BOOK REVIEW


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S.N. Sarkar’s classic work in the late 1950s with the proposal of the Dongargarh system with bimodal andesite – rhyolite (granite), the presence of fluorspar mineralization at Chandidongri and ancient copper workings of Malanjkhand led AMD’s late P.K. Ghosh (formerly with GSI), to conduct the first generation airborne surveys (total gamma from U, Th and K) for uranium in central India (1958-59). Ground follow up of anomalies led to the discovery of numerous uranium shows in sheared rhyolites around Parsori, Baghnadi and Jungalpur. AMD revisited the areas during the early 1970s so as to have uranium resources outside Singhbhumi. These efforts led to significant discoveries of uranium in Palaeoproterozoic metavolcanics and metarhyolites at Bodal and Bhandaritola (1973-74) and Mesoproterozoic sandstones and conglomerates at Mogar (early 1980s). The Dongargarh uranium province in central India was thus well established. The workshop and the special volume that ensued on DKB under review represents AMD’s continued interest to seek a larger knowledge base for new discoveries. The special volume includes a collection of seventeen (17) papers and two (2) short communications (11 on geology and 8 on mineralization) that were presented at the National Workshop titled above held during June 21-22, 2012 at Nagpur organized by the Atomic Minerals Directorate and the Gondwana Geological Society, Nagpur. The N-S to NNE-SSW trending Neoarchean-Palaeoproterozoic DKB (c. 150 km x 90 km) forms the NW part of the Bastar craton and is bordered by the Sakoli belt to the west and the Sauras belt and the CIS to its north, and the Chhatisgarh basin to the east. It hosts the world class Malanjkhand Cu-Au-Mo deposit in the north, two proven, minor shear-controlled uranium deposits in the middle besides numerous shows of U, Au, Cu, Pb, and fluorite and holds promise for possible Ni-Cu-PGE resources. The special volume is thus a welcome addition to the geological data base for this critical belt of the Bastar craton.

Ramachandran and Roy in the lead article (pp.1-16), provide an overview of the evolutionary characteristics of the Bastar craton and ascribe DKB as a major intracratonic rift belt developed during late Archean- Palaeoproterozoic times that modified the thick early Archean TTG through bimodal granite-basalt evolution. They elucidate further (pp.17-24) the development and implications of the intrusive Dongargarh and Malanjkhand granites of DKB in the evolution of the Bastar craton. Asthana and others (pp. 25-40) based on geochemistry including REE inferred that the Dongargarh granites show features akin to A-type with rapakivi structures and have been derived from extreme fractionation of the Ptiepani picritic basalts, which in turn had been derived from a mantle source akin to N-MORB. Inferences on Palaeotectonic regimes based on Rb vs. Y+Yb and Ta+Yb indicate a within-plate to volcanic-arc regime for their evolution. Sensarma and Mukhopadhyay (pp.41-48) based on detailed (c. 450 km2 on 1:25,000) geological mapping of the Salekasa-Darekasa-Bijepur-Bortalo area propose a revision of the status of Bortalo Formation and of the unconformity between the Nandgaon and Khairagargh groups and also suggest that the Dongargarh Supergroup be redesignated as Dongargarh Group. Sikka and Nehru (pp.49-81) provide a comprehensive review of the regional geology, geochronology and mineralization of the giant, world-class Cu, Mo, Au, Ag porphyry deposit associated with the Palaeoproterozoic Malanjkhand pluton. Based on the synthesis of all available data, they propose the use of standardized nomenclature to alleviate problems of correlation and seeking additional geochronological data, especially on samples of Kurse-Korhi rhyolites north of Bodal. They further suggest that samples even from one area should be analyzed separately and combined with others only after a careful scrutiny. They also plead for the use of Th/U ratio besides magnetic susceptibility in mapping various types of granitoids and other rock types. Nehru and Sikka (pp.83-108) provide for the first time a detailed account of the field, mineralogical (with EMP analyses of minerals) and geochemical data on the dykes and dyke swarms (mainly N-S trending with subvertical dips observed in borehole sections) besides minor ones (trending NW-SE, NE-SW, E-W with ramifications) that occur in the pits from the mine area. The dykes are pre-Chilpi in age since none of them intrude the Chilpies. Except for the gabbroic types which are fresh, all are metamorphosed to varying degree. K-metasomatism, is however, pervasive and affects all the dykes including the gabbroic ones. An interesting aspect is the presence of high-Mn bearing ilmenites in the metadolerite dykes which are indicator minerals of diamondiferous kimberlite pipes. A tholeiitic basaltic parentage has been ascribed for the dykes except for the gabbroic rocks which seem to indicate a more primitive parent, probably picritic.

Pal of Hindustan Copper Ltd., (pp.109-118) provides a comprehensive review of the Malanjkhand Cu-Mo-Au deposit with an estimated resource of 470 MT of copper ore averaging 0.9% Cu with a 0.2% cut-off along with significant Au (0.14g/t), Ag (3.5 g/t) and Mo (0.025%). The different views of numerous workers on its origin and a summary of available age data on the deposit are also provided. The calc-alkaline, I-type characters of the Malanjkhand granite and the Re-Os data on its molybdenites has led to the conclusion that the Cu-Mo-Au-Ag deposit belongs
to a Palaeoproterozoic (2490-2450 Ma) subduction setting that formed at the intersection of the N-S Dongargarh-Kotri belt and the ENE-WSW trending central Indian tectonic zone. Sashidharan and Shareef (pp.119-129), based on petrography, mineralogy, geochemistry and discriminant diagrams classify the Malanjkhand and Darbari granites as calc-alkaline, meta-aluminous with A-type (A1) characters with post-orogenic, syn-collision attributes.

