BOOK REVIEW

PETROLOGY: PRINCIPLES AND PRACTICE by Gautam Sen (2014) Springer, 368p, \$89.99

Petrology, in all its three facets, constitutes one of the core subjects of the solid earth. The past decade has witnessed an unprecedented transformation in our understanding of petrological principles owing primarily to the giant strides made in analytical geochemistry and high-pressure experiments. Besides, a much stronger integration with geophysics has resulted in the 'finger printing' of the petrological processes a much more straightforward exercise than ever before. Gautam Sen, an petrologist, well-known for his contributions on the volcanism and mantle xenoliths in the Hawaii, the Columbia River basalts and the Deccan flood basalts, has provided a compact treatise for the sake of the new generation of under graduate earth science students.

'Petrology: Principles and practice' comprise sixteen chapters (twelve of them address igneous rocks and the rest concern sedimentary and metamorphic rocks) aided by two appendices. 'Introduction' (Chapter 1) initiates the reader to various facts about the earth and the theories of its origin, internal structure and the importance of an understanding of the theory of plate tectonics to proceed further. In Chapter 2 fundamentals concerning the types of magmas, their composition, varieties of igneous intrusions, classification schemes in vogue (modal as well as chemical) are provided. To appreciate the origin of igneous rocks a priori understanding of the conditions of melting and crystallization in mineral-melt systems involving a thermodynamic treatment is imperative. Chapters 3, 4 and 5 provide the reader with an overview of the simple (unary) and complex (ternary) systems and the effect of pressure and H₂O and CO₂ on them, mechanism and types of magmatic segregation. The immense utility of REE and various radiogenic isotope systems as tracers in identifying various mantle reservoirs is also addressed.

The great compositional diversity of magmas and the role of various processes such as differentiation, assimilation, mixing and mingling and immiscibility and the geochemical ways to distinguish them vis-a-vis major and trace elements are discussed in detail in Chapter 6. The magmatic evolution of well-known layered intrusions of Skaergaard and Bushveld has also been succinctly brought out as a separate section in this chapter. Basalts are everywhere and a plethora of experimental models have been built over the years on their plausible source rocks. The pressure-temperature constraints derived from such results are exclusively dealt in Chapter 7. Nature and characteristics of basalt magma generated at various Mid-oceanic Ridges and Hawaii 'hot spot' are discussed in Chapter 8. Large Igneous Provinces can occur in the continents and the oceans and at times some of them play an important role as well in the continental break-up. Various competing models for their genesis (plume versus non-plume versus involvement of eclogite) are discussed in Chapter 9 taking the well-studied Deccan and Columbia River Basalts as examples.

Subduction zones are considered to be 'our planet's largest recycling systems', not only constitute the loci of the earth quakes but also the major sites for bimodal volcanism (basalt-andesite-rhyolite). A number of such volcanic arcs e.g., Izu-Bonin-Mariana arc, Andean volcanic arc, Cascades volcanic arc are described and models involving the generation of arc magma are elegantly illustrated in Chapter 10. A section extensively dealing with 'granites' (some of which exclude subduction) has also been clubbed along with this Chapter 10. Kimberlites, carbonatites, alkaline and ultra-alkaline rocks in cratonic and continental rift settings are characterized by exotic mineralogy and unusual geochemistry and at times are also economically significant. Chapter 11 provides a comprehensive account of these rocks and their role in providing insights into the evolution of the sub-continental lithospheric mantle. Rare rock types such as komatiites and anorthosites (Archaean and Proterozoic) and models with regard to their confinement to a particular geological milieu are evaluated in Chapter 12.

Chapters 13 and 14 are concerned with the formation of sediments from pre-existing rocks, various types of sedimentary environments, textures and classification of sedimentary rocks. The last two chapters (15 and 16) deal with the processes involved in metamorphism, formation of metamorphic rocks, their textures, facies, reactions, P-T-t paths and the fundamentals of geothermometry and geobarometry.

To me the three most refreshingly striking aspects of this book are its (i) thrust on phase equilibrium controlled processes yet not deviating much from a classical approach, (ii) outstanding illustrations many of which are original, and (iii) incorporation and discussion of latest research works (80% of the references are post-2000!). Other plus points include (i) 'Boxes' in each chapter addressing aspects of wider interest, (ii) concise summary at the end of each chapter, and (iii) thought provoking exercises (together with their answers!) at the end of many chapters for practice. One area that could be better addressed in future additions of this book is the imbalance in the treatment of igneous, sedimentary and metamorphic rocks which is perhaps a reflection of the author's own predilection and specialization.

I am confident that 'Petrology: Principles and Practice' by Gautam Sen would immensely serve to enthuse this generation of young undergraduate and (even) graduate earth science students by way of elucidating the principles underlying the thermo-mechanical dynamics of the Earth and its role in generating such fascinating products called as *rocks*.

Dept. of Geology, CAS
Benares Hindu University,
Varanasi - 221005
E-mail: nvcr100@gmail.com

N.V. CHALAPATHI RAO