Title: **MAGNETO-MINERALOGICAL STUDIES IN RELATION TO THE TECTONIC EVOLUTION OF THE ANORTHOSITE COMPLEXES IN AND AROUND CHILKA LAKE, EASTERN GHATS BELT OF INDIA**

Index No.: 16/21/Geol.Sc./27

Abstract

The present research work examines the magnetic history in relation to tectonic evolution of Balugaon and Rambha Anorthosite Massif Complexes along with the surrounding high-grade metamorphic rocks of the Chilka Lake area, Eastern Ghats Mobile Belts (EGMB), Odisha, India using a combined approach that includes Petrography, Magneto-mineralogy, Rockmagnetic Study, Anisotropy of Magnetic Susceptibility (AMS) Study and Palaeomagnetic Study. This study aims to ascertain the petrography, generations of Fe-Ti oxides, magnetic remanence carrier minerals, magnetic fabrics and stable magnetic vectors (by Thermal Demagnetization) present within the analysed rocks and the find respective pole position.

The magneto-mineralogical analysis indicates that the primary magnetic remanence carrier mineral is magnetite. Three generations of Fe-Ti oxides have been identified from the studied rocks. They are primary homogeneous titanomagnetite, primary in-homogeneous titanomagnetite (both high and low temperature phases) and ultrafine grained secondary magnetite. Multiple generations of magnetite within studied rocks corresponds to various temperature existed throughout their oxidation. These finding have tectonic implications that depict the upliftment of the crust. The rockmagnetic characteristics along with magnetic fabrics derived from AMS studies are utilized to figure out their tectonic significance. Rockmagnetic studies are carried out to identify the magnetic minerals residing within the studied samples including Isothermal Remanent Magnetization (IRM), Backfield IRM, Thermomagnetic Study and Hysteresis Study. The magnetic domains are identified using a modified Day Plot, using the magnetic hysteresis parameters (coercivity and remanence). All the magnetic domains fall under the Single Domain (SD), which also have great potential of recording the ancient Earth's Magnetic Field. The magnetic fabrics of the region are unravelled by the help of AMS studies. The magnetic susceptibility ellipsoids are dominantly oblate as revealed from the P_j-T_j shape plot. Highly variable magnetic lineation states the multiple phased tectono-metamorphic conditions experienced by the region. The AMS study shows that, in addition to ferromagnetic and paramagnetic minerals, silicates also play a significant role in controlling the development of the magnetic fabrics. The magnetic fabric has tectonic implications related to metamorphism followed by felsic magmatism. One component of magnetization has been established by a

thorough thermal demagnetization and Principal Component Analysis (PCA). This component does not include any significant record of the present day Earth's Magnetic Field (EMF) and is analogous to regional structure.

The mean value of declination and inclination (D_m / I_m) has been obtained from the Thermal Demagnetization analysis of the studied rocks. The primary high temperature phases of titanomagnetites are responsible for the carried vectors obtained during geologic event. This mean D_m / I_m value helps in defining the pole position obtained by this study. The identified pole position, C is (1.15˚ S and 16.15˚ E). The pole is dated (aligning with the established pole locations documented in the literature) in the age group of 850-900 Ma. It falls on the Apparent Polar Wandering Path (APWP) of the Proterozoic India.

Solanky Das.
28.07.2025
SOLANKY DAS

Supriya Mondal.
Signature of Supervisor 28.07.2025

DR. SUPRIYA MONDAL
Professor
Department of Geological Sciences
JADAVPUR UNIVERSITY
Kolkata-700032, W.B.(India)