JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A NOTE ON AURIFEROUS MINERALIZATION IN PARASI AREA, RANCHI DISTRICT, JHARKHAND, INDIA

[1]Bijay Singh, [2]Sapna Xaxa
[1]Head of the department, [2]Ph.D. Research scholar

University Department of Geology, Ranchi University, Ranchi, Jharkhand, India.

Abstract: TheAuriferous mineralization occurs both in primary and placer/secondary forms with diverse litho stratigraphic and tectonic set up in Jharkhand. The Ranchi district, three-forth area is underlain by Chhotanagpur granite gneissic complex of pre-Cambrian age in the northern part and southern part of the area is covered by some part of North Singhbhum Mobile Belt (NSMB) of Palaeo to Meso-Proterozoic (1.0- 2.4 Ga). The gold mineralization is reported from different parts of NSMB along shear/ fracture zone within the meta-sedimentary and volcano-sedimentary rock sequence. The Palaeo-Mesoproterozoic gold occurrence is found in Parasi area, Ranchi district, Jharkhand.Gold occurs in the form of disseminations, specks, streaks, fracture, fillings etc. The phyllite and quartzite are host rock of the area. The Parasi gold mineralization is structurally controlled and shear zone has played a significant role and mostly in associated with sulfides such as arsenopyrite, pyrite and rarely pyrrohotite etc. The paper presents a note on auriferous mineralization of the Parasi area of NSMB.

Keywords: Auriferous mineralization, North Singhbhum Mobile Belt (NSMB), Parasi Gold Deposit (PGD).

INTRODUCTION

The Eastern Indian Shield (EIS) is the richest metallogenic province in the eastern part of India and it comprises of Archaean Singhbhum cratonic nucleus made up of different phases of Singhbhum Granite (SG), North Singhbhum Mobile Belt (NSMB), consisting of volcano-sedimentary sequence with Dalma Volcanic Belt (DVB) emplaced along its spine and the northern high grade mobile belt of Chhotanagpur Granite Gneissic Complex (CGGC).The NSMB is showing a composite history of sedimentation, magmatism, deformation and metamorphism activity. The gold mineralization is reported from different parts of NSMB along shear/ fracture zone within the meta-sedimentary and volcano-sedimentary rock sequence. GSI carried out exploration for gold from several years and established various gold mineralizations in the NSMB (Lahiri et al., 1974, Chakraborti et al., 1986; Chakrabarti, 192; Sharan et al., Sharan et al., 2004; kisku et al., 2006; Ranjan et al., 2013; Banerjee et al., 2014).The Palaeo-Mesoproterozoic gold occurrence is found in Parasi area, Ranchi district, Jharkhand (Ranjan et al., 2013). Gold occurs in the form of disseminations, specks, streaks, fracture, fillings etc. The detailed and comprehensive study of the area is throwing light on many aspects of the mineralization for the further exploration and better exploitation.

LOCATION AND ACCESSIBILITY

The Parasi gold deposit , Ranchi district, Jharkhand is situated at about 12km south of Tamar from where it can be reached by well connected metal road; from Ulidih on National Highway No. 33, the bifurcating road leads to the study area. Tamar block is located at a distance of about 55km from Ranchi. The nearest railway station is Ranchi (S.E.Rly), it has both the rail and airport stations. The Parasi area falls in the north of Sonapet anticline and covered between S.O.I. toposheet no. 73F/9 & 73E/12 (Fig. 1) and is bounded by latitude 22°58′30” - 23°02′00” north to longitude 85°42′00” - 85°45′00” east.

