Comprehensive analysis of mechanics of granitoids from the North- Western Himalayas, Pakistan

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This study explores the mechanical behavior of eight texturally diverse granitoids, including granites, granodiorites, and syenites, from the northwestern Himalayas, Pakistan, under diverse conditions. Mechanical tests, including rock triaxial test (RTT), rock direct shear (RDS), uniaxial compressive strength (UCS), and ultimate tensile strength (UTS), were conducted to examine the response of these rocks to various loading conditions and environmental factors. These tests aim to assess the behavior of the granitoids under different stress regimes and determine their mechanical properties under tension, compression, and shear. Observations from RTT reveal a notable correlation between confining pressure and rock strength. Applying confining pressures ranging from 2 to 10 MPa showcases a consistent trend, i.e., an increase in confining pressure corresponding to elevated rock strength. This trend is attributed to the closure of micro-cracks and enhanced interlocking of mineral grains under higher confining pressures, bolstering rock cohesion and resistance to deformation. In the case of RDS, fresh granitoids exhibit higher maximal and residual shear strengths, and a higher angle of internal friction, compared to highly weathered rocks due to intact mineral grains and fewer micro-fractures. Conversely, highly weathered granitoids show lower shear strength and angle of friction due to mineral degradation and increased micro- fractures. Additionally, fresh granitoids display a higher apparent cohesion, attributed to stronger mineral bonds and better particle interlocking. Moreover, the influence factors such as mineralogy, thickness, and surface roughness are found to have a significant effect on the shear strength of the studied granitoids. The UCS and UTS tests highlight the multifaceted impact of various factors on the strength properties of granitic rocks. Parameters such as grain size, texture, mineralogy, degree of weathering, and overall brittleness significantly shape the observed strength characteristics during testing. Fine-grained

granitoids, especially those with a higher quartz content, exhibit greater compressive and tensile strength compared to coarser-grained or highly-weathered granitoid. Additionally, fresher granitoid, characterized by lower degrees of weathering and brittleness, demonstrate enhanced mechanical properties in both compression and tension tests. The overall findings suggest a direct correlation between granitoid texture, mineral composition, and mechanical strength, emphasizing the significance of these factors in assessing rock behavior under load. This study provides crucial insights into the mechanical behavior of diverse granitoids, informing engineers and geologists in rock mechanics and geological projects.