NOTES

TECTONIC SETTING OF THE MEGHALAYA PLATEAU AND IT'S SULPHIDE MINERALISATION*

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EXTENDED ABSTRACT

The Shillong-Mikir massif represents NE prolongation of the Chotanagpur Gneissic belt of the Indian Continent These consist of the basement complex made up of gneisses and migmatites with enclaves of amphibolites, rarely 'BIF' and patchy distribution of high grade granulitic supracrustals The basement rocks are unconformably overlain by siliciclasitc Proterozoic cover of the Shillong Group

The Shillong Groups of rocks, continue in a linear belt in a NE-SW direction for about 240 km, from Jadukata river section in the southern Meghalaya to north of Mikir hills in Central Assam The metasedimentary units (mica schist, quartzites, phyllites, slates etc) belonging to Shillong Group of rocks, in the Tyrsad-Mawphlang sector, have been involved in folding of four generations The earliest structures are very tight to isoclinal folding (F_1) on bedding plane (S_0) These folds have a high amplitude to wave length ratio, with a pervasive axial planar cleavage (S_1) They have been affected by coaxial, open to tight upright F_2 folds with axial plane striking NNE, with the development of crenulation cleavage (S_2) Both F_1 and F_2 folds provide evidence of buckling origin In the more schistose rocks, NE-trending open recumbent fold (F_3) affecting F_1 cleavage and F_2 axial planes represent structures of the third generation The latest structures are upright conjugate folds and kink bands (F_4) with axial plane striking NE, EW and chevron folds with NW striking axial planes The structure of the last generation, therefore, provide evidence of longitudinal shortening of the Shillong Group of rocks

Search for sulphide mineralisation within the Shillong Group spanned mostly around Tyrsad-Barapani belt — a 40 km stretch of the shear zone Detailed prospecting and drilling was carried out by GSI between 1974-1980 to study the basemetal potentiality, without encountering economically significant sulphide mineralisation Studies indicated that the sulphide mineralisation occurs as specks, disseminations, patches and stringers along the foliation, joints and fissures Pyrite being the dominant mineral with subordinate amounts of arsenopyite, pyrrhotite chalcopyrite, sphalerite and galena in the phyllites, carbonaceous slates of the Shillong Group

Recent discovery of lead-mineralisation associated with silver, occurs as bed-like or lens-like bodies of ores parallel to the compositional layering of the White Quartzites belonging to the Lower Shillong Group, around Mawmaram (4 km from the inferred Tyrsad-Barapani Shear Zone) The ore minerals are dominantly argentiferous galena with subordinate amounts of auriferous arsenopyrite, loellingite, gersdorffite, safflorite/rammelsbergite and varying amounts of chalcopyrite, sphalerite, pyrrhotite, pyrite covellite and cubanite The lead values show a maximum of 29%, while silver value show a maximum of 0 3% Gold values range from 50 to 260 ppb EPMA and EDX studies along with correlation matrix show partitioning of Ag with galena and Au with arsenopyrite, loellingite, gersdorffite and safflorite The occurrence of argentiferous galena along with Pb/(Pb+Zn) ratio of 0 93, monazite, zircon in the quartzites of the Lower Shillong Group are suggestive of a palaeo-geographic, stratigraphic and lithological control for the sulphide mineralisation A new genetic model is proposed akin to the Quartzite-hosted lead deposit modelling (Bjorlykke and Sangster, 1981) for the first time in India (specially N E India) A stable tectonic condition with prolonged weathering of the basement/pediment, leaching out Pb (±Ba) from the decomposing K-felspar, transport of the released metals by groundwater as bicarbonate complexes and hydroxides and deposition in continental-shallow marine condition is envisaged The basal quartzite being the transgressive sequence laid down over a sialic basement

The F_1 phase of folding is responsible for mobilisation of the pre-F_1 ores and distribution of the ores along the bedding planes and concentration near the hinge of the

Lecture delivered at the monthly meeting of the Geological Society of India at Bangalore on 29 September 2004 large scale F_1 fold — thus suggesting a strong structural control in localisation of the ore body The later deformations are superposed and refold the F_1 structure of the host rock as well as the ores and are responsible for the major undulation of the ore bodies, around Mawmaram Most of the ore minerals are crystalline and unzoned indicating that they have crystallised under equilibrium conditions Metamorphoism of the host rocks as well as arsenopyrite-loellingite-pyrrhotite/pyrite association indicates a biotite-grade of regional metamorphism

Three test-boreholes carried out, around Mawmaram, show that the mineralisation occurs in three levels — the first level occurs with/without ferruginised layer up to a depth of 20 m, with a maximum of 25% Pb for 1 6 m, the second level around 35 m, with a maximum of 12% Pb for 0 3 m, and a third level around 65 m, with a maximum of 2% Pb for 1 5 m These are corroborative with the bore-hole geophysical anomalies

Based on Rb-Sr whole rock isotopic age of 1150±26 Ma obtained on the leucocratic granite gneiss, Ghosh (1984) fixed the maximum age of the Shillong Group meta-sediments at 1150 Ma However, Pb-Pb age of the galena mineralisation, around Mawmaram, recently determined by Geological Survey of Canada on samples sent by the author, is 1530-1550 Ma This, therefore, indicates the age of the mineralisation and also fixes the maximum age of the Shillong Group metasediments ~1650-1700 Ma The isotopic date of 607 Ma (Chimote, 1988) of the Mylliem Granite, which are intrusive into the Shillong Group, indicates that the tectonic domain of the Shillong Group experienced thermal reactivation producing these younger granites which are anorogenic in nature There is evidence that both the basement and cover rocks are intruded by such anorogenic granite plutons and veins The granites have yielded Rb-Sr whole rock cluster ranging from 885-480 Ma (Ghosh, 1991, 1994), indicating a major thermal event of crustal addition during the above period

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RISK REDUCTION IN HYDROCARBON EXPLORATION – EMERGING TRENDS AND TOOLS*

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EXTENDED ABSTRACT

As long as hydrocarbons continue to control the global economic equation and power, there is always need to find more and more of these hydrocarbons The demand for hydrocarbons in south Asia including India is expected to increase at an annual growth rate of 4 to 5 % for oil and 6-7% for gas respectively

Whenever oil prices go up, exploration activity increases and the petroleum industry gears up for serious exploration

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