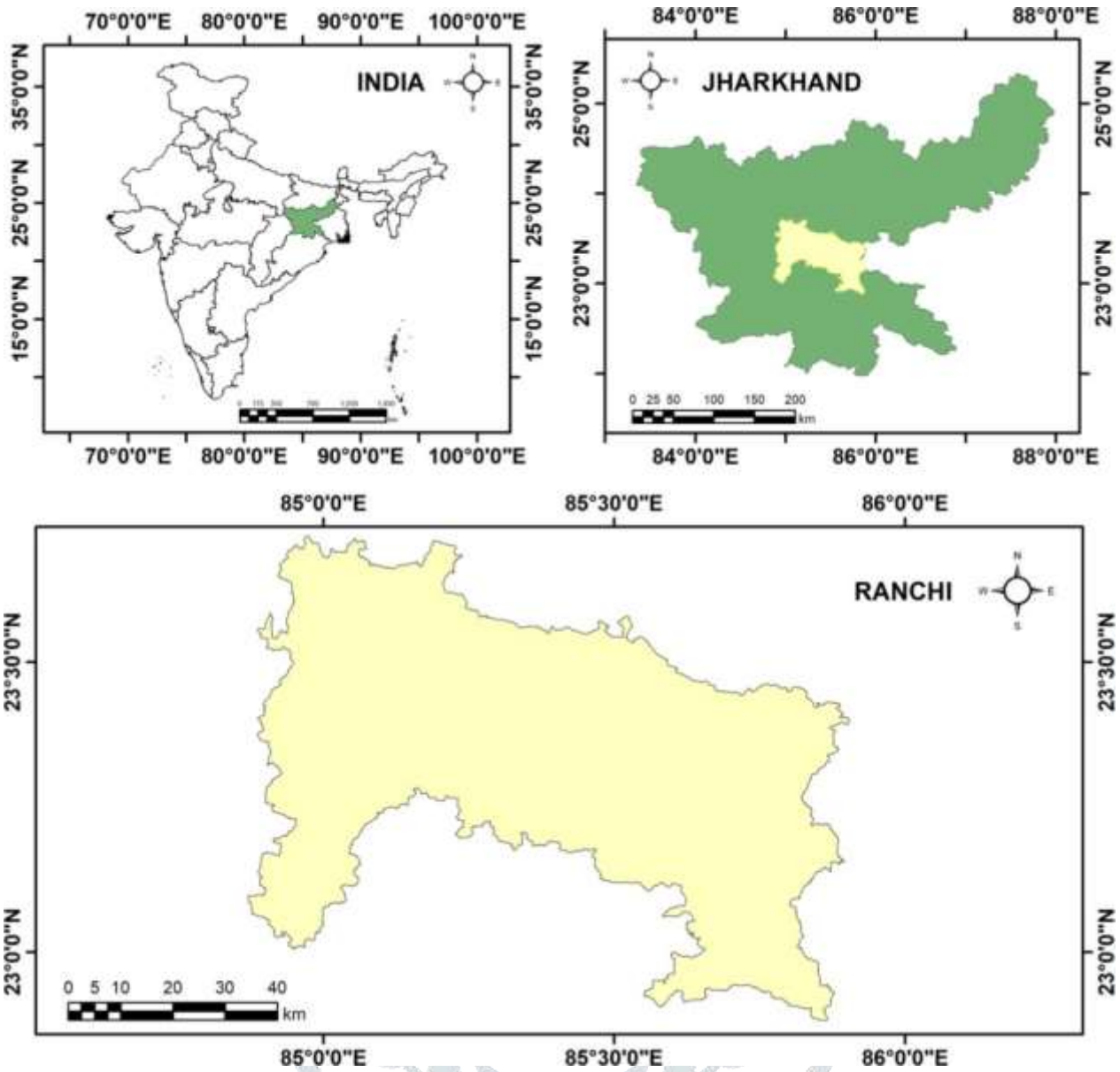

Fig. 1 Location map of the study area

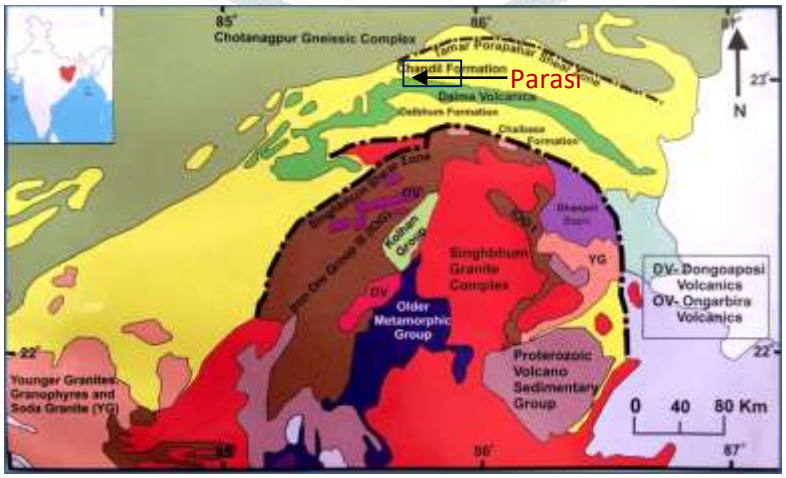

Fig. 2 Regional Geological map of the Singhbhum Crustal Province, eastern India (after Geological map of India, 7th Edition, 1998).

REGIONAL GEOLOGY

The North Singhbhum Mobile Belt (NSMB) is about 200km long and 50km wide curvilinear Proterozoic thrust-fold belt (Gupta, Basu & Ghosh, 1980; Mukhopadhyay, 1984; Sarkar, Gupta & Basu, 1992;). The Palaeo to Mesoproterozoic North Singhbhum Mobile Belt is deformed and metamorphosed volcano- sedimentary rocks between SC (Singhbhum Craton) in the south and CGGC (Chhotanagpur Granite Gneissic Complex) in the north (Gupta and Basu 2000; Bhattacharya and Mahapatra, 2008). The NSMB is trending E-W and it shows evidences of least three phases of tectonic deformation (Baidya, 2015). The region is traversed by two major shear zones, the southern shear zone is known as the SSZ and the northern shear zone is called SPSZ/TPSZ. Tamar Porapahar Shear Zone separates Chhotanagpur Granitic Gneissic Complex (CGGC) from NSMB and SSZ which separates the Singhbhum Granite Complex (SGC) from the NSMB (Mahadevan, 2002). The NSMB is divided as the five litho-tectonic domains, namely, Dhanjori, Chaibasa, Dhalbhum, Dalma and Chandil Formation from south to north(Gupta and Basu, 1991,2000; Acharyya, 