Geochemistry of Pyritiferous Black Shales from Mangampet Baryte Mine, Andhra Pradesh, India: Implications on Provenance and Genesis

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Platinum Group of Elements are unevenly distributed in the mineral phases in most of the rocks and these elements are collected in PGE rich phases as Platinum group of Minerals , inclusions inside that phases such as Chrome spinel or sulphide minerals. Organic-rich, often pyritic-rich, sediments such as Black shales serve as a syngenetic collector for PGE in the solution. Geochemical studies of black shales, in recent times have played an important role in precious metal exploration, since many of them host the worlds most precious metals like platinum and polymetallic ores and as well as for geochemical modelling studies to understand the genesis of these deposits in the sedimentary environment. Detailed petrological and geochemical studies have been undertaken on the sulphidic black shales from Cumbum formation of Proterozoic age to understand their genesis and depositional environments. In the Cumbum formation of Cuddapah basin, black shales comprise a widely found, exclusive rock suite along with Baryte and are also characterised by the presence of unusual mineral such as Shungite (fullerenes), graphite and sulphides. These lamellar bedded shales with the disseminated distinct patches of pyrite are exposed in the different horizons in the baryte mines of Mangampet area. The abundant presence of grey shale along with this black shale is clear indicative of change in the environmental conditions from anoxic and deep to oxic which is shallower during the deposition of these shales. Ni and Cr concentrations in these shales are high and, together with increased MgO and Fe_2O_3 contents and low HFSE (high field strength elements) suggest a significant mafic to ultramafic component in the source. The elevated concentrations of Ni and Cr in these shales is due to the intimate contact of hydrothermal solution containing high dissolved metal concentrations with black shales and have presumably due to water-rock interactions. The massive sulfides

present in these black shales of the Cumbum formation is indirect evidence of early digenetic pyritization in deepwater. The chondrite normalized REE pattern of black shales show LREE enrichment over HREE. This is evidenced by the ratios such as La/Yb_N (12.25-16.22) and La/Lu_N (10.57- 15.31). They show slight positive europium anomaly (Eu/Eu* = 0.96 to 1.34).The total REE of these samples ranges from 71.21 to 316.12 μg/g. These shales have high CIA (Chemical Index of Alteration) values (avg.75), high Al/Ti and Al/Na ratios indicating intense chemical weathering conditions in the source region. This is further substantiated by low values of Na/Ti and Ca/Ti. The total PGE concentration of these shales range from 1.22 to 1.48. Individual elemental concentrations of PGEs are found to be Ru (0.04-0.32 ng/g), Rh (0.06-0.14 ng/g), Pd (0.82-1.92 ng/g),Ir (0.02-0.06 ng/g), Pt (0.26-0.49 ng/g). The chondrite normalised PGE patterns of these black shales show nearly identical patterns as those of hydrothermal PGE deposits. Detailed geochemical exploration for PGE & Au is proposed in the black shale horizons of the adjoining areas in the SW part of Cuddapah basin.

Keywords: Mangampet, Baryte, Black Shales, Platinum Group of Elements