influences health and evaluates social connection as a causal determinant of health.

An article that I feel would have an extended readership is that by Vela and colleagues entitled 'Eliminating explicit and implicit biases in health care: Evidence and research needs'. This article is based on the assumption that healthcare providers hold negative explicit and implicit biases against marginalized groups, which have an important impact on the patient–doctor relationship, in institutionalized healthcare practices. Bias is reflected in the practice of stereotyping individuals based on race or community among others, but may also be so ingrained so that it is automatic and without intention. As an educator in medical field, I wondered, as I read the article how much this issue permeates our own healthcare system and to what extent medical students are influenced in this regard during their training in medical colleges as part of the informal or 'hidden curriculum.'

I have highlighted only a few of the many articles in this edition of the *Annual Reviews*. As in earlier years the articles are grouped under certain broad categories which include Epidemiology and Biostatistics, Social Environment and Behaviour, Environmental and Occupational Health, Public Health Practice and Policy and Health Services. In this edition, I found the articles engaging both in breadth and depth. Despite the ongoing COVID pandemic, it was nice to see a much broader coverage of public health issues. The inclusion of historical perspectives in several articles appealed to my own interest in the history of medicine, but they also speak of the need of addressing current health problems through an understanding of past events. Many articles have succinct summaries and also highlight 'knowledge gaps' – these are welcome components for students. It was gratifying to see qualitative research highlighted in several of the articles as also broader social-ecological frameworks. I have always looked forward to reading the new editions of the *Annual Review of Public Health* – the current edition left me self-reflective and satisfied.

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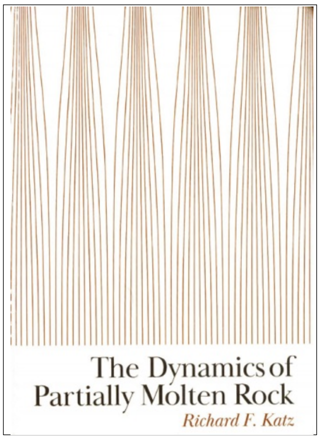

The Dynamics of Partially Molten Rock. Richard F. Katz. Princeton University Press, Princeton, New Jersey 08540. 2022. xxii + 341 pages. Price: US$ 75.00/£ 62.00. ISBN: 9780691176567.

Magmatism is a fundamental process of chemical and thermal evolution of the Earth and other planets. Partial melting of mantle peridotite is a typical situation in Earth's asthenosphere, the source of the prolific magmatism along mid-ocean ridges. Our knowledge of the asthenosphere derives from many disciplines and approaches. The asthenosphere was recognized as a geophysical low-velocity zone beneath the lithosphere based on seismological data, and geophysical techniques have greatly expanded and improved since. Petrologists and geochemists learn about the composition, dynamics, and evolutionary history of the asthenosphere by mineralogical and geochemical (including isotopic) studies of ocean-floor rocks, whether sampled *in situ* or exposed on land in ophiolites. Given that the Earth's upper mantle including the asthenosphere is a fluid on long time scales, and characterized by slow convection, yet another approach to understanding the asthenosphere is that of fluid dynamics. All these approaches are complementary; the ideal situation would be one in which specialists in one discipline or approach would understand the methods, results, uncertainties and potential pitfalls of other approaches.

This is a geologist's review of the book by Richard Katz, Professor of Geodynamics at Oxford University. The book deals with fluid dynamics, mechanics and rheology of the asthenosphere, coupled with petrological thermodynamics, geochemical transport and numerical modelling. A fundamental theme of the book is the nature and behaviour of liquid-crystal aggregates in the asthenosphere, in which a basaltic partial melt of mantle peridotite exists within pores of the unmolten residual peridotite (often harzburgite, and after high-degree melting, dunite). Parameters such as shear viscosity and permeability of this two-phase system, aided by stresses arising from plate tectonics, govern the segregation of basaltic liquid from residual peridotite, leading to large-scale magmatism at the mid-ocean ridges.

A range of fascinating research questions are addressed in the book. For example, how does magma move through the asthenosphere and adjust to varying physico-chemical conditions as it moves? What mechanical parameters govern the rate of buoyancy-driven melt transport? Is melt transport simply and purely vertical, and what forces and processes drive *lateral* melt transport? How does melt transport occur at the boundary between the asthenosphere (where porous flow dominates) and the lithosphere (where brittle fracture is required)? How do modal lithological variations in mantle rocks, implying varying degrees of mantle fusibility or fertility (i.e. basalt content), affect melting and melt transport? Under what conditions do crustal flow (creep) and melt-rock reaction increase or decrease permeability and thus melt transport? And how are these variations in mantle lithology, fusibility and the melt extraction processes reflected in the magmas erupted, say at mid-ocean ridges?