2003a,b) (Fig. 2) and volcanism and sedimentation in a rapidly changing tectonic scenario(Mazumder, 2005; Eriksson et al., 1999, 2006; Mazumder et al., 2000, 2012 a, b).The Dhanjori Formation comprises low grade, metamorphosed siliciclastic sedimentary rocks interlayered with ultramafic to mafic and isolated felsic volcanic and volcaniclastic rocks(Gupta et al., 1985; Saha, 1994; Singh, 1998). The Chaibasa Formation consists of interbedded sandstones, shales, siltstone and mudstone with minor mafic volcanic rocks of Singhbhum shear zone (Bose et al., 1997). The Dhalbhum Formation basal part is represented by phyllite, quartzite and ferruginous shale and the upper part is consisting of tuffaceous rocks (Gupta et al., 1980, 1982). The Dalma Formation occur as an arcuate belt about 200km long and 3-7 km wide in E-W extension characterized by mafic – ultramafic volcanic rocks with lenses of mafic agglomerates and volumetrically minor quartzite (Dunn andDey, 1942; Gupta et al., 1980; Chakraborti 1980; Bose & Chakraborti, 1981; Bose, 1994; Singh 1997, 1998; Sengupta et al., 2000). The Chandil formation which comprises low to medium grade Metasedimentary and metavolcanic rocks between the Dalma range in the north CGGC in the south (Dunn and Dey, 1942). The study area consists of Singhbhum Group of rocks, CGGC and Dalma Group of volcanic rocks.

