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Stones that Stand the Test of Time:

Exploring the Durability and Weathering of Metamorphic Rocks of Sri Lanka

Figure 1: Exfoliation of metamorphic rock

"The interplay of various factors affecting the durability and weathering of metamorphic rocks in Sri Lanka highlights the complexity of natural systems and the need for interdisciplinary research approaches"

Weathering and durability are the key properties of the rock to evaluate the suitability and end-use for different kinds of applications such as building and construction material and engineering structures. Weathering is simply known as the alteration or breaking down of rocks due to air, water, etc. whereas durability of rock can be defined as the ability to resist the weathering to maintain the characteristics of strength under various environmental conditions. To evaluate the strength of rock, the degree of weathering and durability can be used as main indicators[1] as the measure of strength depends on the external force resistance.

This indicates, a comparatively low-strength rock also can withstand under the fine climatic condition where the external forces are fairly negligible. However, depending on the type of rock the composition, physical properties, strength, and resistance to weathering can vary, and hence the strength and durability will differ[2].

There have been several research studies carried out regarding quality assessment of geomaterials concerning durability by laboratory and field testing globally [1, 2, 3]. However, in Sri Lanka, research study related to the assessment of weathering and durability are rare. In 2017 some researchers [4] examined the properties of weathered metamorphic rocks under the tropical climate. They concluded that the effects raise due to the change in the property of rocks under rapid weather conditions are unconvincing. Furthermore, they mentioned that the studies focused on the weathering aspect of metamorphic rocks under tropical climatic conditions were rare.

Sri Lanka is geologically composed of around 90% Precambrian metamorphic rocks and they are divided into three groups known as; Highland Complex, Wanni Complex, and Vijayan Complex [5]. Metamorphic rocks: Granite-gneisses are the commonly used rock type in Sri Lanka for aggregate production. The aggregate produced from this type of rock generally has high strength, good resistance to abrasion and fragmentation, and good surface characteristics with low absorption. So, it is always important to get the maximum use of these characteristics because some intrusions generally encounter during mining activities led to significant property variation in the rock [6]. This always raises the importance of quality analysis. Hence, analysing the quality of Sri Lankan Metamorphic rocks under tropical climate including the concept of durability has become a matter of prime concern.

A single test is not enough to predict the suitability of rock and aggregates. To analyse the weathering and durability along with the suitability of the rocks for different uses, physical, chemical, mechanical, optical tests and indices of rocks are widely in use. Among many tests coming under the above-mentioned categories, the Micropetrographic index and rock durability index of static and dynamic states are accepted as some of the best for this type of analysis [1]. These indices can be analysed by conducting some testing such as Point load index test, Modified aggregate impact value test, specific gravity test, Uniaxial compressive strength test, Los Angeles abrasion value test, determination of porosity test, Sodium Sulphate soundness test, water absorption test, ethylene glycol soak index test, Slake durability index test and petrographic examination test [1, 7].

Micropetrographic index is a good indicator of the weathering rate which can be obtained by petrographic examination test whereas, the durability can be assessed using tests named slake durability index and uniaxial compressive strength [1]. Furthermore, the Point load index test has a direct correlation with the uniaxial compressive strength. The ability of pores to allow the water to penetrate or the ability of rocks to absorb the water is simply known as porosity. From literature findings, a Freeze-thaw experiment was carried out on different types of rocks and it was concluded that the rocks having high porosity are intended to generate cracks quickly and deteriorate faster[7]. Thus, the porosity analysis test is also important in durability assessment. Furthermore, while checking the porosity it is always important to be concerned about the pore sizes because they can influence durability in a way that, coarse pores are more durable than fine pores. The purpose of doing the Los Angeles abrasion value test is to identify the abrasion resistance of the rock sample. The permeability of an aggregate can be considered as an indirect measure of its water absorption and has the potential effect on the strength, soundness, shrinkage, and durability of a rock. So the Sodium Sulphate soundness test, water absorption tests, and ethylene glycol soak index test needs to be carried out to identify the resistance to weathering of the rocks [7]. An aggregate impact value test is commonly done to identify the resistance of the aggregates when applying a sudden shock. Moreover, analysing the specific gravity is also important to identify the weathering rate because weathering can be increased when the specific gravity decreases. According to the study done by

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a research group in 2017 [1], in terms of durability and weathering of rocks, it was stated that the test results are found to be reliable. Therefore, it is crucial to evaluate the weatherability and durability of rocks before utilizing them in construction projects. It is also important to thoroughly investigate all the properties to analyse the service life of those rock types as well.

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