**Magmatism in India through Time.** Hetu C. Sheth and Kanchan Pande (Guest Editors). *Proceedings of the Indian Academy of Sciences* (*Earth and Planetary Sciences*), vol. 113, December 2004. pp. 517–838 (Free online access at www.ias.ac.in/epsci/contdec2004.html)

This special issue of *Proceedings of the Indian Academy of Sciences* (*Earth and Planetary Sciences*) entitled *Magmatism in India through Time* contains twenty-two research papers dealing with geochemistry, origin, and emplacement of intrusive and extrusive igneous rocks of India from early Archaean up to the present day. The papers are thematically arranged. The first thirteen papers focus on geochemistry and petrogenesis, the 14th and 15th on geochronology, the 16th and 17th on geophysics, the 18th and 19th on structural and regional geology, and the 20th to 22nd on physical volcanology.

The papers on geochemistry and petrogenesis address rocks broadly in the following two categories: (i) basaltic and evolved extrusives as well as associated dykes from different stratigraphic horizons; (ii) granitic and charnockitic bodies intruding the Precambrians. There are ten papers under the first category and three under the second.

On extrusives and dykes, L. Melluso, M. Barbieri and L. Beccaluva report the most mafic types of Deccan lavas of the Western Ghats (Mumbai–Nasik) grading into more evolved ones towards the central region (Dhule–Aurangabad). They notice a distinct low-Ti affinity of the Dhule flows, Kathiawar lavas and the Tapti dykes, thus allowing chemical correlation. J. S. Ray and P. N. Shukla, based on trace element modelling, propose a model for derivation of the Amba Dongar carbonatites by mutual immiscibility of carbonatite and coeval alkaline silicate magma separated from a mantle-produced phonolitic primary magma. R. K. Srivastava *et al.* describe high-Ti basalts from the ophiolite suite of South Andaman and point out their similarity to N-MORB. M. A. Alam *et al.* discuss the major and trace element variations in prehistoric lavas and a lone basaltic dyke from Barren Island volcano. They highlight the similarity of these lavas to the low-K volcanics of Sunda arc, Indonesia. Nepheline-normative mafic alkaline lavas occur both on the continents and on the ocean islands. Based on extensive published chemical data and high-pressure experimental petrological studies, S. Keshav and G. Gudfinnsson demonstrate that partial melting of carbonated lherzolite alone can generate these lavas. R. K. Srivastava and A. K. Sinha discuss geochemistry and petrogenesis of the subalkaline basaltic–andesitic dykes intrusive into the Archaean gnesisses of Shillong Plateau. The geochemical characteristics of the dykes are considered to have been emplaced during early Cretaceous time. In their paper on the Kundal volcano-plutonic complex belonging to the Malani suite of igneous rocks, A. K. Singh and G. Vallinayagam consider the basaltic flows and associated gabbroic bodies as derived from the melting of komatiitic amphibolites and emplaced in an anorogenic environment. Trace and REE geochemistry and Sr–Nd–O isotope systematics of ultramafic dykes of the Newer Dolerites swarm have been exhaustively dealt with by A. Roy *et al.* These dykes have apparently intruded the Singhbhum granites around 2613 Ma, i.e. late Archaean time. Nd isotopic values indicate source heterogeneity, best explained by mantle metasomatism caused by fluids from subducted crust. According to N. Chatterjee and S. Bhattacharji, the Hf zoning and Y and REE compositions of zircons and monazites from the Deccan felsic dykes of Rajula (Gujarat) strongly suggest anatectic felsic melts as the immediate parent, though a few crystals bear resemblance to those of the crust proper. An interesting paper by S. Sensarma *et al.* addresses the mineralogy and bulk major and minor element chemistry of the anorthoclase-bearing Bijli rhyolites belonging to the Precambrian volcano-sedimentary Dongargarh Group. Despite certain geochemical evidences in favour of mantle involvement, overall in-depth assessment suggests fractional crystallization of crustal partial melts. Oxygen isotope data strongly favour the role of crust–mantle interaction in the formation of both Bijli rhyolite and the associated Pitepani mafic volcanics.

Regarding plutonic bodies, S. Bhattacharya *et al.* comment on the geochemistry and genesis of five granitic stocks around Bhuban (Orissa), situated between the Singhbhum craton and the Eastern Ghats mobile belt. Considering the normal chemical and mineralogical variations encountered in such Precambrian granitoids, all the five stocks could have been considered as a single unit for discussion on petrogenesis. The authors propose anatexis and dehydration melting of enclaves from adjacent belts for granitogeny and relate it to a major craton–mobile belt collision. M. F. Hussain *et al.* portray the geochemical signatures of gneisses and granite plutons from the Bundelkhand and Bastar cratons. The gneisses are rightly considered as precursors of the granitoid intrusives. At a time when the term charnockite itself is on the verge of being deleted from petrological nomenclature on the consensus presumption that the so-called charnockites are all hypersthene-bearing granulites and are truly metamorphic, H. M. Rajesh and M. Santosh have boldly come forward to establish the magmatic identity and character of the charnockites on the lines of high Ba–Sr granitoids. They present a wholesome multi-element geochemical and petrogenic account of the charnockite massifs of the South Indian granulite terrain, such as the Biligirirangan, Shevaroy, Pallavaram, Cardamom Hill and Nagercoil. Extensive geochemical exercises and comparisons with experimental petrological data form the basis of the authors' interpretation of charnockitic magmatism.