GEOLOGY OF THE AREA

The Parasi Gold Deposit (PGD) falls in the northern part of Sonapet anticline. The study area is enclosed by Chhotanagpur Granite Gneissic Complex (CGGC) in the north and Dalma volcanic Belt (DVB) in the south. Major rock types occur in the area includes magnetite-biotite-quartz-sericite schist, ferruginous quartzite, tuffaceous quartzose phyllite with intercalated schistose quartzite, carbon phyllite, rhyolite, acid tuff, tremolite-actinolite bearing ultramafic and amphibolite and vein quartz and quartz/carbonate veins, which are mostly trending from NE- SW to WNW- ESE with steep dip varies from 75° to 90° on either side. Major part of the area is covered by thick soil except few isolated outcrops of most resistant rock. Magnetite-biotite-quartz-sericite schist forms the dominant litho-unit in the area. It is fine to medium grained and grey in colour. Carbon phyllite found in southern part of study area, dark grey in colour and crumbled in nature (Fig. 4a).The brownish grey colour Tuffaceous phyllite with intercalated schistose quartzite occurs along the Kutacholi Nala (Fig. 4b). In the study area three types of quartz veins are visible viz. white reef quartz, bluish grey quartz veins and limonitic white quartz veins. Large reef quartz associated with carbonaceous phyllite exposed in the Kutacholi Nala (Fig. 4c) and bluish grey quartz veins are also prominently seen in the area (Fig. 4d).The secondary features like micro and meso folds seen in the phyllite (Fig. 4e). At few localities transverse- faults have been noticed and three major sets of joints are also noticed near Kutacholi Nala (Fig. 4f). The most important structural feature of the Parasi gold deposits is the ductile shear zone trends approximately in ENE-WSW direction. The width of shear zone is varies from 100m to 150m and it extends in length for up to 2.5 km long.

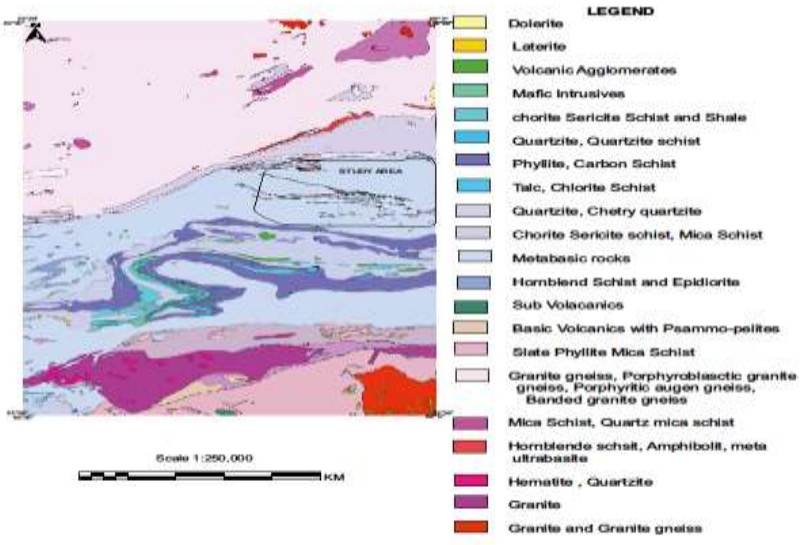

Fig. 3. Geological map of the study area (after Geological quardrangle map by Geological Survey of India, 2016

