

## GENETIC ASSOCIATION OF TRACE ELEMENTS WITH SPECIAL EMPHASIS ON Cu, Ni and Cr IN THE MANGANESE ORES OF VIZIANAGRAM DISTRICT, ANDHRA PRADESH, INDIA

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### Abstract

The Manganese ore deposits of Vizianagram district, A.P. form a part of Eastern Ghat Granulite Complex and occur in association within a sequence of Precambrian rocks, belonging to Khondalite and Charnockite Groups of the Dharwar Supergroup. These rocks have been studied for their Geochemical characteristics. Thirty samples of manganese ores from different localities of the area under study were collected and analysed for major, minor and trace elements. The concentration of the Cu, Ni and Cr in the samples from the study area varies from 35 to 425, 25 to 260 and 13 to 187 (ppm) respectively. Copper present in the ores by means of adsorption shows a variable positive relationship with MnO, while negative relationship with SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, FeO and MgO indicates non coherence. Nickel shows positive relationship with Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, FeO, P<sub>2</sub>O<sub>5</sub>, CaO, Na<sub>2</sub>O and K<sub>2</sub>O but negative relationship with SiO<sub>2</sub>, TiO<sub>2</sub>, MnO and H<sub>2</sub>O<sup>+</sup>. Chromium shows a positive relationship with Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, FeO, P<sub>2</sub>O<sub>5</sub>, CaO, Na<sub>2</sub>O and K<sub>2</sub>O and negative relationship with SiO<sub>2</sub>, TiO<sub>2</sub>, MnO and H<sub>2</sub>O<sup>+</sup>.

The elements like Cu, Zn, Co, Ni, Sr and Cr etc. appear to be mostly concentrated in the minerals Psilomelane, Cryptomelane, Hollandite, Pyrolusite and related secondary minerals. On the basis of geochemical characteristics, a genetic model is suggested for the evolution of the ores. The geochemical data of the manganese ore samples from the study area reveals a two stage evolution of the ore deposits and the genetic relationship of the constituent elements. At first, the manganese rich sediments were deposited in a basin under oxidizing conditions which led to the formation of Braunite, Bixbyite, Vredenburgite, Jacobsite and Hausmanite. This was followed by the formation of secondary manganese minerals like Psilomelane, Cryptomelane, Hollandite, Pyrolusite and Wad due to continued enrichment of Mn and other elements with the help of meteoric water via leaching process. The alteration process of the manganese minerals in presence of colloidal solutions of these elements assisted to assimilation in the manganese ores because the ionic radii and ionic charges of the substitute and the substituent are almost identical such as Cu<sup>2+</sup>, Mg<sup>2+</sup> and Fe<sup>2+</sup>. The other conditions being favourable led to their assimilation in significant concentration along with some other trace elements.

*Keywords:* Manganese ore, Psilomelane, Cryptomelane, Hollandite, Pyrolusite, Copper, Nickel, Chromium, assimilation.