There are two papers on geochronology. R. Bhutani *et al.* report $^{40}Ar$–$^{39}Ar$ thermochronology for the Ladakh region in the India–Asia collision zone. The pleateau ages of granodiorites and their constituent micas place the partial melting of the batholith at 46 Ma, with late-stage emplacement extending to 29 Ma. Two basalt samples from the suture zone indicate that the post-collision tectonothermal event lasted for 8 million years. K. Pande *et al.* provide the first $^{40}Ar$–$^{39}Ar$ age of 66.4 ± 0.9 Ma for a Giravali Ghat lava flow from the top of the reversely magnetized Bhimashankar Formation of the Western Ghats Deccan Traps.

On geophysical studies, two papers deal with the gravity models over the Rajmahal Traps and also the Deccan Traps proper. Using Bouguer anomaly distribution over the Rajmahal Trap region and applying a priori east–west DSS profile information, A. P. Singh *et al.* create a 2D gravity model to show a highly warped-up Moho at a depth of 26 km from the surface. They also come up with a 3D density model which shows 10–15 km thick high-density mafic magmatic underplate. S. Bhattacharji *et al.* present 2D as well as 3D gravity models of areas over the western continental margin and the Narmada–Tapti rift – the two major linear

tectonic segments that have influenced the Deccan eruptions. The 3D gravity model postulates large N–S-trending, ellipsoidal, gabbroic cupolas beneath the west coast margin and smaller, scattered, ovoid mafix bodies below the Narmada–Tapti rift. These subjacent masses are estimated to occur at a depth of 6.5–7 km in both the study areas.

Under the theme of structural and regional geology there are two papers. T. K. Biswal *et al.* present interesting meso- and microstructures of a nepheline syenite pluton occurring along a shear zone of the Eastern Ghats mobile belt. The plethora of structural data exemplify 'coupling' or absolute concordance of the intrusive fabric with that of the host rocks, thus indicating syntectonic emplacement. Foliation layers of this syenite body at places exhibit plunging folds of class-2 geometry. SC fabric suggests NW sense of shear. Age data place the thrusting of the shear zone at around 1.5 Ga. K. K. Sharma discusses the geology of Sindreth region (Rajasthan) to understand the three phases of Malani igneous activity – predominantly rhyolitic flows associated with minor basaltic flows, granitic intrusives and felsic–mafic dykes. The author discusses tectonic evolution in some detail and traces the volcanic activity to Rodinia splitting and Neoproterozoic anorogenic magmatism.

Under the theme of physical volcanology there are three interesting papers which mainly deal with the field features of lava flows. Newer structures are being recognized through intense field studies, which are becoming sparse these days. N. Bondre *et al.* bring out the macro- and meso-morphology of Deccan basalt flows and the Columbia River basalts, and cite many differences between the two. They emphasize the importance of gathering more field data in both provinces to understand the mechanisms of extrusion and emplacement. Duraiswami *et al.* describe the Deccan flows of Daund, 300 km SE of Mumbai, where they have unearthed an eroded lava tube extending for nearly 300 m. The wall of the tube is layered and shows distinct textural and structural features. The authors conclude that the Daund lavas had low effusion rates and the tubes and tumuli originated due to the gradient and microtopography characterizing the region not far away from a probable feeder vent. The final paper throws light on the so-far missed or mistakenly identified circular cones and craters occurring over the Deccan basalt terrain. H. C. Sheth *et al.* report the occurrence of shallow cones with craters on the uppermost mafic flow below the rhyolite summit of Mount Pavagadh, Gujarat. They consider these as rootless cones like those encountered in Iceland. The random distribution of craters, the undeformed and overlapping nature and a host of other features are cited in favour of a phreatomagmatic or hydrovolcanic process. The authors envisage a mechanism by which a feeder lava tube, when entering a waterlogged environment, would lead to rootless eruptions.

This special issue is not just a collection, but a meticulous selection of valuable research papers reflecting current trends in investigation of volcanism and magmatism in India. The efforts of authors and reviewers deserve appreciation. Of course, the Guest Editors, Hetu Sheth and Kanchan Pande, and the Indian Academy of Sciences, have to be congratulated for bringing out such a precious volume. This special issue is only the first volume on this exciting subject and we hope that more such books would follow suit, covering more magmatic provinces, kindreds and epochs.

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# MEETINGS/SYMPOSIA/SEMINARS

**International Conference on Mesoscale Processes in Atmosphere, Ocean and Environmental Systems**

Date: 14–17 February 2006
Place: Delhi

Topics include: Monsoon variability and predictability; Regional climate change; Advanced observational systems and data assimilation; Natural hazards and coastal zone management; Urban pollution, etc.

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**Annual Convention and Meeting on Earth system Processes related to Earthquakes, Tsunamis and Volcanic Eruptions**

Date: 7–9 December 2005
Place: Bhopal

Themes include: Solid earth geophysics; Atmosphere, space and planetary sciences; Marine geosciences; Theoretical and experimental geophysics; Environmental geophysics; Exploration geophysics, etc.

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