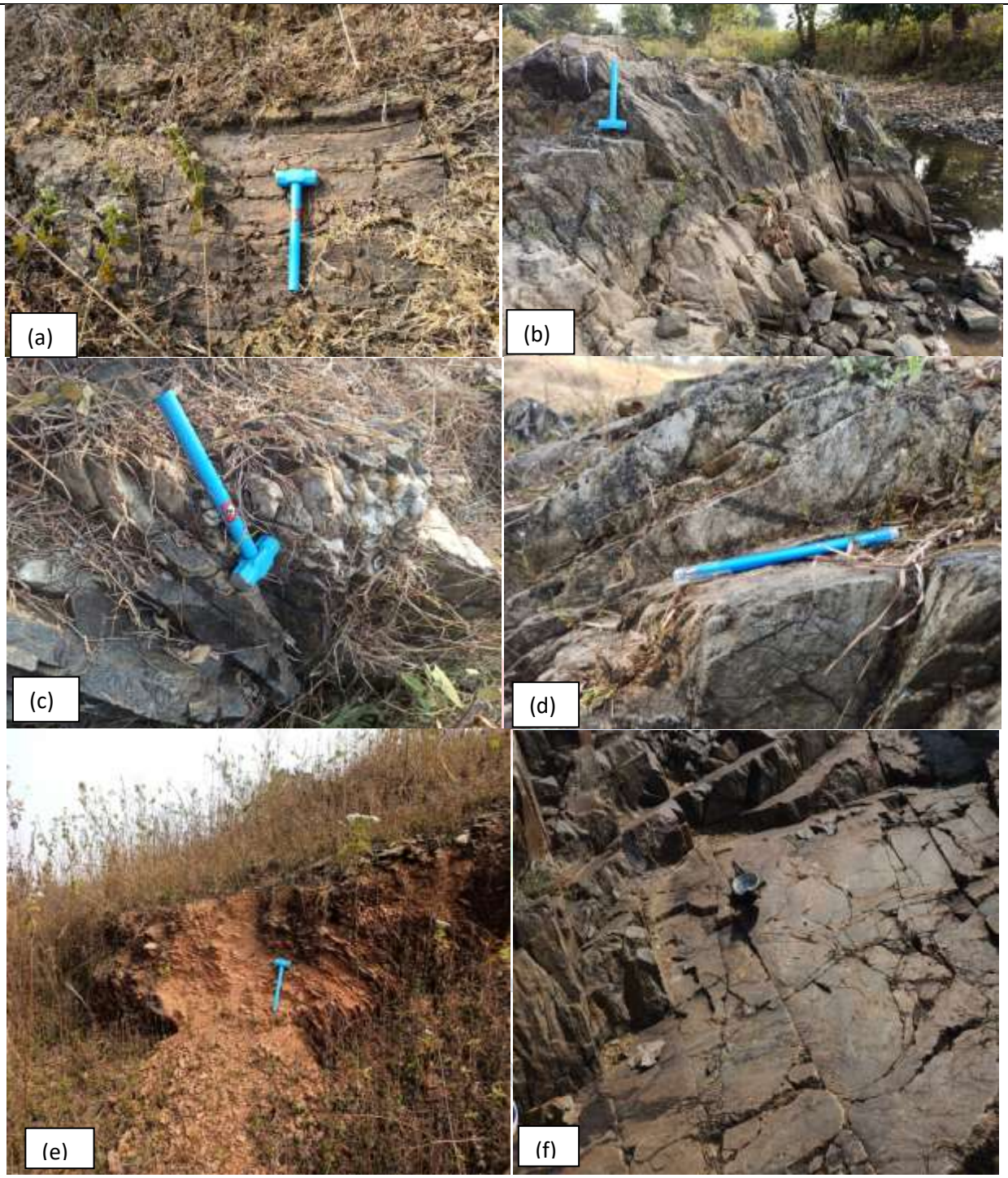

Fig. 4.Field photograph showing (a) exposure of Carbon phyllite in the study area (b) exposure of quartzite in the study area (c) reef quartz associated with carbonaceous phyllite (d) bluish grey quartz veins present in the area (e) Folding visible in phyllite (f) joints visible in fine grained quartzite.

