

## BOOK REVIEW

**MAGMATISM, TECTONISM AND MINERALIZATION.** Santosh Kumar (Editor).  
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Magmatism, Tectonism and Mineralization have long been discussed as three independent themes. The credit for linking them and bringing the trinity to a common venue goes to Prof. Santosh Kumar, who efficiently conducted a National Seminar embracing the three themes, at the Department of Geology, Kumaun University Nainital during 29-31<sup>st</sup> October 2007. The seminar was co-sponsored by South Asian Association of Economic Geologists (Indian Chapter).

This book under review is a well edited collection of twenty-five papers presented at the seminar and few invited ones. The first eight papers deal with magmatism highlighting petrography and comprehensive geochemistry to arrive at the petrogenesis and the tectonic regimes.

The section begins with the paper by T.C. Khanna et al. of NGRI on the Neo-Archaean 'Bonninites of Gadwal Greenstone belt of the Eastern Dharwar craton. They point out prominent geochemical differences between the Guntipalli and Garlapadu occurrences and ascribe them to two pulses of generation from a heterogeneous mantle.

The following five papers deal with granitoid magmatism from the Himalayan belts and the Aravalli-Delhi orogen.

- B.N.Singh and Santosh Kumar present a well-knit account of microgranular enclaves (ME) and the host, Abu granite massif. They observe that while Abu granites reflect both reduced and oxidized A-type characteristics the ME are solely of the oxidised A-type. Based on geochemistry they relate the complex to within-plate tectonic regime, and ascribe the diversity of ME to felsic-mafic magma mixing and mingling preceding a low degree of fractionation.
- C. S. Dubey, Igor Villa and N. P. Singh discuss in detail the petrography, geochemistry and geochronology of the K-rich alkali syenites of Sikkim Himalaya and marshal convincing evidences in favour of anorogenic, within-plate tectonic character and the genesis of syenites through melting of the Indian continental crust during Cretaceous (~ 90 Ma).
- Felsic igneous intrusives encountered in the Western Arunachal Himalaya range in age from Pre-Proterozoic to Tertiary. In a novel approach to differentiate the varied granitoid complexes, Santosh Kumar and Manjari Pathak

painstakingly attempted the application of Magnetic Susceptibility (MS) following Ishihara's works on five major granitoid units spread over Lesser and Higher Himalaya. They relate them to magnetite, ilmenite and magnetite-ilmenite transitional granite series. They also observe that magnetite-ilmenite contents and  $\text{Fe}_2\text{O}_3/\text{FeO}$  of the granites correlate well with the magnetic susceptibility values, which help to identify them as S-type and I-type.

- Based on geochemistry, Sheik A. Rashid and Naqeebul Islam find the Palaeoproterozoic Bomdila granitoids of Arunachal Pradesh as peraluminous (S-type) originated under syn-collisional tectonic conditions. They have also attempted geobarometry based on normative Qtz-Ab-Or values.
- A very exhaustive account of the granite magmatism along the southern margin of Eastern Karakoram, Ladakh has been presented by Hakim Rai and D. Rameshwar Rao. They report three major granite bodies viz., the Karakoram batholith, Morgo granite and granites within the AqTash volcanics. Their geochemical interpretation describes all the three units as peraluminous adamellites with a prominent calc-alkaline trend, volcanic-arc affinity and pre-plate collision tectonic setting.
- There are two noticeable papers on the Deccan Volcanic Province. In his comprehensive presentation on the Flood Basalts of the Deccan Volcanics, K.S. Misra discusses at great length his unique interpretation of the volcanic episode, based mostly on airphoto and satellite image interpretation. He cites effusive centres along west coast longitudinal and Narmada latitudinal fault zones. He simplifies the Deccan Trap sequence into lower felsic followed by middle simple and compound flows and an upper group of only compound flows. All his ideas have to be evaluated by the active up-coming volcanologists of India who are getting familiar with present day active volcanoes like the Barren island and Narcondam isles of Andaman, as well as other global occurrences. The author could have referred to earlier monumental contributions on this subject.
- M.V. Subbha Rao et al. of NGRI present an impressive geochemical account of the olivine-gabbro plugs of the Ambadongar complex of Deccan Volcanic Province, and

highlight the possible potential occurrence of Platinum Group of Elements in them. They relate the genetic source of the complex to mantle plume, based on Nb and Ta enrichment.

The following papers deliberate on the structure and tectonics of the crystalline complexes from different parts of the Himalaya, with a lone paper on the Bundelkhand massif.

