

NOTES

SEDIMENTOLOGY AND MOLYBDENUM POTENTIAL OF THE BEAUFORT GROUP IN THE MAIN KAROO BASIN, SOUTH AFRICA

The Geological Society of South Africa has brought out a memoir recently on the Sedimentology and Molybdenum potential of the Beaufort Group in the Main Karoo Basin, South Africa by D.I. Cole and P.E. Wipplinger, (Mem. no.80, Geol. Soc. South Africa, 280, Pretoria Street, Silverton, Pretoria; 2001; 225p.) This note attempts to summarise the salient aspects of this memoir for the benefit of our readership.

Molybdenum, due to its superior metallurgical properties like high melting point, low coefficient of thermal expansion, malleability, ductility, good electrical and thermal conductivity, high strength at elevated temperatures and resistance to attack by many acids, water-dissolved alkalies and liquid metals, is a strategic refractory and alloying metal with many industrial applications. Since South Africa is totally dependant on imports for its molybdenum requirement, a project was initiated in 1980's to investigate the potential of local sources of Mo, and the present memoir is the outcome of this project. The volume contains six major chapters, viz., Geology (14 pages), Techniques and Data Capture (7), Sedimentology and Depositional Environments (70), Mineralogy and Petrography (26), Statistical Analysis of Data (15), Metallogenesis (9) and Molybdenum Potential (4), besides the abstract, introduction, economic viability, concluding remarks (each 1 page) and references (10).

The project started with a scrutiny of the records of Mo occurrences in South Africa, which indicated that the sandstone-hosted uranium occurrences of the Beaufort Group in the southern Karoo basin (early Permian) constitute the most favourable exploration target. The investigation was divided into two parts viz., an initial reconnaissance study for delineating regional target areas and a subsequent detailed study of these target areas. The reconnaissance study covered the entire Beaufort Group, with sampling and analysis of rock and stream sediment samples by a portable XRF, which led to the identification of two target areas in the western parts of the Karoo basin. During this study it was found that the provenance (the Cape Fold Belt) and stratigraphy are important factors affecting the distribution of U-Mo mineralisation. The detailed study was therefore focused on these parameters which led to the identification of fluvial sandstones as host for both U and Mo, with their source being intermittently

exposed basement granitoids, in the provenance occurring to the SW, S-SE and W-NW of the basin, besides a minor volcanic source for U. The sandstone bodies were deposited by both ephemeral sheet floods in straight to braided channels and by perennial channels in meandering channels, with interbedded flood-basin and lacustrine mudrock being more abundant than sandstone. The entire Lower Beaufort Group, including the mineralized sandstone was deposited in a semi-arid, warm climate on an alluvial-plain that is comparable to the Indo-Gangetic plain of northern India.

The Mo (U) mineralisation was recognized in two types of sandstones, viz., clast-supported, laminated sandstone and matrix-supported, carbonate-cemented sandstone, with both containing reductants of organic matter and sulphides (pyrite, arsenopyrite, bornite, covellite, löllingite and chalcopyrite). The Mo mineralisation is mainly in the form of molybdenite flakes whereas the uranium mineralisation is mainly as coffinite and uraninite in addition to a host of secondary uranium minerals like abernathyite, arsenuranylite, autunite, meta-autunite, metakahlerite, metatorbernite, novacekite, betauranophane, urnophane, carnotite, iriginite etc. Metallogenesis occurred shortly after deposition of sand bodies, with slightly oxidized metal-rock solutions migrating through both the flood basin muds and fluvial sands and precipitation in local parts of the sand body where a reductant was encountered. The laminated sandstone hosts bulk of the Mo (av. 800 ppm), U (av. 1280 ppm), As (av. 320 ppm) and is concentrated in the basal few metres of the sand body in horizontally bedded sandstone, where reducing conditions are most intense. Carbonate-cemented mineralisation is present in both the basal position with lower grade of Mo (500 ppm) and in the middle of sandstone bodies where less reducing conditions resulted in the low grade of Mo (100 ppm). Palaeowater-table played a critical role in the metallogenesis by preserving both the organic reductant and ore in the basal, water-logged portion of the sandstone. The semi-arid, warm climate ensured relatively low water table, and mineralisation is preserved within the thicker sandstone bodies, where the lower portions could persist below the water table. Of the different members of the Beaufort Group, the Poortjie Member has the best combined Mo-U potential, followed by the Moordenaars Member, with U being the principal commodity. Other members having lower Mo-U