GOLD MINERALIZATION

Auriferous mineralization in the Parasi area is hosted by the phyllite and quartzite. The style of mineralization includes disseminations, specks, streaks, fracture, fillings and it is found mostly in quartzitic rocks. Auriferous mineralization is mostly associated with sulfide minerals viz. arsenopyrite, pyrite and rarely with pyrrhotite. The arsenopyrite identified is much larger than pyrite and is almost present in all formations and occur along the plane of schistosity. The major ore forming minerals are includes pyrrhotite, arsenopyrite, pyrite, magnetite, ilmenite, chalcopyrite and sphalerite. On the basis of the analytical results and bore hole data investigated by GSI (field seasons: 2001-02, 2002-03 & 2003-04) and MECL (2009, 2010, 2014 & 2015) the 12 Au mineralized zones have been identified and belong to G1, G2, & G3 category with

UNFC nomenclature code of 331+332. The total estimatedAu ore is 2.38 Mt (1.25g/t) at 0.5 ppm cut off (Sharan and Kurien, 2004). Gold mineralization around Parasi area is structurally controlled and shear zone has played a significant role.

DISCUSSION AND CONCLUSION

The dominant lithology in the area includes magnetite-biotite-quartz-sericite schist, ferruginous quartzite, tuffaceous quartzose phyllite with intercalated schistose quartzite, carbon phyllite, rhyolite, acid tuff, tremolite-actinolite bearing ultramafic and amphibolite and vein quartz/ carbonates veins. In the present work, the different litho-units study explained the source rocks which are act as channel for gold occurrences. The Parasi area is highly gold potential deposit in the Ranchi district. Gold mineralization occurs both in primary and placer/secondary form. The major ore forming minerals observed in these areas are pyrite, pyrrohotite, arsenopyrite, chalcopyrite, magnetite, ilmenite and sphalerite etc. Gold mineralization within the study area occurs as disseminations, specks, streaks, fracture, fillings etc. Extensive works of exploration done by Geological Survey of India (GSI) and Mineral Exploration Corporation Limited (MECL) within this area disclose auriferous occurrences. The Parasi gold deposit was recently auctioned for mining lease and GSI has estimated the gold ore reserves UNFC nomenclature code of 331+332.

Acknowledgement

The authors are thankful to the Head of University Department of Geology, Ranchi University, Ranchi for providingnecessary facilities and his valuable guidance and suggestion. The second author is very much thankful to NFST (National Fellowship and Scholarship for Higher Education of ST student) for providing research fellowship.

