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Assessment of Tertiary (Oligocene and Miocene) Limestone for their Suitability as Dimension Stone, Sona Pass Area, Karachi Pakistan

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Abstract

Geochemical and geotechnical characterization of Pir Mangho limestone, Halkani limestone unit Talawa limestone and Turitela bed of Tertiary age was carried out for their suitability as dimension stone. For this purpose, limestone samples (n = 8) were collected from Sonapass area. Petrographic properties reveals that all the collected samples are fine grained allochemical limestone enrich with fossil fragments as frame work grain. As per Dunham (1962) classification, Pir Mangho and Talawa limestone are classified as boundstone while Halakni limestone and Turitela units are classified as grainstone. According to Folk (1959) classification Pir-Mangho and Halkani limestone unit is classified as biosparitic limestone while, Talawa limestone is bio-micritic limestone. As per Munsell color chart most of the samples are reddish yellow followed by pinkish white and yellowish red in color. CaO and MgO content varies in the order of Lp (49.9%) > Lt (47.40%) >, Lh (30.81) > Lm 25.45% and Lm (2.20%) > Lh (1.30%) > Lt (0.84%) > Lp (0.72%) respectively. In Lp and Lt limestone samples, the average SiO_2 content is < 6%. On the other hand, Lh is found to contain 32.59% silica. Likewise, the mean content of Na_2O and K_2O varies in the order of Lh (0.47%) > Lm (0.44%) > Lt 0.06% > Lp (0.05%) and Lh (1.25%) > Lm (0.69%) > Lt (0.23%) > Lp 0.215% respectively. On the other hand, Al2O3 content in all studied samples varies in the order of Lh (5.94%) > Lm (4.76%) > Lt (1.28%) > Lp (1.15%). The average iron oxide content in collected samples is found to be 1.36% (Lp), 2.99% (Lt), 3.67% (Lh) and 14.90% (Lm) respectively. Absorption data of present study reveal that except sample Lm-8, all samples are classified as high density rocks where mean absorption values of all samples varied in the order of 3> 1.42 > 2.66

for Lh, Lt, and Lp respectively. On the other hand, sample Lm-8 is classified as medium density rock with high degree of absorption (5.27%). Collected samples have shown variable bulk density where average values are 2545.673 kg/m^3, 2289.44 kg/m^3, 2326.33 kg/$m^3$3 and 1990.80 kg/m^3 for Lp, Lh, Lt and Lm respectively so these rocks are classified as high to medium density rocks. The average compressive strength of collected samples are 42.21, 41.93 and 42.16 Mpa for Lp, Lh, and Lt respectively suggesting that these are medium density rocks and results are comparable with ASTM C 568. The Lt, Lp and Lh have acceptable range of modulus of rupture, with the average value varying in the order of 23.7 > 22.61 > 22.48 and comparable with ASTM C568. Absorption has negative relationship with compressive strength and density. While, density has positive relationship with compressive strength. Hence, these results indicate that except sample Lm-8 all the collected limestone samples of Nari and Gaj formations are suitable for the purpose of medium grade dimension stone.

Keywords: Limestone, Tertiary age, dimension stone, geochemical and geotechnical properties.

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