As mentioned by the author the book grew from a series of lecture notes, and covers the above topics in 15 chapters, each of which contains problems and exercises at the end. The chapters are: (1) Introduction. (2) A condensed history of magma/mantle dynamics. (3) A review of one-phase mantle dynamics. (4) Conservation of mass and momentum. (5) Material properties. (6) Compaction and its inherent length scale. (7) Porosity-band emergence under deformation. (8) Conservation of energy. (9) Conservation of chemical species-mass. (10) Petrological thermodynamics of liquid and solid phases. (11) Melting column models. (12) Reactive flow and the emergence of melt channels. (13) Tectonic-scale models and modelling tools. (14) Numerical modelling of two-phase flow. (15) Solutions to exercises. The last chapter is followed by a Bibliography and an Index. The book is necessarily highly mathematical, but while readers proficient in mathematics will enjoy it and benefit from it the most, others not so could still learn much from it. The author notes that the theory presented in the book is a continuum theory, on a volume scale much larger than the mineral grain-scale or microscopic scale, but complications arising from the latter are recognized.

The principles discussed in the book primarily address magmatism at the mid-ocean ridges, but are also applicable to other tectonic environments on Earth and other planets. In fact, the author points out that the physics and rheology of polycrystalline aggregates of basaltic melts and unmolten residual peridotite are comparable to those of other natural systems in which partial melting occurs, such as temperate glaciers and ice sheets that contain aggregates of meltwater and ice crystals. Indeed, there is a useful (if inaccurate) comparison to be made between Japanese-Hawaiian *shave ice* (the Indian *ice golas*) and partially molten mantle rock, notwithstanding the obvious differences between the two systems (such as in temperature, composition, and the fact that liquid water is denser than ice).

I could not find a description or caption for the cover design of the book, but as informed by the author (pers. commun., 2022), it relates to reactive flow (chapter 12) and represents the streamlines of magma as they rise buoyantly and converge into channels, under the reactive infiltration instability. The figures in the book (most of which are numerical solutions or model curves) are neatly done and printed. However, the individual panels in several figures (e.g. 10.1 to 10.4) are somewhat small and it would be preferable to have them printed at larger size. Given the key subject theme of the book, namely melt-crystal aggregates (essentially basalt and olivine in the asthenosphere), it would have been nice if the book included photomicrographs in colour or backscattered electron images of real mantle (or crustal) rocks that represent such melt-crystal aggregates. Trapped interstitial melts are common in intrusions (e.g. gabbros with interstitial granophyres) and in lava flows (e.g. tholeiitic basalts with interstitial rhyolitic glasses), and in laboratory experimental charges (e.g. quenched glasses in partially molten peridotite). Also common are rocks in which originally trapped melts segregated and were transported away by brittle fracture, reflected in veining in the host rock at outcrop, hand specimen or petrographic thin section scales. Then there are the rock bodies within which migrating melts are supposed to have reacted with their host rock, both changing in chemical and mineralogical composition as a result. Dunite 'channels' in harzburgites of the Oman ophiolite and their significance for reactive flow and melt-rock interaction are a classic example mentioned in the book, but no photographs are included. A couple of good field photographs of these important and easily accessible rocks in the Muscat harbour would have been an excellent inclusion in the book. For geologist readers, and even more so non-geologist readers, the field photographs, photomicrographs and BSE images would have provided valuable *real-world* examples and applications of the phenomena and theoretical principles described in this book. These will hopefully be included in a future edition, and will make it much more visually appealing than the current one, which is rather 'dry' with almost every figure a model curve or numerical simulation.

I found a few errors of oversight in the book, for example, in Table 9.1 the decay constants have units of year instead of reciprocal year. In Table 10.2, the given chemical formula of fayalite olivine is the same as that of forsterite olivine. There is an error showing apparent confusion on p. 140, where a sentence reads: 'Volatile species such as water and carbon typically have concentrations on the order of 100 ppm (by mass) in the asthenosphere (10^{-6}%)…'. Given that 1 weight percent is 10,000 ppm, the quantity within the brackets should be 0.01 wt%.

The bibliography provided at the end of the book contains more than 300 references. However, the referencing is very incomplete and uneven. A great number of cited journal papers have the authors, title, journal name and volume numbers, but no page numbers. For journals that do not use page numbers but a DOI instead, no DOI is often provided. A book citation on p. 324 lacks not only page number but even publisher's name. Terms such as 'East Pacific Rise', 'Enceladus', or 'Skaergaard' all lack capitalization of the first letters (p. 328, 329, 333). Adjacent references at the end of p. 330 alternatively capitalize and do not capitalize the initial letters in the book titles whereas journal paper titles on p. 331–335 do use capital letters unlike all others. 'Petrogenesis' is misspelt as 'Petrologensis' on p. 336.

As regards the book's physical attributes, it is neatly printed. The font size, I think is a little small, especially for elderly readers. The book is very reasonably priced.

This book provides much helpful scientific material to specialists and non-specialists alike to improve their understanding of the geodynamics of the asthenosphere, Earth's dominant magma factory that currently supplies a 60,000 kilometer-long network of mid-ocean ridges. It would be of considerable use even to readers who are not well-versed in the author's field of research, but are interested in learning the relevant arguments. Notwithstanding the relatively minor issues mentioned above, which should be easy to address in a future edition of the book, I recommend this book to professors, researchers and research students in various solid-earth science disciplines.

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