Sridhar and others (pp.131-142) provide an overview of the airborne geophysical surveys for mineral explorations that were conducted by AMD in the DKB. Aeromagnetic, regional gravity and remote sensing data facilitated in mapping lithostructural settings for mineral exploration including uranium. Parihar (pp.143-152) provides a review of the different types of uranium mineralisations that were discovered so far in the DKB (e.g., Bodal, Bhandaritola, Mogarra and others). Considering the geological and tectonic evolution of the DKB as a intra-cratonic rift with A-type granitoids, the Khairagarh basin has been identified for seeking possible Proterozoic unconformity-related, IOB type and sandstone type mineralization. Krishnamurthy (pp.153-158), based on existing ore genetic and ore-control models of Bodal and Bhandaritola uranium deposits has re-emphasized an exploration strategy that seeks to combine conducive stratigraphy, lithology and geochemistry (Bijili rhyolite-Pitepani basalt hybridized and sheared contact zones intruded by quartz veins) to seek surface and sub-surface ore zones. Integration of a variety of tools such as remote sensing, geophysical and geochemical (lithology and soil) surveys have been proposed. Roy and others (pp.159-165) propose that the Kotri-Dongargarh rift belt has several geological and tectonic features that are favourable for hosting iron-oxide breccia complex (IOBC) type deposits that carry U, Cu, Au, Ba and REE in phreatic-environments over A-type granitoids as well as in the case of world class Olympic Dam deposit in South Australia. They have demonstrated that the ferruginous material of quartz- conglomerates that occur along regional shears and fractures contain UO₂ (0.01-0.048%) with minor to trace amounts of P, Cu, Ni, Cr, Zn, Pb, REE and Y. Such features provide impetus to seek IOBC type deposits in this belt. Chaturvedi and others (pp.167-174) provide an overview of the Mesoproterozoic sandstone-conglomerate hosted uranium mineralization at Mogarra in the Khairagargh basin (within Bortalo sandstones in the northern part of DKB) and the Bogan –Waler river areas in the Abhujmarh basin (within Gundul sandstones and conglomerates in the southern end of DKB). Sinha and others (pp.175-180) based on surface and sub-surface geological data from the N-S trending Kuntedtora- Bhandaritola-Kunwardalli sector (c.9 km x 4 km) infer that the basalt-rhyolite alternations apparent in the sequence is mainly due to folding although the tongues, lenses and patches of metarhyolites in metabasalts are intrinsic to the lithounits and provide a conducive host lithology for uranium mineralization. Sinha and others (pp.181-196) evaluate the nature of uranium ore bodies at Bodal and Bhandaritola using data obtained through geophysical methods such as gravity, magnetic, IP and resistivity surveys. Such an exercise has led them to suggest exploratory drilling targets for hidden sulphides and U in this belt. Tirupathi and others (pp.197-202) describe the Neoarchean-Palaeoproterozoic, quartz pebble conglomerate, palaeo-placer, U-mineralisation at the base of the Bailadila Group from Goutumura area on the eastern margins of DKB. Presence of detrital, mafic-fine shaped uraninite along with thorite, thorianite, anatase, monazite and zircon with authigenic braneriter, U-Ti complex and gummite have been identified. This discovery opens up a new horizon, below the BIFs for QPC type in the Bastar craton. Rai and others (pp.203-212), based on the geochemistry of metabasalts from Bodal and Bhandaritola areas and inferences on tectonic settings using Pearce’s discriminant diagrams, have inferred that the basaltic volcanism was initially continental tholeiitic, bimodal rhyolite-basalt-basaltic andesite (Nandgaon Group) and later developed into a continental-margin, island arc type with basaltic andesite and andesite (Khairagarh Group). Joydip Mukhopadhyay and others (pp.213-214), based on 206Pb/238U SHRIMP age (2725±7 Ma) of detrital zircon from basal arenites of the Bailadila Group and zircon age from the Bijili rhyolites (2450 Ma) in the Kotri belt, infer that the BIFs of Bastar are comparable to the oldest Superior type shelf BIF succession of the Hamersley Supergroup of Western Australia and the Transvaal Supergroup, South Africa. Such comparisons implying hydrothermal origins for the BIFs raises the hopes for deep seated hidden ore bodies in the Bailadila belt. Asthana and others (pp. 215-218) pose the question as to which of the models, either the intra-cratonic rift or an Andean-type continental margin fit the evolution of DKB and seek a re-evaluation of the crustal models of Basta craton.

Except for a few illustrations in some papers that lack clarity, apparently traceable to authors constraints, the editors must be complimented for their persistent efforts in bringing out the proceedings in a nicely produced, bound volume which otherwise, as in most cases of workshops and seminars, would remain as abstract volumes. The special volume thus provides an easy access to a wealth of new data on the DKB and Bastar craton, would benefit basic researchers on evolution of cratons and mobile belts the world over besides prospectors and exploration geologists from government agencies and private companies seeking new resource bases for the fast-depleting, non-renewable mineral resources.

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