REFERNCES

1. Acharyya, S. K. 2003a. The nature of Mesoproterozoic Central Indian Tectonic Zone with exhumed and reworked older granulites. Gondwana Research, 6: 197-217.
2. Acharyya, S. K. 2003b. A plate tectonic model for Proterozoic Crustal evolution of Central Indian Tectonic Zone. Gondwana Geological Magazine, 7: 9-31.
3. Baidya, T. K. 2015. Archaean metallogeny and crustal evolution in the East Indian Shield. Earth Science, 4: 1-14.
4. Banerjee, A., Raja, C.K., Mazumder, B. 2014. Investigation for gold in Iargadih-balidih block, saraikela-kharsawan district, Jharkhand. Prog. Rep. Field Session 2012-2014.
5. Bhattacharya, H.N. and Mahapatra, S. 2008. Evolution of the Proterozoic rift margin sediments-North Singhbhum Mobile Belt, Jharkhand-Orissa, India. Precambrian Research, 162: 302-316.
6. Bose, M.K. 1994. Sedimentation pattern and tectonic evolution of the Proterozoic Singhbhum Basin in the eastern Indian shield. Tectonophysics, 231: 325-346.
7. Bose, P.K., Mazumder, R. and Sarkar, S. 1997. Tidal sandwaves and related strom deposits in the transgressive Protoproterozoic Chaibasa Formation, India. Precambrian Research, 84: 63-81.
8. Chakraborti, M.K. 1980. On the pyroclastic rocks of Dalma volcanic sequence, Singhbhum, Bihar, Indian journal of earth science, 7: 216-222.
9. Chakarbarti, P. 1992. Preliminary search for gold in Sonapet valley, Singhbhum and Ranchi District, Bihar. Progress report for the field session 1991-92.
10. Chakarborti, A.K., Kar, N., Sarkar, B. 1986. Report on test geophysical investigation for placer gold Tamar area, Ranchi district, Bihar Progress report for the field session 1984-85.
11. Chaudhari, B.K., and Roy, R.K. 2001. Gold mineralisation in Eastern India- status review and a look to the future. Journal of Geological Survey of India, Special Publication, 58: 29-57.
12. Dunn, J.A. and Dey, A.K. 1942. The geology and petrology of Eastern Singhbhum and surrounding areas. Memoir of Geological Survey of India, 69(2):281-456.
13. Eriksson, P.G., Mazumder, R., Sarkar, S., Bose, P.K., Altermann, W and Van Der Merwe, R., 1999. The 2.7-.20 Ga volcano-sedimentary record of Africa, India and Australia: evidence for global and local changes in sea level and continental freeboard. Precambrian Research, 97: 269-302.
14. Eriksson, P.G., Mazumder, R., Catuneanu, O., Bumby, A.J. and OuntscheIlondo, B. 2006. Precambrian continental freeboard and geological evolution: a time perspective. Earth-Science Reviews, 79: 165-204.
15. Gupta, A. and Basu, A. 2000. North Singhbhum mobile belt. Eastern India- a review. Geological Survey of India, special issue, 55: 195-226.
16. Gupta, A. and Basu, A. 1991. Evolutionary trend of the mafic-ultramafic volcanism in the Proterozoic North Singhbhum mobile Belt. Indian Minerals, 45: 273-283.
17. Gupta, A. and Basu, A. 1984. Stratigraphy and tectonics of Precambrian in and around Sonapet valley, Singhbhum and Ranchi district, Bihar: GSI, F.S. 1976-77.
18. Gupta, A., Basu, A. and Ghosh, P.K. 1980. The Proterozoic ultramafic and mafic lavas and tuffs of Dalma greenstone belt, Singhbhum, eastern India. Canadian Journal of Earth Sciences, 17: 210-231.
19. Gupta, A., Basu, A. and Ghosh, P.K. 1982. Ultramafic volcaniclastic of the Precambrian Dalma volcanic belt, Singhbhum, Eastern India. Geological Magazine, 119: 505-510.
20. Gupta, A., Basu, A and Singh, S.K. 1985. Stratigraphy and petrochemistry of Dhanjori Greenstone belt, Eastern India. The Quarterly Journal of the Geological, Mining and Metallurgical Society of India, 5: 248-263.