- After a thorough structural and tectonics analysis Bhatt and Gupta have shown that there have been three stages of deformation with an early ductile phase followed by brittle shear in the Dinara-Garhman and Dinara-Barmer shear zones of the Bundelkhand granitoid massif. Photographs lack clarity.
- Bhaduriya, Bhattacharya and Sharma decipher syn-formal folding after the emplacement of the crystallines of Garhwal Lesser Himalaya at Nandprayag with excellent documentation.
- A similar exercise on the Goriganga valley crystalline exposures of Kumaun Himalaya by Patel and Kumar has brought out four phases of deformation, with a SW fold vergence dominated by shear sense. The illustrations are very good.
- Sharma, Nandy, Devi and Kanwar discuss in detail the tectonogenesis of the Mishmi Block resting as a roof over the two pillars of Eastern Arunachal Himalaya and Indo-Myanmar Mobile Belt. They demonstrate the similarity of Namchi Barva and Siang Syntaxial Antiforms with convincing evidences.
- Macro- and micro-structural elements of the large-scale ductile shear zones of the Main Central Thrust, Kumaun-Garhwal Himalaya have been examined by Bhattacharya. The author highlights their influence in ore-mineralization observed in the belt.
- Mondal and Devi define the environment of deposition of Barail and Surma sandstones as active and passive continental margins, using La-Th-Sc discriminant diagram. They suggest Himalayan felsic intrusives as the major source of clastics. The paper is a little out of place in this series.

The following papers deal with mineral genesis and geologic setting in different parts of the Himalaya and the Peninsula.

- R. Upadhyay reports very high U and Th values in the zircons of granite dykes along the Shyok suture zone and also Ladakh Batholith, suggesting detailed exploration.
- Joshi, Pant and Upadhyaya record similar geochemical

signatures in the dolomitic host rocks as well as the associated magnesite and talc deposits emphasising strata-bound genesis. They further suggest burial metamorphism and the role of algae in the genetic process. Photomicrographs are quite illustrative.

- Rajesh Sharma gives a detailed account of sulphide mineralization with predominant Cu in the Chamoli Formation, Pokhri area where the host rocks comprise metasediments, metavolcanics and mylonitic granite-porphry. Cu vs Ni distribution in pyrite indicates submarine exhalations in the sedimentary pile metamorphosed later under greenschist facies. Structural data confirm remobilization.
- Tiwari and Singh describe the epigenetic gold mineralization at Sona Pahari, U.P. The emplacement is along the shear zones irrespective of the composition of the host rocks. Fluid inclusion studies place the temperature of mineralization at 250°C-300°C.
- In an ideal state of the art article on the well known Malanjkhand Copper-Molybdenum deposit hosted in the Palaeoproterozoic granitoid complex in juxtaposition with the Central Indian Suture, Panigrahi, Dinesh Pandit and Naik cite the global occurrences of porphyry-Cu being confined to post-Mesozoic and brush out such a genesis for Malanjkhand. Based on geology, exhaustive geochemistry and fluid-inclusion studies, the authors suggest two phases of granitoids of which the latter subordinate leucogranites are considered as the major source of S and CO<sub>2</sub>-rich fluid to transport the metallic sulphides along the fracture zones filled by ore-bearing quartz reefs. This extremely well written paper is rightly dedicated to late Prof. Asoke Mookherjee, a doyen of ore petrology.
- S.K. Singh and Satyendra Singh discuss tungsten (wolframite) mineralization in the volatile rich S-type, Post-Erinpura Balda granite, Sirohi. The granite is considered as a geochemically specialized metallogenic type.
- Faruque Hussain, Dwivedi and Mondal report chalcopyrite depletion and Ni-Cu-PGE enrichment in the contaminated dolerite and metadolerite dykes of Bastar craton.
- The occurrence of ultramafic peridotite complex riddled with podiform chromitites has been studied by Krishnakanta Singh who reports higher concentration of Platinum Group of Elements in the chromitite pods.

The following two papers come under a special category:

- Rai and Singh summarise a theoretical framework on mathematical physics to quantify heat and mass transfer

of magma generated and tectonically controlled mineralising fluids in the crustal region up to 15-20 km depths, considering the crust as porous medium.

- Advances in geochemical analytical techniques and their applications in different geological disciplines such as mineral exploration, petrogenesis, geochronology and environmental sciences, has been succinctly presented by Balaram. The article forms a sort of mini guide on the latest analytical tools available today in our country.

The book on the whole is a worthy compilation of well-researched articles on Magmatism, Tectonism and Mineralization. The get-up, printing and binding are good. The book would certainly be welcomed by researches in the academic and professional fields.

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