classic" Coca Cola (p. 110). We learn also of his dislikes — that the use of the word "scenario" in describing oil prospects (p. 88) automatically evokes distrust and that a strong antipathy is aroused in him by any employment of coal as an energy source (p. 19-20). This is indeed a very personal text — revealing, certainly, and that may be good; but sometimes very close to navel-gazing (*e.g.*, p. 95, 107), and that is *not* so good. (Yes, those ambiguous reactions again!)

There are passages (*e.g.*, p. 143, 151) in which I can read and understand each word and each sentence, but am left wondering what point is being made. Other passages, however, explain so lucidly the task of a geologist that one could usefully quote them to second-year geology majors: examples are the description of the technique and value of coring (p. 96-98) and the crisp explanation of the term "wild-cat" (p. 16-17). There are yet other passages that cause an appreciative smile; for example, on p. 135:

> Occasionally, you will meet a geologist with an ego, who acts as if every lift of his eyebrows should be chronicled in a little black book. A *leader* — in a profession of men and women who cannot be led, and will not. They are in the wrong business, these salesmen of self. Do not suffer them. Ring their doorbells at night and then run. Cast them out. They make the earth and the oil that is down there in pockets and cracked fissures less warm. I like to think that when you are entering the freeway and your car hesitates, or when you shut your engine off and it clatters unexpectedly, this happens because the fuel harbors a few drops of oil found by one of the ego-geologists.

Yes, well, I find myself, at the end of writing this review, in the same uncertain frame of mind as when I embarked upon it. Did I like this book, on the whole? Not really. Did I like parts of it? Yes, very much. If you're involved at all in the search for oil, better read it yourself and see how *you* react to it!