21. Jha, V., Singh, S. and Venkatesh, A.S. 2015. Invisible gold occurrences within the quartz reef of Babaikundi area, North Singhbhum fold-and- thrust belt, Eastern Indian Shield: Evidence from petrographic, SEM and EPMA studies. Ore Geological Reviews, 65: 426-432.
22. Khatun, M., Singh, S., 2018. Genesis of the sulfide hosted refractory gold occurrences within the carbonaceous Metasedimentary units of Dalma Volcano-sedimentary basin, North Singhbhum Mobile Belt, Eastern India. J. Geol. Soc. India. 92: 11-18.
23. Kisku, S.R., Haque, M.W., Mishra, P.S., and Singh, B.K. 2006. Final report on investigation for gold in Pahardia-Rungikocha area, west Singhbhum district, Jharkhand, Progress report for the field session 1999-2000, 2000-01 & 2001-02 & 2002-03.
24. Lahiri, D., Gupta, A., and Charavorty, K.K. 1974. Progress report on the investigation for gold in Maysera area, Singhbhum district, Bihar. Progress report for the field session 1970-71.
25. Mahadevan. T.M. 2002. Geology of Bihar and Jharkhand, Geological Society of Bangalore.
26. Mazumder, R. 2005. Proterozoic sedimentation and volcanism in the Singhbhum crustal province, India and their implications. Sedimentary Geology, 176:167-193.
27. Mazumder, R., Eriksson, P.G., De, S., Bumby, A.J. and Lenhardt, N. 2012a. palaeoproterozoic sedimentation on the Singhbhum craton: global context and comparison with Kaapvaal. In: Mazumder, R., Saha, D. (eds.), Palaeoproterozoic of India, Vol. 365. Geological Society of London, Special Publication: 51-76.
28. Mazumder, R., Van Loon, A.J., Mallik, L., Reddy, S.M., Arima, M., Altermann, W., Eriksson, P.G. and De, S., 2012b. Mesoarchaean-Palaeoproterozoic stratigraphic record of the Singhbhum Crustal Province, Eastern India: a synthesis. In: Mazumder, R., Saha, D. (eds.), Palaeoproterozoic of India, Geological Society of London, Special Publications, 365: 31-49.
29. M.E.C.L. 2009. Geological report on detailed exploration for Gold Ore in Parasi (Central) Block Gold deposit phase-1 North of Sonapet Anticline, district- Ranchi, Jharkhand.
30. M.E.C.L. 2010. Geological report on detailed exploration for Gold Ore in Parasi (Central) Block Gold deposit phase-2 North of Sonapet Anticline, district- Ranchi, Jharkhand.
31. M.E.C.L. 2014. Geological report on detailed exploration for Gold Ore in Parasi (East) Block Gold deposit north of Sonapet Anticline, district- Ranchi, Jharkhand.
32. M.E.C.L. 2015. Geological report on detailed exploration for Gold Ore in Parasi (West) Block Gold deposit north of Sonapet Anticline, district- Ranchi, Jharkhand.
33. Mukhopadhyay, D. 1984. The Singhbhum shear zone and its place in the evolution of the Precambrian mobile belt, north Singhbhum. Indian Journal of Earth Science, CEISM Volume: 205-212
34. Ranjan, S., Narayan, P. and Singh, V. 2013. Report on investigation for gold in Sindauri- Ghanshyampur block, Ranchi district, Jharkhand (G3). GSI Unpublished Report. F.S. 2010-2013.
35. Saha, A.K. 1994. Crustal evolution of Singhbhum-North, Orissa, eastern India. Geological Society of India Memoir, 37: 341.
36. Sarkar, S.C. 1984. Geology and ore mineralization of the Singhbhum Copper-Uranium belt, eastern India. Calcutta: Jadavpur University: 263.
37. Sarkar, S.C., Gupta, A. and Basu, A. 1992. North Singhbhum Proterozoic mobile belt, Eastern India: its character, evolution and metallogeny. In: Sarkar SC, ed. Metallogeny related to Tectonics of the Proterozoic mobile belts. New Delhi: Oxford and IBH:271-305.
38. Sengupta, S. and Mukhopdhyay, P.K. 2000. Sequence of Precambrian events in the eastern Indian craton. Geological Survey of India Special Publication, 57: 49-56.
39. Sharan, R.R., Kurien, P.S., 2004. Report on investigation for gold at Parasi in Lungtu-Parasi-Sindauri Area, Ranchi district, Jharkhand.
40. Sharan, R.R., Kisku, S.R. and Singh, S.P. 2000. Report on search for Gold and other noble metals in Dalma volcanic and Singhbhum Metasedimentary rock in parts of Paschimi Singhbhum & Ranchi district (F.S. 1994-1995), Unpublished prog. Report. GSI.
41. Singh, S.P. 1997. Geochemistry of acid volcanic of the Dalma Group, Singhbhum, Eastern India. Journal of the Geological Society of India, 49: 437-441.
42. Singh, S.P. 1998. Precambrian stratigraphy of Bihardan overview. In: Paliwal, B.S. (ed.), the Indian Precambrian. Scientific Publishers, Jodhpur: 376-408.