Abstract

Geotechnical comparison between Limestone and Dolostone from the Upper Indus Basin, Pakistan

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The geotechnical comparison between limestone and dolostone samples collected from the geological formations in the Upper Indus Basin, Pakistan is presented. The limestones from Sakesar and Samana Suk Formation, while dolostones from the Jutana and Kingriali Formation were examined. The physical and mechanical properties of the samples were evaluated using porosity, water absorption, specific gravity, Schmidt rebound hardness, ultrasonic pulse velocity, point load index, and uniaxial compressive strength (UCS).

Petrographic analysis shows that the Sakesar Limestone sample contains skeletal grains, embedded in the micrite matrix and classified as a bioclastic wackestone. In contrast, the limestone from the Samana Suk Formation comprises non-skeletal grains, including ooids in sparite matrix and is classified as an ooidal grainstone. The dolostone from the Jutana Formation consists of fine to medium-grained subhedral to anhedral dolomite crystals, whereas the dolostone from the Kingriali Formation is composed of dolomite with significant secondary porosity caused by diagenetic alterations.

The findings reveal that the dolostone from the Jutana Formation exhibits the highest strength among all samples, attributed to its primary dolomitic nature, subhedral to anhedral crystal morphology, and minimal porosity. Conversely, the dolostone from the Kingriali Formation demonstrates the lowest strength due to significant secondary porosity. The limestone samples exhibit intermediate strength, with the bioclastic wackestone of the Sakesar Limestone outperforming the ooidal grainstone of the Samana Suk Formation. This difference is attributed to the micrite matrix in the bioclastic wackestone, which provides higher strength due to its fine-grained and cohesive nature, whereas the sparite matrix in the ooidal grainstone, being coarse-grained with loose intergranular contacts, reduces its overall strength.

These findings emphasize the role of mineralogical composition, grain size, and porosity in determining the mechanical behavior of carbonate rocks, with important implications for geotechnical applications in the construction industry.

Keywords: Geotechnical properties; Limestone; Dolostone; Upper Indus Basin; Petrographic analysis