

Comparative Analysis of Mechanical and Mineralogical Properties of Rocks from Maddhapara Granite Mine, Bangladesh

*Alam¹ AMKB, Fujii² Y, Dipu¹ NH, Ghalib¹ FH,
Sajib¹ AI and Ullah³ ASMW

¹Petroleum and Mining Engineering Dept, MIST, Bangladesh

²Faculty of Engineering, Hokkaido University, Japan

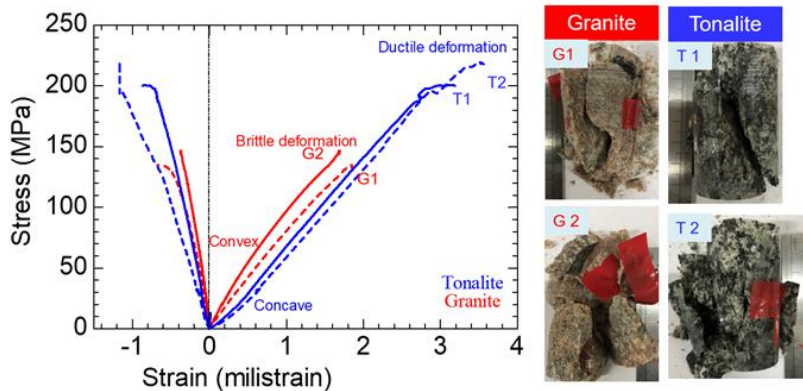
³Geology Department, University of Dhaka, Bangladesh

*Corresponding author: Email: badrul.alam@pme.mist.ac.bd

Abstract

This study presents a comprehensive analysis of the mechanical and mineralogical properties of rocks collected from Maddhapara Granite Mine (MGM) in the northern region of Bangladesh. The research focuses on the characterization of two main categories of rocks, distinguished by their color and mineral composition, namely the dominant black rock and the flashy colored rock. Microscopic studies were conducted to categorize the rocks, leading to the identification of minerals such as quartz, feldspar, amphibole, and biotite within the rock samples. The black rock was classified as Tonalite, with specific mineral compositions, while the flashy colored rock was identified as granite, exhibiting distinct mineral proportions. The research further delves into the physical properties of the rocks, including density, effective porosity, P-wave velocity, S-wave velocity, and Uniaxial Compressive Strength (UCS). Notably, UCS tests were performed to characterize stress parameters such as crack closure stress, crack initiation stress, crack damage stress, and peak stress for both rock types. The results revealed significant differences in stress levels and mechanical responses between the two rock types, with tonalite exhibiting higher stress levels and distinct mechanical behaviors such as plastic deformation and shear deformation, compared to the granite. These variations are attributed to the dominating minerals present in each rock type, particularly amphibole and quartz for tonalite, and feldspar and quartz for granite. The findings of this study have implications for the stability of drifts and stopes in mining operations, as the mechanical responses of the rocks, influenced by their mineralogical composition, may impact their suitability for various engineering applications. This research contributes to the understanding of rock properties in the context of mining engineering,

providing valuable insights for the assessment and utilization of rocks from MGM and similar geological formations.



Keywords:

Maddhapara Granite Mine; rock characterization; mineralogical analysis; mechanical properties; UCS testing