When I was asked to review this book, the Editor made it clear that this is no geophysical equivalent to the Richard Scarry’s ‘Cars, Trucks, and Things that Go’ I remember from childhood. This is, indeed, a serious in-depth work, written specifically for the exploration geologist practitioner. The hard-backed book weighs in at 454 pages, organized into six chapters covering the major geophysical methods applied to exploration geology in a logical and consistent way. Each chapter is valuable as a stand-alone contribution, and is focused around introduction to the principles of the relevant method, survey design, and a strong emphasis on how fundamental rock properties and survey design affect interpretation.

For the interested reader, the provided content also goes deeper, with electronic appendices describing a range of further geophysical techniques less commonly used by the mining industry (including magnetometric and magnetotelluric methods, radar- and radio-frequency electromagnetic methods and the seismic refraction method), explaining the basic terminology and characteristics of vectors and waves, and presenting a summary of sources of information for mining geophysics - particularly case studies.

The book is nicely illustrated throughout with high-resolution colour images, and the sponsors of the work should be applauded for their role in supporting these high production values.

Potential field methods

Chapter 3 on gravity and magnetic methods is probably the key section for most exploration geologists. The chapter nicely outlines survey design and objectives, including practical tips on noise, merging, gridding, and enhancement techniques. This chapter is very thorough, especially in regards to survey design.

The effectiveness of this section is enhanced when taken together with the earlier discussion on heuristics and forward modeling. The former in particular represents an illuminating, or perhaps disturbing, section for those who like to believe structural interpretation isn’t subjective – while in the latter, the authors tackle the important subject of data inversion – perhaps the first moment in the book that you may be reminded of the classic Gary Larson cartoon in which an overwhelmed student raises his hand and asks plaintively “Mr Osborne, may I be excused? My brain is full.”

Full or not though, this is a key discussion. From a personal perspective, I look at inversion models every day in my job, and in my experience, every one of those models is over-interpreted by geologists. The authors do a great job here of tackling that issue, explaining the non-uniqueness of models and the concept of plausibility, but I would have liked to see these ideas taken further using real case studies, including model and interpretation failures. This is an area in which geologists play a disproportionately large role in the interpretation relative to the uncertainties in the science.

Electrical and electromagnetic methods

Chapter 5 on electrical and electromagnetic methods is a monster. When I opened this up, I knew my Junior Geophysics scout badge was on the line. My initial reaction was that
holes for DHEM have been a strategic revelation in our business – and key to several Ni-Cu deposit discoveries – too many geologists still just drill holes and then add DHEM as a ‘save me please’ afterthought. Handling of this approach here represents a considerable step up from the toilet rolls that were first used to explain the technique to me, but I would have still liked to see this expanded further – in particular through the addition of strategies for using the technique.

Radiometrics
Radiometrics represents a crossover method from geophysics to geology – with geologists often doing the majority of the interpretation of radiometric data in practice.

I enjoyed the structure of this chapter as a one-stop shop for the theory, pitfalls, and design of surveys, paired with case studies of success and failure. Such development is a general – and highly effective – element of the book’s design – but from my geological perspective worked particularly well here – although I would again have liked to see more of this in action in areas such as mapping ultramafics, granoid zonation, or more variants of alteration.

Seismic
This is a small chapter, reflecting its relatively peripheral role in mineral exploration today. As with other chapters it provides just enough coverage of introductory concepts, and an overview of methods and visualization techniques. The compilation and illustration of seismic properties is outstanding and provides an immediately useful reference point. Much of the data is somewhat intuitive given the role density plays in acoustic impedance, but these compilations allow comparisons of minerals, rock types and alteration in one place – and in particular highlight the potential significance of substantial mineralisation. If you have ever wondered why imaging massive pentlandite-pyrrhotite-chalcopyrite sulfide in variably serpentinitized ultramafic on a basalt contact is a contrast (let alone technical) challenge, then Figure 6.35 is your starting point.

As has been noted at various points above, during my career to date I have had the opportunity to work with a number of patient and knowledgeable geophysicists. Many exploration geologists don’t get such opportunities any more, and one of the key contributions of this text is the redress of this modern experiential gap. Dentith and Mudge have written the book so exploration geologists can learn what they need to know, and perhaps more importantly what they need to ask, about geophysical techniques and interpretation, with the reader benefiting from the enormous collective experience and knowledge of the authors, digested into a series of clear practical do’s and don’ts. This is very much a practical book, written for the practicing exploration geologist.

As a general observation, I also particularly like the use of summaries at the end of sections and chapters, which allowed me to pull together the key take-home messages. If EM theory fries your brain, then at the end of the section you can pull it all back together through the summaries.

This is a beautifully illustrated text that covers geophysical data use all the way from introductory concepts through to visualization and interpretation pitfalls. Future exploration geologists must develop a more diverse skillset than traditionally seen – and in particular, as the exploration industry pushes further under cover, geophysical savvy will be critical. I see this book as essential reading for all exploration geologists, especially those who don’t have their ‘junior geophysics scout badge’.