potential are the Barberskrans, Nieuwefontein, Loxton, Davidskolk, Oukloof and Hoedemaker. Of these deposits, six are large with > 3 million tonnes (MT) of ore and the rest contain between 0.5 and 1 MT of ore. Although these would have been marginally exploitable during the 1980's, the current low prices of these metals, together with substantial rise in capital and operating costs, mitigate against any development in short to medium term.

The volume contains numerous well drawn line-drawings of maps, sections and chemical plots, and a few high contrast field photographs and ore textures. It includes four appendices that present data on U-Mo concentrations at reconnaissance sites, location of different sites investigated in the regional target area and their lithostratigraphy, results of XRF-based extensive geochemical analyses (U, Mo, As, Cu, V, Co, Pb, Zn, Ni, Zr, Th, Rb, Sr, Y, Nb and

Ba in ppm) on 980 samples and references for palaeocurrent data, besides an index of 26 pages. It gives a step by step account of the entire gamut of exploration for sandstone-hosted Mo-(U) mineralisation. The authors as well as the Council for Geoscience - Geological Survey of South Africa are to be complimented for the present publication that is of interest to all exploration geologists in general, and those working for Mo and U in particular. The memoir is available in the library of the Geological Society of India for reference purposes.

*Atomic Minerals Directorate for
Exploration and Research,
Department of Atomic Energy,
Hyderabad - 500 016*

R. DHANA RAJU

REPORT ON THE INTERNATIONAL SYMPOSIUM ON "ASSEMBLY AND BREAKUP OF RODINIA AND GONDWANA AND GROWTH OF ASIA", HELD AT OSAKA CITY UNIVERSITY, JAPAN

The international symposium on the "Assembly and Breakup of Rodinia and Gondwana and Growth of Asia" was held at Osaka City University, Japan from 26th October to 30 October 2001. The symposium was organized under the aegis of UNESCO-IUGS-IGCP projects 386/411/440, International Association for Gondwana Research (IAGR) and Osaka City University (OCU). Three hundred participants covering thirty two countries attended the symposium. The symposium was divided into following thematic sessions:

- Gondwana and Rodinia assembly and breakup (IGCP 368, 440, 418).
- Orogenic processes and growth of Asia (IGCP 411, 420).
- Island arc process and continental growth.
- Basin development and in relation to Rodinia-Gondwana-Asia tectonics (IGCP 4199).
- Metamorphic and magmatic process in relation to Rodinia-Gondwana-Asia tectonics.
- Mineralisation and mineral resources in relation to Rodinia-Gondwana-Asia tectonics.
- Global environment changes in relation to Rodinia-Gondwana-Asia tectonics.
- Quaternary stratigraphy of Asia and pacific region (INQUA).

- Environment, natural disaster and urban geology of Gondwana countries.

Earth system science is witnessing revolutionary changes in understanding the dynamic correlation among lithosphere, hydrosphere and biosphere through the recent advances made in tracing the history of supercontinents, their amalgamation, evolution and dispersion. The assembly, disruption and reassembly of supercontinental configurations can be traced from Rodinia (existed at 1.0 Ga) and its rifting during Neoproterozoic resulted in the formation of Gondwana at 0.55 Ga. Tectonic forces of rifting and assembly of continents between 1.0 and 0.55 Ga caused marked changes in the conditions of lithosphere, biosphere and hydrosphere. Rodinia was assembled through the dispersion of an older, Mesoproterozoic supercontinent. South East Asia represents a collage of Gondwana derived blocks, which travelled far. These jigsaw puzzles have controlled the distribution of earth resources, zones of natural hazards and global environmental changes among various other fundamental earth resources.

Several Indian earth scientists including Dr. S.K. Acharyya, D.G., GSI; Prof. S. Acharya, Ex-Vice Chancellor, Utkal University, Bhubaneswar; Prof. D. Mukhopadhyay, Kolkata; Prof. N.K. Mahalik, Orissa; Dr. T.K. Biswal, IIT